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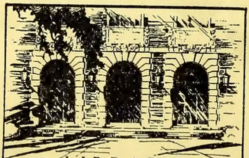

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REPORT

OF THE

SECRETARY OF WAR;

BEING PART OF

THE MESSAGE AND DOCUMENTS

COMMUNICATED TO THE

TWO HOUSES OF CONGRESS

AT THE

BEGINNING OF THE THIRD SESSION OF THE FORTY-SIXTH CONGRESS.

IN FOUR VOLUMES.

VOLUME IV.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1881.

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REPORT

OF THE

CHIEF SIGNAL OFFICER.

REPORT

OF THE

CHIEF SIGNAL OFFICER OF THE ARMY.

WAR DEPARTMENT,
OFFICE OF THE CHIEF SIGNAL OFFICER,
Washington, D. C., November 15, 1880.

SIR: The established course of drill and instruction in military signaling and telegraphy, meteorology and the Signal Service duties at stations of observation and report, together with the military drills, has continued at the school of instruction and practice at Fort Whipple, Va. The apparatus needed for the study and exercises, with instruments, for practice in the meteorological duties at stations of observation; the equipment for the drill in field signaling; the drill with the field telegraph train; the construction drill for permanent telegraph lines; and the duties on signal and telegraph stations is full and has been improved by useful additions. The duties at the post are conducted under strict military rule. The course at Fort Whipple is intended to furnish and maintain a force of enlisted men, selected after examination, disciplined as soldiers and fitted by special instruction for the special duties of the Signal Service.

Particular attention has been given in the year just passed to the drill of the force with arms and to such armed maneuvers as would be necessary for the corps in time of war. A rigorous practice of this kind is required for a force organized to act—armed, if need be—independently of other organizations, and to be capable of protecting with its own guard its own material and works.

Experiments in signaling and telegraphy are made at Fort Whipple under proper supervision. It is endeavored to keep up in all improvements with the progress made by scientific ingenuity in the special duties of the service, in the use of improved war material, and in the different modes of rapid communication now necessary and expected to be used, as of course, in war. With each ensuing year the duties of corps analogous in their service to the Signal Corps become more prominent, and hardly a month passes without some suggested improvement in telegraphic or signal apparatus, or in the methods of using them. Such are here tested as may have received the notice of this office, or to which attention is directed by higher authority. It is by following plans determined by tests had at this office and at Fort Whipple that the proper construction of the iron lines now so successfully used on the sea-coast and for the connection of posts, settlements, and stations on exposed frontiers and in the uninhabited interior has been arrived at.

The telegraphic line connecting Fort Whipple with this office, a field line, has been in constant use, different forms of telephones being employed upon it. Telephonic communication is adopted as the usual mode for all communications between this office and Fort Whipple.

The wires are so arranged and fitted with instruments that the ordinary modes of telegraphing may be used for any matters requiring to be of record. As a result of the experiments with telephones, telephonic communication has been established at points upon the sea-coast. Where connecting the life-saving stations, it has been used with fair success.

A series of experiments has been made with sun-flashes, with a view of improving upon the forms of heliograph to be adopted for the general uses of the Army, and it is believed that soon an improved heliograph will be adopted which combines great simplicity with efficiency. There have been other experiments, for which the post and the force stationed at it furnish, as they are intended to do, good facilities, as described in preceding reports.

The duties at this post are conducted under strict military rule. The post is controlled as connected with and as forming part of this office. The officers of the Signal Corps pass a course of drill and instruction, and serve regularly at this post, before being put upon any other duty of the Signal Service. It is recommended that all officers of the Army intended to be instructed as acting signal officers, or to be temporarily instructors in geographical military departments for the field duties of the Signal Service, be here instructed before being put upon detached duty. Instructors not themselves thoroughly instructed are worse than useless, and bring discredit on the Signal Service. It is aimed to furnish, by means of the thorough course of study and practice at Fort Whipple, a force of enlisted men, enlisted after examination, thoroughly disciplined as soldiers, and fitted by careful instruction for the special duties of the Signal Service.

The importance of the field duties of the Signal Service, and of the modes of communication such services make possible, are now recognized throughout the world. The modes of instruction in field or outdoor signaling, now nearly similar in the Army and Navy of the United States, ought to be made so absolutely, and a course so complete established that any force of either arm will be surely competent at any time to put itself in signal communication with any other force either of its own or of the other arm within signal distance. It is not necessary now to represent at length to any who have served in or read of recent wars, the propriety and the need that any armed force of any army should be able to telegraph or to communicate by other signals with any other of the same nationality or obeying the same general command.

The habitual practice of the duties of field signaling and telegraphy ought to become a part of the regular exercises adopted for the militia forces of the different States. To a small extent this practice has been already entered upon in some of the States.

The course of instruction at Fort Whipple for officers to be acting signal officers, and that for enlisted men, candidates for promotion to to the grade of sergeant in the Signal Corps or to the grades of first-class privates and corporals, are given herewith. (Paper 1.) They embrace such branches of study as experience has shown best suited to fit the pupil for the different positions of duty in which he may be placed. Papers 2 and 3 exhibit the names and number of officers instructed and the amount of field practice had by each.

During the year ending June 30, 1880, eight commissioned officers were under instruction, of whom five completed the full course in military signaling, telegraphy, and meteorology, and three are still under instruction.

Eighty-two enlisted men have been instructed for the position of assistants to observers. Of this number, fifty-nine completed the course of instruction, drill and practice, passed the necessary examination, and have been ordered to duty at stations as assistants. Two were discharged the service at their own request, three for cause upon the recommendation of the Chief Signal Officer, and eighteen are still under instruction. (Paper 4.)

One enlisted man has been instructed for promotion to the grade of sergeant, and four for promotion to the grade of corporal. Of these, four, successfully passing the examination, have been promoted and assigned to stations, and one is still under instruction. (Paper 5.)

The action of Congress, in permanently organizing the enlisted force of the Signal Corps and increasing its number, has imposed additional labor upon the instructor.

The habitual drills with arms, at the post of all the enlisted force stationed at the office of the Chief Signal Officer in Washington, in connection with the enlisted force at Fort Whipple, has continued during the year.

During the year ending June 30, 1880, First Lieut. R. P. Strong, acting signal officer, has remained in charge of the post.

The duties of instruction were under the immediate charge of First Lieut. F. C. Grugan, acting signal officer, until November 19, 1879, at which date he was relieved by First Lieut. B. H. Gilman, acting signal officer, who remains in charge, and performs in addition the duties of quartermaster and commissary of the post.

Acting Assistant Surgeon L. W. Ritchie was relieved from duty as post surgeon, March 20, 1880, and succeeded by Acting Assistant Surgeon Thomas E. Massey, who remains in charge. Dr. Ritchie had been on duty at the post continuously since September 23, 1869, and the records show that his duties were faithfully performed.

The storage capacity of the water supply of the post has been doubled by the erection of an additional tank holding ten thousand gallons.

A fire-engine is needed for the proper protection of the buildings and the valuable property stored at the post.

The number of men at Fort Whipple for duty has varied during the year from thirty-eight to sixty-two, and the number of officers from two to ten. The average number of enlisted men present during the year has been fifty-two.

The morning report of Fort Whipple, Va., for June 30, 1880, exhibits forty-eight enlisted men present for duty, of whom three were signal sergeants, two were corporals, forty-one privates, one commissary sergeant, and one hospital steward. Of this force one private was a candidate for promotion to the grade of corporal and twenty-six privates were under instruction for the position of assistant on station.

In preceding reports the Chief Signal Officer has expressed his conviction that the economy assured to the United States by the duties practiced at this post far exceeded the annual cost of maintaining it. Longer experience confirms this view.

As stated in that report, this post alone has made it practicable to put on station duty and in charge of stations those non-commissioned officers and men only who have been drilled, taught, tried, and so known to be fit for the labors and responsibilities to be required of them. There is no one of its varied duties but to which the force of the Signal Corps can be here habituated in practice before being brought to face the difficulties of its actual discharge. The benefits resulting from the school as one of practice, in which men are trained to be at once soldiers and students, have been apparent throughout the United States.

The enlisted men of the Signal Corps are engaged on duty as constant in time of peace as in the presence of actual war. The uses of the post at Fort Whipple for the discipline and instruction of the officers and enlisted men of the corps do not cease while either remain in the service. The force, made useful in time of peace by employment through which it is now admitted they return to the United States more than the cost of the service, is kept in readiness for any emergency of armed duty by regular drills, in which the officers and men stationed at this office and those whose changes of station bring them even temporarily within reach of Fort Whipple are there practiced and maneuvered as a part of accustomed duty. Men thus practiced are trained in discipline, and look upon events transpiring in their vicinity with soldierlike views.

The advantages of having distributed in the different cities of the United States a force of men with such training, habituated to acting in concert by order and promptly; capable of reporting simultaneously by telegraph and in cipher, as a duty, upon matters of military interest to which their attention may be directed, aside from the routine duties of their station, have been sufficiently evidenced. The self-possession of the non-commissioned officers in charge of stations, their prompt, concise, and reliable reports, rapidly collected over great extents of territory, for the information of superior authorities, in emergencies which have occurred, have received the warm commendation of officers high in rank. The rapid making of reports of this character and their transmission by telegraph, by aerial signals, or by other methods of communication, is the especial duty required in the service of the corps in time of war.

It is considered that the movements of the Army of the United States can be made by this agency as rapid on occasions of need as any of which there is record.

It is difficult to compute in money value the power of attaining such results. The advantages resulting to the War Department and to those especially charged with the management of the duties so varied and extensive as those of the Signal Service have become, from the knowledge that of all the force of the Signal Corps the course pursued leaves no man who, called upon for any duty of the service, would fail to be found fitted for it by careful instruction, are evident.

Meager reports only have been received of the instruction for the field duties of the Signal Service had elsewhere than at Fort Whipple.

In the Department of the Missouri, reports of instruction in field signaling have been received from Fort Bliss, Tex.; Fort Riley, Kans.; Fort Gibson, Ind. T., and Fort Union, N. Mex.; and in the Department of the East, from Fort Wayne, Mich.

The chief signal officer remains of the opinion that the general instruction of the Army in signaling and telegraphy, to be successfully carried on, should be confided only to officers who have themselves been carefully instructed, and who are responsible to the Chief Signal Officer for the discharge of their duties as instructors.

It is again recommended that provision be made that a force of six subaltern officers may be constantly under instruction at Fort Whipple, Va., in the duties of field signaling and telegraphy, it being understood that as each shall have completed the course and passed the necessary examination, he shall join his company and regiment; the number undertuition at the school of instruction to be kept constant by details to be made from companies and regiments not before instructed, as vacancies occur.

The legislation of the act approved June 16, 1880, increasing the enlisted force of the Signal Corps by fifty additional men, has been and will be productive of good results. This and previous legislation has fixed the service on an honorable footing, and opened a career, of which they are proud, to the best class of young American citizens. The applications for enlistment are numerous. The severe examinations are successfully undergone. The clause providing "that two sergeants may in each year be appointed to be second lieutenants," gives that stimulus of permanent service and promised reward so long and earnestly sought for. The success of this desired legislation is largely attributable to the steady and strong support of the Secretary of War.

Each year, however, since the passage of this act, additional duties not then contemplated have been imposed by Congress upon the corps.

The candidates for enlistment in the Signal Corps become year by year, as the service progresses and is approved, more numerously representative of the better educated classes of citizens.

The men to be enlisted are required to pass first a preliminary physical and educational examination before they are accepted for enlistment. After enlistment they are sent to Fort Whipple to be drilled and instructed. They are then tested by practice and further taught by a year of duty and study in the positions of assistants at stations. They are instructed later in higher branches at the school of instruction at Fort Whipple, and again examined and again tested by practice before being intrusted with the management of stations. They are held to a rigid observance of duty and with careful discipline at their several stations. The plan has furnished a force of soldiers of superior education and good character at the many stations throughout the United States. Their work is in evidence.

The work aggregating at this office has become each year more extensive. A field of operations actually coextensive with the northern hemisphere is now within its scope.

The details are many and complicated, each requiring to be elaborated for each day with the many checks necessary for accuracy, and each limited for its discharge to fixed and brief periods of time.

The organization of the service, improved by experience, has permitted each branch of duty to be carried on with regularity. The force on duty at this office, small in view of the onerous and extensive duties devolved upon it, has been at times, and necessarily, overworked.

The staff of the office since the date of the last annual report has been constituted as follows: First Lieuts. J. P. Story, H. H. C. Dunwoody, Robert Craig, C. E. Kilbourne, and H. W. Howgate, acting signal officers and assistants, who have been in charge, respectively, at different periods, of records, general correspondence, orders and enlistments; of the general charge of instruction, and general supervision of non-commissioned officers and assistants on station duty; the receipt, record, and publication of daily weather reports; and of the property division.

First Lieuts. J. P. Story, H. H. C. Dunwoody, Robert Craig, C. E. Kilbourne and A. W. Greely, acting signal officers, and Cleveland Abbe, A. M., have alternated, under the direction of the Chief Signal Officer, in immediate charge of the issue of cautionary signals, synopses, and indications, and the preparation of the publications of the office.

First Lieuts. J. P. Story, H. H. C. Dunwoody, J. McClellan, J. A. Buchanan, S. C. Vedder, C. A. Booth, and B. H. Gilman, and Second Lieut. C. A. Tingle, acting signal officers, and Second Lieuts. L. E. Sebree, J. S. Powell, and W. A. Glassford, Signal Corps, U. S. A., have been at different times attached to the office as inspectors.

The Chief Signal Officer refers with pleasure to the faithful services of these officers, as also of those serving at Fort Whipple and on detached duty elsewhere. The zeal and interest in the service manifested by the acting signal officers as a class, have won success in the duties with which they have been charged.

The aggregate of office correspondence has become very large, embracing many thousands of communications, exclusive of telegrams sent and received. The record is herewith. (Paper 6.) While the office work has increased in magnitude, it has not changed markedly in character since the date of the last annual report. As then stated, the office is in communication with numerous foreign correspondents, having now official relations with the scientific men and the chiefs of meteorological services of nearly every prominent power in the northern hemisphere. It has become the acknowledged center for meteorological information on the continent; it has succeeded in connecting itself with the meteorological work of the world. It maintains a system of exchanges valuable and interesting at once to those who send and who receive, more extensive, prompt, and regular than would have been possible for the service without the aid of military organization for its members and the incident power of regulation and control which accompanies it. Co-operation wherever sought has been cordial and courteous.

The preparation of statistics and reports upon special requests for the uses of individuals or institutions and journals which wish to publish data is a work of magnitude. The numerous applications for information on various subjects, many of them only indirectly connected with the duties of the office, require of themselves much attention. Requests for consolidated data or the discussion of meteorological facts, requiring in compliance days of labor, are made at times apparently without thought of how much has been asked for. It has been the rule of the office to furnish whatever has been in its power whenever it has been considered to be for the public benefit. (Paper 7.)

The work in the property division of the office is carefully systematized. It has become extensive with the increasing duties of the service. To meet, as it was hoped, the views of Congress, an economy almost parsimonious has been practiced. The shrinkage of values everywhere has permitted a reduction of outlays, without which the continuation of the work of the office in its present scope would, with the appropriations now available, have been impracticable. The management and the accounting for the sums appropriated for the official telegraphic lines of the United States, the uses of which are, by law, in part for commercial purposes, as well as for the special duties of this office, and for the conduct of military affairs, has become a work involving time, care and responsibility.

A number of useful maps and charts have been prepared in the map-room of the office. The work of this room, offering, as it does, in synoptic view, and at a glance, the results had from thousands of observations extended over years of labor, and condensed, after careful consideration, into the lines of the charting, becomes yearly, with the lapse of time, more valuable for the studies daily necessary. A glance at the chart exhibits to the student what else could be known only by the personal experience of years. It is desirable to increase the force employed and the work of the room, systematizing, in this way, the series of generalizations established by the duties of the service. A number of clerks are constantly employed in the computations necessary to fix these generalizations. On the success of this duty will rest much of the permanent advance to be hoped for.

Three hundred and four dollars and forty-five cents have been received during the year ending June 30, 1880, from the sale of maps and other office publications, in accordance with the act of Congress approved March 3, 1874, authorizing such sale.

The many inquiries received at this office as to the manner in which the publications of the office may be procured, indicate the want of a general knowledge of the fact that the sale of copies of any or all of its publications, or of any map or papers regularly issued by it, is authorized by law to be made to any applicant upon the payment of the actual cost to the United States of the paper or publication sought for. Valuable data of the office are always procurable in this way, for the study of any sufficiently interested in the subject to which the papers have reference, by paying the very moderate cost of paper and printing.

Nine hundred and twenty-seven meteorological instruments have been purchased for station use, and one thousand two hundred and fifty-six have been issued during the year ending June 30, 1880.

The artisans' work in the instrument and repair shop of the office has steadily increased in amount with the increased distribution of instruments and the number of stations. A number of meteorological instruments, made after original designs, have been here manufactured, to be tested in the office as to their value for practical use or for the purposes of distribution.

The practice of sending instruments by mail, in the charge of postal agents, under the special arrangement for this purpose made with the Postmaster-General, has continued to be successful, and is of material benefit to the office. The superintendent of the railway mail service and his assistants of the Post-Office Department, as well as the agents of that department generally, have rendered careful and energetic aid in this transportation. Such aid is important to a service now ramifying into every portion of the United States.

It is by the aid of the postal agents and the facilities had through them for the conveyance of instruments over their routes, that the wide distribution of meteorological apparatus, rendered necessary on seas and continents by the plans of observation and study now adopted, has become possible, and will be maintained.

A considerable number of instruments, anemometers, hygrometers, water-thermometers, rain-gauges, &c., have been issued to the Chief of the Bureau of Navigation of the Navy Department for use on vessels of the United States Navy in making, in co-operation with this office, the naval series of simultaneous observations directed by the honorable Secretary of the Navy in G. O. No. 220, dated December 25, 1876. This office supplies, upon proper application and receipt, any instruments required for this purpose. Reports of naval observations transmitted to this office are entered on the international bulletin and are charted upon the international weather charts.

A number of instruments have been furnished for temporary use on vessels of the commercial marine engaged in similar co-operation upon the marine series of observations.

The library of the office now contains four thousand four hundred and twenty-five bound volumes, and eight hundred and eighty-nine pamphlets, being an increase since the date of the last annual report of two hundred and seventy-six bound volumes and sixty-seven pamphlets. These works have been carefully catalogued and are filed for convenient reference. The list comprises an extensive collection for meteorological research, with other works, relating to the several duties of the service. Copies of some of the volumes are not to be found elsewhere, and are especially valuable. A number of important works have been obtained, without cost to the United States, from foreign societies and associations, in courteous exchange for the publications of this office.

The total number of stations of observation in operation June 30, 1880, within the territory of the United States, and maintained for the Signal Service, was two hundred and forty-seven, including those upon the telegraph lines in charge of this office, and the special river and sunset stations, from which reports are regularly received. Reports are also received from seventeen additional stations established by the authorities of the Dominion of Canada; also from one at St. John's, N. F., and one at York Factory, B. A. Telegraphic reports have been regularly received throughout the year from one, and mail reports from two, stations located in the West India Islands, and during a portion of the year telegraphic and mail reports from three others. The number of stations from which telegraphic reports are received at this office tri-daily is one hundred and forty-six; the number from which one telegraphic report only is received daily is thirty-four, and from which two telegraphic reports are received daily is one; making the total number of stations from which telegraphic reports are received daily one hundred and eighty-one.

The sums expended for the service secure for the United States not only the reports from the officially established stations, but incidentally those had from the additional stations, to which reference is made elsewhere.

The following is the record of regular stations for the year ending June 30, 1880:

ALBANY, NEW YORK.

[*Official number*, 16.]

Latitude	42° 40′
Longitude	73° 45′
Elevation of barometer above mean sea-level	75.26 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for six years	29.922
Mean annual barometer (reduced to sea-level) for six years	30.010
Mean annual temperature for six years	46°. 9
Mean annual rainfall for six years	39.78 inches.

Established December 22, 1873.

Office, No. 44 State street.

Sergeant S. W. Beall was in charge of the station until December 10, when he was relieved by Sergeant J. O. Barnes and ordered to Oswego, N. Y. Private G. E. Kelley has been on duty as assistant. Private G. A. Smith was assistant and telegraph operator from August 11 until March 25, when, owing to the removal of the office, his services were no longer required and he was ordered to this office.

The station was inspected in August, 1879, and in June, 1880. In both instances the office was found in excellent condition.

The Erie Canal closed November 25, and the Hudson River December 6, 1879. "Peoples" line of steamers began running on March 10. Erie Canal opened April 19.

The office was removed from a building on the grounds of the Dudley Observatory to its present location, No. 44 State street, March 15.

Extracts from the observer's semi-annual reports:

> The interest in the service is daily increasing; business men and students come to the office for information in reference to the operations of the service.
>
> The papers in this city deserve special mention for the interest manifested in the service, employés coming to the office daily to obtain information for publication.

PUBLICATIONS.

Number of Farmers' Bulletins issued during the year ending June 30, 1880	28,754
Number of Bulletins (manifold) issued during the year ending June 30, 1880	8,316
Number of Local Reports issued during the year ending June 30, 1880	980
Number of Forms 15 issued during the year ending June 30, 1880	622
Number of Forms 22 issued during the year ending June 30, 1880	132
Total	38,804

ALPENA, MICHIGAN.

[*Official number*, 85.]

Latitude	45° 5′
Longitude	83° 28′
Elevation of barometer above mean sea-level	608.25 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.325
Mean annual barometer (reduced to sea-level) for seven years	29.971
Mean annual temperature for seven years	42°. 0
Mean annual rainfall for seven years	35.78 inches.

Established September 10, 1872.

Office, corner Fletcher and Dock streets.

Sergeant J. A. Barwick has been in charge of this station throughout the year. On May 13 Private J. T. Foy was ordered from Milwaukee to assume temporary charge of the station, Sergeant Barwick having been ordered to Detroit for medical examination. On June 7 Sergeant Barwick returned and assumed charge. Private Foy then returned to Milwaukee. It was inspected in June and reported in a satisfactory condition.

Navigation closed at this port on December 10, 1879, and opened on March 23, 1880.

The display of cautionary signals was discontinued December 25, and resumed March 15.

Extracts from the observer's semi-annual reports:

The interest taken in the service at this point continues, the lumbermen and fishermen paying strict attention during the spring and fall to the cautionary signals.

Weekly and monthly weather reports have been furnished the Weekly Argus and Pioneer.

Forty-five cautionary signals were displayed during the year at this station.

Extracts from special reports of the observer relative to the display of cautionary signals:

September 3.—The mail steamer was detained two days by the storm, also several other vessels remained in harbor during display.

September 29.—Mail steamers delayed on account of heavy weather outside.

October 2.—No disasters reported; all vessels remained in port during display.

November 9.—No disasters reported; all sailing vessels remained in port during the display.

December 9.—Schooner L. C. Butts, towed into port in a leaking condition, having dragged her anchor and grounded near Thunder Bay Island at Nine-Mile Point.

PUBLICATIONS.

Number of Local Reports issued during the year ending June 30, 1880	96
Number of Forms 22 issued during the year ending June 30, 1880	30
Total	125

ATLANTA, GEORGIA.

[*Official number*, 198.]

Latitude	33° 45′
Longitude	84° 23′
Elevation of barometer above mean sea-level	1131.30 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for one year	28.932
Mean annual barometer (reduced to sea-level) for one year	30.061
Mean annual temperature for one year	61°. 8
Mean annual rainfall for one year	50.30 inches.

Established September 25, 1878.

Office, Kimball House, Pryor street.

Corporal Harry Hall has been in charge during the year. There is no assistant at this station. It was inspected in December and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

> A copy of Form 22 is furnished to Dr. B. W. Westmoreland, editor of the Atlanta Medical and Surgical Journal, for publication. A summary of the monthly reports has been published by the Constitution. Great interest is taken in the reports and in the work of the service, by the citizens, especially those engaged in the cotton and pork trades.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	1,672
Number of Local Reports issued during the year ending June 30, 1880	306
Number of Forms 15 issued during the year ending June 30, 1880	36
Total	2,014

ATLANTIC CITY, NEW JERSEY.

[*Official number*, 116.]

Latitude	39° 22′
Longitude	74° 25′
Elevation of barometer above mean sea-level	12.86 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for six years	30.033
Mean annual barometer (reduced to sea-level) for six years	30.043
Mean annual temperature for six years	51°. 6
Mean annual rainfall for six years	39.26 inches.

Established December 10, 1873.

Office, Apsley Cottage, Rhode Island avenue.

Sergeant E. W. McGann has been in charge during the year. Six assistants have been ordered to this station during the year and five transferred to other points. The station was inspected in March and found in good order.

The instrument shelter was moved from the ground to an office window, facing north, on April 8.

A summary of Form 22 is furnished and published by the Atlantic City Times, a weekly paper.

Cautionary signals and cautionary off-shore signals were displayed during the year at this station.

Extracts from special report of the observer relative to the display of cautionary signals:

> *July* 5.—Steamer G. W. Childs remained in port during the display.
>
> *July* 8.—Schooner Lydia B., Captain Sheppard, while entering the channel, was blown ashore on the inner bar.
>
> *July* 12.—All yachts remained in harbor until signal was lowered.
>
> *July* 26.—Two yachts cruising northward, observing the signal, put into port and remained during display.

August 16.—All vessels remained in harbor during the display. No disasters reported.

August 18 to 19.—Signals fully justified. In the northeastern part of the city houses were lifted from their foundation and others blown down. All the pleasure yachts were more or less injured; four were sunk and one blown to sea. Two small steamers were carried up on the meadows, but sustained only slight injury. Of the hundred bath-houses, not one is left standing and many have been carried to sea. In the city, many of the shade-trees were blown down, and the camp of Company E, N. G., of Philadelphia, was prostrated. The board walk which runs the entire length of the city along the beach was swept away. Schooner Flora Curtis of Perth Amboy, N. J., was driven ashore.

August 24.—The schooner Flora Curtis, which was driven ashore during gale of 18th, went to pieces. Signal gave timely warning of the approaching storm, consequently no casualties to report. All vessels remained in port.

October 10.—One fishing steamer and one schooner put into this port on account of the heavy weather. The Italian bark Antionetta Costa, from Genoa for New York, in ballast, went ashore on Brigantine Beach at 1.30 a. m. of the 11th.

November 18.—Two schooners put in, and, as soon as the signals were lowered, put to sea.

November 19.—Several schooners put in on account of the severe gale and remained during the display.

February 4.—Storm very severe; no vessels in port and no results reported.

February 16.—Thirteen fishing vessels put in and remained until signal was lowered.

February 24.—Two schooners put in night previous and went to sea at 7.30 a. m.

March 3.—One schooner put in and remained until the signals were lowered. No casualties.

March 9.—Very heavy weather reported at sea.

April 12.—One schooner put back upon observing signal and remained until it was lowered.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	851
Number of Forms 15 issued during the year ending June 30, 1880	1,157
Number of Forms 22 issued during the year ending June 30, 1880	34
Total	2,042

AUGUSTA, GEORGIA.

[*Official number*, 23.]

Latitude	33° 28′
Longitude	81° 54′
Elevation of barometer above mean sea-level	185.35 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.909
Mean annual barometer (reduced to sea-level) for eight years	30.084
Mean annual temperature for eight years	64°.0
Mean annual rainfall for eight years	49.11 inches.

Established November 2, 1870.

Office, Nos. 735 and 737 Reynolds street.

Sergeant I. A. Reed has remained in charge during the year. Private F. R. Gurley was relieved from and Private C. R. Zappone assigned to duty as assistant December 6, 1879. The station was inspected in November.

Highest water in the river, 30 feet 1 inch, occurred December 16, 1879; lowest water, 3 feet 9 inches, July 19, 1879.

Extract from the observer's semi-annual report:

> Merchants generally manifest the greatest degree of interest in the service, as they are kept well posted as to the state of the weather throughout the cotton States and grain-growing district of the Northwest.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	3,159
Number of Local Reports issued during the year ending June 30, 1880	294
Number of Forms 22 issued during the year ending June 30, 1880	31
Total	3,484

BALTIMORE, MARYLAND.

[*Official number*, 18.]

Latitude	39° 18′
Longitude	76° 38′
Elevation of barometer above mean sea-level	45.19 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	30.016
Mean annual barometer (reduced to sea-level) for eight years	30.055
Mean annual temperature for eight years	55°.5
Mean annual rainfall for eight years	42.46 inches.

Established January 1, 1871.

Office, corner South and Water streets.

Sergeant William Black was relieved August 29, and Sergeant Robert Seyboth was assigned in charge September 27. Four assistants have been ordered to, and four relieved from, this station during the year.

Extracts from the observer's simi-annual reports:

The location of the office is central and convenient, as regards business interests, but not well adapted for the display of cautionary signals. The repetition of day signals at the Marine Observatory on Federal Hill does, however, considerably lessen this objectionable feature. Two large weather maps—one at the Corn and Flour Exchange, the other at the Merchants' Reading-Room—are changed daily, except Sundays, displaying the morning reports from seventy-two stations. Much interest is manifested in these maps, more especially by the members of the Corn Exchange. A very gratifying interest in the work of the service is manifested by all classes, the press included, which always has a kind word for the signal service.

Such of our business men as are more directly interested in the daily reports—as oyster-packers, pork-packers, and grain merchants—place the utmost reliance in them, and are largely governed by them in their daily business operations. The assistant who changes the large weather map at the Corn Exchange is usually surrounded by a large crowd of operators eagerly scanning each report as displayed. Frequent calls are also made at this office for information by business men, pleasure seekers, invalids, and sportsmen.

Vessel reports from Cape Henry are telephoned to the Merchants' Exchange or to the agents as soon as received, and are of very great advantage, especially in the case of the large ocean steamers, where a few hours of time gained in preparing for the arrival of emigrants and cargo are often equivalent to hundreds of dollars saved. Messrs. A. Schumaker & Co., agents for the Bremen and Allan Lines steamers, are very appreciative of the benefits thus received, and endeavor to make return for the same by urging their captains to furnish Marine Bulletins with all possible regularity.

The morning papers continue to publish full local reports, also midnight reports from the coast and from twenty northern and western stations. The American and News also publish weekly summaries in their Sunday issues. The Evening Herald and News publish local reports and the morning indications furnished through this office. Monthly summaries are published in full by all morning papers.

During the wheat harvest in June, when prices fluctuated according to the state of the weather in the West, and when a protracted corner in wheat existed, the anxiety to see the reports became very great, and many merchants called at this office daily before the exchange was open for business, and also to see the afternoon and midnight reports, which are not bulletined at the Exchange. The frequency which this office is called upon for the indications, in person or by telephone, proves that public faith in their reliability remains unshaken.

Eleven cautionary signals and six cautionary off-shore signals were displayed during the year at this station.

Extracts from special reports of the observer relative to the display of signals:

November 17.—High northwest winds were reported on Chesapeake Bay, although the signals were not justified at this port.

November 19.—Bay steamers arrived late and report heavy northwest gales and cold weather. Harbor very rough and tide unusually low. Steamer Mystic ashore and bilged near Queenstown. Several smaller vessels reported capsized or sunk in bay. The timely display of signals undoubtedly prevented many small crafts from leaving harbor.

March 23 to 25.—A brewery on the Frederick road was unroofed by the gale. The stove-pipe of the bark Governor lying in the stream was blown over, setting fire to the vessel and damaging her to the extent of $200. Extremely low tide in the harbor this morning, caused by continued northwesterly wind. Allan Line steamship grounded in mid-channel and remained fixed for the present.

April 11.—No marine disaster reported; some damage done to roofs and sign-boards in the city.

April 29 to 30.—Severe gale reported on the Chesapeake, compelling bay steamers to seek a harbor and delaying them. High tides on Maryland and Virginia shores, during which steamer Massachusetts was driven ashore in Dividing Creek.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	3,451
Number of Local Reports issued during the year ending June 30, 1880	2,517
Number of Forms 15 issued during the year ending June 30, 1880	3,349
Number of Forms 22 issued during the year ending June 30, 1880	64
Total	9,381

BANGOR, MAINE.

[*Official number*, 111.]

Latitude	44° 49′
Longitude	68° 46′

Established November 6, 1874.

Office, No. 4 Main street.

Private C. C. Buck has been in charge during the year. This station is maintained for the purpose of printing and distributing the Farmers' Bulletins. It was inspected in August. The management of this station has not been satisfactory to this office, and a change will soon be made. During the year one hundred and sixty-three post-offices have been supplied with the Farmers' Bulletins. There are no meteorological instruments at this station, and no observations are taken.

Extract from the observer's semi-annual report:

> The value of the indications to farmers and to the shipping interests is hardly to be calculated, and the foot-note of the Farmers' Bulletin is very carefully read by the farmers during the haying season.

PUBLICATIONS.

Number of Farmers' Bulletins issued during the year ending June 30, 1880	105,460
Total	105,460

BARNEGAT, NEW JERSEY.

[*Official number*, 115.]

Latitude	39° 48′
Longitude	74° 9′
Elevation of barometer above mean sea-level	20.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for six years	30.011
Mean annual barometer (reduced to sea-level) for six years	30.024
Mean annual temperature for six years	50°.9
Mean annual rainfall for six years	49.73 inches.

Established December 10, 1873.

Office, Life-saving station No. 17.

Private J. D. Marx has been in charge of this station during the year. One assistant has been relieved from, and one assigned to this station. It was inspected in March and found in good order.

Extracts from the observer's semi-annual reports:

During November and December this section of telegraph line was rebuilt and moved to a position of safety behind the sand hills.

Each day the telegraphic reports are sent to the central office, giving the number of vessels seen passing station during the day, and vessels seen displaying *signal letters* or otherwise recognizable are reported as soon as observed.

Sixty-one cautionary signals and thirty-nine cautionary off-shore signals were displayed during the year at this station.

Extracts from special reports relative to the display of signals:

October 18.—The sea ran very high and submerged the beach for several hundred yards, washing out the poles of the "Signal Service telegraph line," and carrying them completely away.

November 29.—One schooner anchored in the inlet and remained during display.

December 22.—Three sloops anchored in the inlet and remained during display.

February 2.—Ten schooners anchored in sight of station, remaining until signals were lowered.

February 3.—One schooner and one sloop anchored four miles off shore. Beach submerged.

February 9.—One schooner anchored off shore in sight of station during display.

February 13.—Two schooners anchored off shore in sight of station until signals were lowered.

February 19.—Three fishing schooners anchored near station during off-shore display.

March 16.—Brig Tropic, Capt. Joseph P. Otter, owner, ashore fourteen miles south of station at 3.30 a. m., fifteen days out with logwood, from Marigoner, Hayti, for New York; vessel full of water; crew of seven men landed by life-saving crew No. 21. Four schooners and three sloops anchored near station during off-shore display.

March 21.—Four schooners anchored near station.

March 25.—Five schooners and two sloops anchored near the mouth of Barnegat Inlet on the 24th, and remained until signals were lowered.

April 12.—Three schooners anchored near station.

April 17.—Seven schooners anchored near station.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

BOISE CITY, IDAHO TERRITORY.

[*Official number*, 145.]

Latitude	43° 40′
Longitude	116° 6′
Elevation of barometer above mean sea-level	2,768.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for two years	27.151
Mean annual barometer (reduced to sea-level) for two years	30.078
Mean annual temperature for two years	52° .7
Mean annual rainfall for two years	13.92 inches.

Established July 1, 1877.

Office, Overland Hotel, northwest corner Main and Eighth streets.

Sergeant Barnet E. Light has been in charge during the year. There is no assistant at this station. The station was inspected in August and found in good order.

Extracts from the observer's semi-annual reports:

There does not seem to be any abatement in the interest felt here for the service, and the records are taken as authority. In a great many cases inquiry is made as to the time of frost in previous years, also as to amount of rainfall.

The office continues to be visited by the leading men of the city, and a deep interest is manifested in the service. The weekly, monthly, and yearly reports are published regularly in the papers.

PUBLICATIONS

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

BOSTON, MASSACHUSETTS.

[*Official number*, 13.]

Latitude	42° 21′
Longitude	71° 4′
Elevation of barometer above mean sea-level	142.19 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.847
Mean annual barometer (reduced to sea-level) for nine years	29.989
Mean annual temperature for nine years	48° 4
Mean annual rainfall for nine years	50.82 inches.

Established November 1, 1870.

Office, Equitable Building, corner of Milk and Devonshire streets.

Sergeant B. M. Purssell has been in charge during the year. Three assistants have been ordered to, and two relieved from, this station. It was inspected in July, 1879, and in June, 1880, and was found in excellent order, and the work being properly performed. During the year six hundred and fifty-nine post-offices have been regularly supplied with the daily Farmers' Bulletin.

Extracts from the observer's semi-annual reports:

The Lowell Telephone Company, at the request of many of its patrons, is arranging to connect its central office in this city with the Signal Office. This will be an accommodation to a large number of people who now are required to visit the office when any special information is desired.

Constant demands are made at the Signal Office for more extended reports from other stations, especially from stations in the northwest and in the Southern States or cotton district. The reports received from other stations, together with the "Indications" and local records, are published without interruption in every paper in the city, except the Globe, which publishes the "Locals" and "Indications" daily. The past records of the service, both here and elsewhere, are daily brought into use by private parties, firms, corporations, and especially the courts, whose demands have at times been so frequent as to seriously interfere with the station duties. The records have frequently saved the city of Boston many dollars in the cases brought for damages by accidents from snow and ice in the streets. The records are also admitted as evidence in the United States courts.

The incidental and miscellaneous service rendered by this office is continually increasing, and consists in furnishing data from the local records, to be used in various ways, by physicians, civil engineers, and many others; also in furnishing information relative to the current telegraphic reports to many applicants daily.

The duty of dropping the Boston time-ball and attending to the batteries and instruments connected therewith has been performed with great care, but two failures having occurred during the six months.

The service is daily becoming more necessary to the public, and is cordially sustained by the press and public opinion. All extensions in the work of the service will find hearty support and encouragement from the people and press of New England.

A considerable number of masters of vessels sailing from Boston have been induced to aid in the marine work of the service, and are now making daily observations in many remote parts of both the Atlantic and Pacific.

In conclusion, I would state that all classes of citizens of every profession, occupation, or trade share in the benefits of the service, commend its usefulness, and testify to its value and the necessity of its continuance by liberal support from Congress.

Fifty-two cautionary signals and thirty cautionary off-shore signals were displayed at this station during the year.

Extracts from special reports relative to the display of signals:

July 8.—Many vessels remained in port; the wind blew a gale outside; no damages reported.

July 16.—The most severe storm since September, 1869. Life and property imperiled by the furious gale; trees denuded of branches or swept to the ground, windows broken, chimneys carried away and fences leveled, lives lost and vessels wrecked; five persons drowned by the capsizing of the yacht Myrtle. A boat containing two persons capsized and one drowned. Numerous other disasters reported. The loss of life by this storm now foots up a total of thirty persons.

August 18 to 19.—This was one of the most severe storms ever observed at this station, as the gale lasted over twelve hours and the wind blew in sudden gusts. Not a vessel left port during display.

October 10.—No vessel left, as the weather was very thick and threatening. No damage done.

October 19.—No vessels left port during the display. No damages reported.

October 24.—But few vessels left port during the display. No disasters reported.

October 29.—Gale severe and protracted; very few vessels left port during the display, and very little damage done on this immediate coast, but farther down the coast many vessels were wrecked.

November 3.—No vessel left port during the display; no damage reported.

November 16.—Only a few vessels left port during the display.

November 18 to 19.—No vessels left port during the display; no serious damage done owing to ample warning given the coasters; gale very severe, with heavy snow and rain.

November 20 to 22.—Gale severe and protracted; none but foreign vessels left port during the display; nearly all coasting vessels put into harbor in time to avoid the storm; no damage of importance caused by this gale owing to the timely warning.

November 29 to 30.—Very few vessels left port during the display.

December 22.—A number of vessels wrecked on the northeast coast.

January 30 to 31.—Gale very severe; no wrecks reported.

February 1 to 2.—Gale very severe; one schooner ashore.

February 3 to 4.—Gale exceedingly heavy and dangerous; many small disasters, none serious.

February 9.—A number of vessels sailed with the northwest wind; no wrecks or damages on this coast.

February 11 to 13.—A few vessels left port during the display; no damage on the New England coast.

February 13 to 14.—A few vessels sailed during latter part of display; one schooner went ashore at Nantucket shore; no lives lost.

February 20.—Gale very severe and protracted; no wrecks reported.

February 24.—No vessel sailed during display; no damages done on this coast.

March 6.—Gale very severe from off shore; but no damage done on this coast.

April 13.—Several vessels sailed during display. Bark Georgiana ashore at Chatham; gale very severe, from the southwest, on Cape Cod.

PUBLICATIONS.

Number of Farmers' Bulletins issued during the year ending June 30, 1880	54,628
Number of Bulletins (manifold) issued during the year ending June 30, 1880	8,127
Number of Local Reports issued during the year ending June 30, 1880	2,489
Number of Forms 15 issued during the year ending June 30, 1880	552
Number of Forms 22 issued during the year ending June 30, 1880	288
Total	66,084

BRECKENBRIDGE, MINNESOTA.

[*Official number*, 82.]

Latitude	46° 11′
Longitude	96° 17′
Elevation of barometer above mean sea-level	966.50 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	28.955
Mean annual barometer (reduced to sea-level) for seven years	29.966
Mean annual temperature for seven years	38°.5
Mean annual rainfall for seven years	25.35 inches.

Established April 10, 1872.

Office, corner of Wisconsin avenue and Fifth street.

Private C. E. Truesdell was relieved from the charge of this station, March 10, 1880, by Sergeant H. Bessant. It has not been inspected during the year.

Extracts from the observer's semi-annual reports:

The newspapers publish a weekly report of the maximum, minimum, and mean temperatures, and the amount of rainfall.

A number of persons from the East have visited the office during the past six months, and all express themselves as highly pleased with the service and its predictions. Newspaper reports of the observations of rainfall and temperature at this station are attracting attention, being found useful to people arriving here with the intention of engaging in agriculture. Great interest is manifested in the service by the citizens, and all speak highly of its reports and forecasts.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

BUFFALO, NEW YORK.

[*Official number*, 33.]

Latitude	42° 53′
Longitude	78° 55′
Elevation of barometer above mean sea-level	664.48 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.287
Mean annual barometer (reduced to sea-level) for eight years	29.974
Mean annual temperature for nine years	46°.8
Mean annual rainfall for nine years	37.08 inches.

Established November 1, 1870.

Office, No. 22 Weed's block.

Sergeant Orin Parker has been in charge during the year. Two assistants have been ordered to, and two relieved from, this station. The office has not been inspected during the year. Two hundred and eighty-two post-offices have been regularly supplied with the daily Farmers' Bulletins.

Navigation closed December 17, 1879, and opened March 19, 1880.

The display of cautionary signals was temporarily discontinued December 25, and resumed March 15.

Extracts from the observer's semi-annual reports:

It is gratifying to note increasing interest and faith manifested in the indications and cautionary signals. All classes are most certainly benefited thereby, but more especially navigators, roofers, farmers, gardeners, and the contractors on the government breakwater. Through the courtesy of the latter, telephonic communication has been established and maintained with the docks and other parts of the city, including all the daily newspaper offices. This has proved very advantageous in publishing storm warnings, and also to hundreds who have desired to obtain information, of every nature in regard to the weather, from this office.

This being the head of navigation on the Great Lakes, with enormous interests involved in the grain and other traffic, the importance of accurate storm warnings can scarcely be overestimated. It is a sufficient commentary on the past displays to state that they have been uniformly heeded by those interested. When the weather is expected to be fair, propellers frequently leave here towing two or more grain barges, all with very light or no loads at all, and therefore in imminent danger in even a moderate storm, because unmanageable in severe wind or high waves. It seems certain disasters would have occurred in many instances but for the timely warnings of approaching bad weather from the central office. The observer has been cited to appear with the records in several important cases. The records are received without question and as conclusive.

The display of cautionary signals has served as a guide to safety for vessels during a very stormy season.

The tug office is in telephonic communication with this office almost incessanty-during stormy weather, and through that office, which is in this way made heald quarters for the purpose, all latest telegrams and reports are instantly published to all interested. That no disaster of importance has occurred in this vicinity is acknowledged to have been due to the certain and prompt warnings which have been issued from the office of the Chief Signal Officer. Farmers' Bulletins have been issued, without failure, and distributed to designated persons and places, and have grown in public favor until now considered almost a necessity. They benefit particularly farmers and gardeners in planting, harvesting, and guarding from loss by frosts.

Forty-six cautionary signals were displayed during this year at the station.

Extracts from special reports relative to signals:

September 2 to 4.—Owing to the timely warning, no damages are reported.

October 29 to 30.—The office was visited almost hourly during the display by captains of vessels and others interested in shipping; the timely warning doubtless prevented many disasters, and was very favorably commended.

November 2 to 4.—Vessels driven back to harbor and reported severe winds; thick and threatening weather; no disasters reported.

November 24 to 25.—Nearly all of the vessels that left port yesterday were forced to put back, and report a terrific storm on the lake.

April 17.—Slight damages reported to several vessels; one seaman lost from schooner Miama Belle.

PUBLICATIONS.

Number of Farmers' Bulletins issued during the year ending June 30, 1880	102,962
Number of Bulletins (manifold) issued during the year ending June 30, 1880	7,504
Number of Local Reports issued during the year ending June 30, 1880	1,702
Number of Forms 15 issued during the year ending June 30, 1880	633
Number of Forms 22 issued during the year ending June 30, 1880	80
Total	112,881

BURLINGTON, IOWA.

[*Official number*, 122.]

Latitude	40° 49′
Longitude	91° 7′

Established September 30, 1874.

Office, No. 412 North Main street.

Corporal E. D. McKenna continued in charge during the year. There are no instruments at this station and no meteorological observations are taken, the station having been established for the purpose of printing the Farmers' Bulletin. It was inspected in August, 1879. One hundred and eighty-nine post-offices have been regularly supplied with the Farmers' Bulletin during the year.

Navigation closed December 11 and opened March 10.

Indications are furnished to the telegraph superintendents of the Chicago, Burlington and Quincy Railroad, and Burlington, Cedar Rapids and Northern Railroad companies.

Extracts from the observer's semi-annual reports:

> The citizens, especially those engaged in agricultural pursuits, express themselves in the warmest manner in regard to the benefits they derive from the Indications.

PUBLICATIONS

Number of Farmers' Bulletins issued during the year ending June 30, 1880	63,298
Total	63,298

BURLINGTON, VERMONT.

[*Official number*, 45.]

Latitude	44° 29′
Longitude	73° 15′
Elevation of barometer above mean sea-level	267.99 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.732
Mean annual barometer (reduced to sea-level) for eight years	29.979
Mean annual temperature for eight years	44°.8
Mean annual rainfall for eight years	29.70 inches.

Established May 24, 1871.

Office, Howard block, southwest corner Bank and Church streets.

Private J. H. Sherman was relieved from charge of this station July 1, 1879, by Sergeant G. C. Schaeffer. The station was inspected in August, 1879, and in June, 1880, and found in good order.

Extracts from the observer's semi-annual reports:

> The public have manifested much interest in the service, and the indications are consulted daily. The lumber merchants, especially, depend upon the official reports of the office when expecting barges from Canada.
>
> For the information of farmers in the State, reached by the newspapers, a tabulated report of the comparative temperature (daily mean thermometer for nine years) is made up once a week Much interest has been taken in this report.
>
> The office has been visited by persons from the city and points throughout the State, and also by those from other parts of the country, and no pains have been spared to make the service of interest and benefit.

PUBLICATIONS.

Number of Local Reports issued during the year ending June 30, 1880	2,578
Number of Forms 22 issued during the year ending June 30, 1880	25
Total	2,603

CAIRO, ILLINOIS.

[*Official number*, 53.]

Latitude	37° 0′
Longitude	87° 12′
Elevation of barometer above mean sea-level	377.35 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.673
Mean annual barometer (reduced to sea-level) for eight years	30.062
Mean annual temperature for eight years	57°.9
Mean annual rainfall for eight years	45.09 inches.

Established June 1, 1871.

Office, United States custom-house, No. 71 Ohio levee.

Sergeant W. H. Ray has had charge of the station during the year. Private J. E. Miller was relieved from duty March 2, since which time there has been no assistant at the station.

The highest water in the river, 46 feet 7 inches, occurred March 21 to 23; lowest water, 2 feet 7 inches, October 9 and 10.

Extracts from the observer's semi-annual reports:

> Floating ice was observed on the Mississippi River on the 18th of December and continued up to the end of the year, navigation of river being obstructed by the heavy flow of ice from December 26 to January 1. The interest taken in the service, as manifested by the people in general, is highly gratifying. The persons who are most benefited by the reports are the river men and merchants engaged in the shipping business. I am also informed by the pork-packers and dealers in fresh fish, that they

are governed in their business transactions by a careful study of the weather bulletins as to probable changes to take place in the temperature, through which means the former know when to slaughter and the latter when to order a supply of fish. There has been a very noticeable increase of interest in the service during the past six months by all classes, and especially this can be said of our local physicians, who study the meteorological reports in connection with their professional duties.

Dr. John A. Rauch, of Chicago, who is secretary of the State board of health, called at this office upon numerous occasions during the yellow fever season, for the purpose of obtaining certain meteorological data which would aid him in regulating the quarantine, and I have it personally from that gentleman that he was entirely governed by the information deduced from the observations of the Signal Service, and he further stated that he had given the weather reports considerable study with beneficial results.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	4,910
Number of Local Reports issued during the year ending June 30, 1880	978
Number of Forms 22 issued during the year ending June 30, 1880	84
Number of Forms 26 issued during the year ending June 30, 1880	4,865
Total	10,837

CAPE HATTERAS, NORTH CAROLINA.

[*Official number*, 123.]

Latitude	35° 14′
Longitude	75° 30′
Elevation of barometer above mean sea-level	8.37 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for five years	30.042
Mean annual barometer (reduced to sea-level) for five years	30.036
Mean annual temperature for five years	61°.2
Mean annual rainfall for five years	78.68 inches.

Established September 1, 1874.

Office, first floor of assistant light-house keeper's dwelling.

Private William Daly was in charge until March 5, 1880, when he was relieved by Private J. M. Wright. Two assistants were ordered to, and two relieved from, this station during the year. It was inspected in February, and the work found to be fairly performed.

Extracts from the observer's semi-annual reports:

All facts relating to disasters to vessels are promptly reported to the Chief Signal Officer over the coast telegraph line, and through information given in this way the owners of vessels are enabled to save much valuable property. The sea-faring community of Hatteras Inlet manifest considerable interest in the reports.

Seventy-eight cautionary signals and twenty-one cautionary off-shore signals were displayed during the year at this station.

The observer reports as follows relative to the display of signals:

August 15 to 19.—Flag-staff blown down and broken, anemometer cups blown off, schooners Water Lily and Southern Cross, both of Hatteras, driven ashore in the Pamlico Sound; the former cut away both masts to save vessel; schooner Ida B. Silsbee, of Patchogue, N. Y., sank in Hatteras Roads; residence blown down at Hatteras; coast line badly damaged.

January 25 to 28.—Schooner Moses Knowlton, of and for Baltimore, from Jamaica, cargo, fruit, struck on Hatteras Shoals and put into Hatteras Inlet leaking.

March 27 to 31.—Schooner Watchful bound from Newberne, N. C., to Philadelphia, cargo, shingles, was driven on shoals in Pamlico Sound, three miles northwest of Hatteras Inlet; no lives lost.

June 14 to 18.—A chimney and portions of framework blown from house occupied by principal keeper of Hatteras light; a grist-mill belonging to Capt. W. R. Jennett, together with a number of trees, blown over, the trees falling generally in the direction from which the wind blew; no further damage known.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

CAPE HENRY, VIRGINIA.

[*Official number*, 118.]

Latitude	36° 56′
Longitude	76° 0′
Elevation of barometer above mean sea-level	16.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for six years	30.029
Mean annual barometer (reduced to sea-level) for six years	30.044
Mean annual temperature for six years	58°.7
Mean annual rainfall for six years	56.66 inches.

Established December 15, 1873.

Office, new building, 150 feet east of light-house keeper's residence.

Sergeant J. H. Bokel was relieved October 10, for making false reports, and discharged the service. Sergeant D. Cuthbertson has been in charge since November 26. Six assistants have been ordered to, and five ordered from, this station during the year. The station was inspected in February and found in good order.

Extracts from the observer's semi-annual reports:

The reporting of vessels by telegraph to the central office is one of the important duties at this station, and no vessels, no matter how small, pass this station without being reported to the Chief Signal Officer at the earliest possible moment.

A large number of people visit this office in the summer. Not only American captains, but those of all other nations, take great interest in the display of signals, and I have heard them pronounce "the Signal Service of America the admiration of the world." Great benefit is derived from the telephone, as constant communication is kept between this office and life-saving stations Nos. 1, 2, 3, 4, and 5, so that in case of wrecks occurring between these points on the North Carolina coast word can be sent to this office and thence to the chief office in a few minutes. All vessels have been reported as soon as their distinguishing signal could be made out. Considerable difficulty is often experienced in making out signals on account of the thickness of the weather and the long distance of vessels from station.

Eighty cautionary signals and twenty-two cautionary off-shore signals were displayed at this station during the year.

The sergeant reports as follows relative to the display of signals:

August 18 to 19.—Anemometer cups blown off; maximum velocity estimated at 100 miles per hour at 12.45 p. m. of the 18th. Bark North Carolina ran ashore 9.45 a. m. 18th; crew of 17 all saved. American brig Northern Star in distress opposite station; telegraph line greatly damaged.

September 20 to 23.—Norwegian bark Stanley ran ashore half mile north of life-saving station No. 7; no cargo; no lives lost. Schooner Woodruff Sims wrecked off this station one mile south of life-saving station No. 2; crew saved; cargo, cordwood and oak plank; vessel and cargo a total loss.

November 17 to 21.—British steamship Rathmore, bound to London from Baltimore, encountered the storm shortly after passing this station on the 17th; her decks were swept and bulwarks blown away. Rowles, master, was killed by falling of rigging; she was obliged to return to port.

January 12 to 14.—This was a very severe storm. The warning was timely. A large number of vessels took shelter in Lynn Haven; sea very rough.

February 23 to 24.—This storm was very severe. A number of vessels returned to Norfolk upon seeing signal flying; no disasters.

March 23 to 25.—Gale most severe of the year; no damage reported.

March 29 to 31.—The most severe storm this year; no disasters reported.

May 21 to 22.—Warning in time and fully justified; no disasters reported.

June 14 to 17.—An ocean steamer came ashore near station, but got of without being damaged.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

CAPE LOOKOUT, NORTH CAROLINA.

[*Official number*, 136.]

Latitude	34° 36′
Longitude	76° 36′
Elevation of barometer above mean sea-level	15.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for three years	30.050
Mean annual barometer (reduced to sea level) for three years	30.061
Mean annual temperature for three years	63°.1
Mean annual rainfall for three years	81.93 inches.

Established April 16, 1876.

Office, light-house keeper's dwelling.

Private H. J. Forman was in charge until January 19, when he was transferred to the central office; Private R. Graham from January 19 to March 6, and Private T. J. Kenan from March 6 to date. There is one assistant at this station. It was inspected in February and found in fair condition.

Extract from the observer's semi-annual report:

The fishermen on the beach derive great benefit from the service.

Sixty-four cautionary signals and sixteen cautionary off-shore signals were displayed during the year at this station.

The observer reports as follows relative to display of signals:

August 15 to 18.—Halliards broken and signal lantern blown away. Estimated velocity 160 miles per hour; last velocity recorded by self-registering anemometer was 138 miles per hour. Houses blown down, trees twisted off and uprooted. A schooner and several boats carried in shore, turned over, dashed to the ground and demolished. Ten miles of telegraph line prostrated; 50 yards of Shackelford's Point washed away; cable broken in two places; potato and corn crops ruined.

December 11 to 16.—Ship Jacob Trumpy ashore 25 miles north of station and a total loss.

January 13 and 14.—Anemometer cups broken off.

April 13 to 17.—Survey steamer Endeavor made harbor in Hook during storm.

June 14 to 18.—One schooner anchored in Hook during gale.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

CAPE MAY, NEW JERSEY.

[*Official number*, 54.]

Latitude	38° 56′
Longitude	74° 58′
Elevation of barometer above mean sea-level	26.99 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	30.022
Mean annual barometer (reduced to sea-level) for eight years	30.045
Mean annual temperature for eight years	53°.2
Mean annual rainfall for eight years	45.78 inches.

Established May 24, 1871.

Office, Block A, lot 27, Beach avenue, Cape May Point.

Corporal John R. Williams was in charge of this station until February 19, when he was relieved by Corporal J. J. Fitzgerald and ordered elsewhere. Three assistants have been ordered to, and three relieved from, this station during the year. There is now no assistant at the station. It was inspected in March and found in good order.

On January 31 this station was discontinued as a full reporting station. Since that time but three daily observations have been taken, none of which are forwarded by telegraph.

Extracts from the observer's semi-annual reports:

> The benefits derived from the display of cautionary signals at this station cannot well be ascertained. The large percentage of justification and the large number of vessels passing within observing distance must undoubtedly render them valuable. All vessel and wreck reports have been forwarded promptly by telegraph to the central office. The office is visited daily by merchants, business men, and seafaring men, and the public interest taken in the service remains unabated.
>
> Seventy-two cautionary signals and forty-eight cautionary off-shore signals were displayed during the year at this station.

PUBLICATIONS.

Number of Forms 15 issued during the year ending June 30, 1880	738
Number of Forms 22 issued during the year ending June 30, 1880	24
Total	762

CEDAR KEYS, FLORIDA.

[*Official number*, 233.]

Latitude	28° 12′
Longitude	83° 2′
Elevation of barometer above mean sea-level	22.50 feet.

Established November 7, 1879.

Office, Rogers' building, northwest corner Second and C streets.

Private J. H. Melton was in charge until April 10, when he was relieved by Private F. W. Mixer and ordered to this office. There is no assistant at this station. The station was inspected in February and found in good order.

Under date of October 30, 1879, the station at Saint Mark's, Fla., was ordered discontinued and transferred to Cedar Keys, Fla. Station was opened here on the 7th of November, 1879, only partial reports being taken until November 15, when full reports were commenced. The office is pleasantly located and conveniently arranged.

Extracts from the observer's semi-annual reports:

> The citizens manifest much interest in the service and have expressed their gratification at having the station established here. Frequent inquiries are made by shippers and dealers in fruit in regard to the weather, and "Indications" for the East Gulf States would be highly appreciated could they be displayed at this station.
>
> Seven cautionary signals were displayed during the year at this station.

The observer reports as follows relative to the display of signals:

> *January* 26.—One steamer remained in port during the display; no damages reported.
>
> *February* 2.—Storm was quite severe; carried away part of rigging and rudder of schooner Ruby; very high tide during display.
>
> *March* 27.—Severe gale; very rough weather at sea reported.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	16
Total	16

CHARLESTON, SOUTH CAROLINA.

[*Official number*, 21.]

Latitude	32° 45′
Longitude	79° 55′
Elevation of barometer above mean sea-level	52.49 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	30.031
Mean annual barometer (reduced to sea-level) for eight years	30.085
Mean annual temperature for eight years	65° .8
Mean annual rainfall for eight years	64.59 inches.

Established January 5, 1871.

Office, corner of East Bay and Broad streets.

Sergeant W. A. Chapman was relieved from charge of this station July 26, and Private J. H. Walter placed temporarily in charge. On August 23 Sergeant J. H. Smith was ordered to assume charge of the station. There has been no change in the assistant. The station was inspected in November, and found in good order.

Extracts from the observer's semi-annual reports:

The interest in the service at this port has not diminished, but appears to be gradually on the increase. Captains and vessel owners, rice and cotton planters, brokers and factors are about the only class of people at this place who are directly benefited by the reports. Mariners place explicit confidence in the storm warnings, and rarely leave port while signals are displayed without calling or sending to the office for information in regard to the nature of the disturbance and prevailing weather along the coast.

The operations of the service are highly appreciated by all classes, and the interest heretofore reported remains unabated.

Eleven cautionary signals and one cautionary off-shore signal were displayed during the year at this station.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	7,295
Number of Local Reports issued during the year ending June 30, 1880	247
Number of Forms 15 issued during the year ending June 30, 1880	1,560
Number of Forms 22 issued during the year ending June 30, 1880	27
Total	9,129

CHARLOTTE, NORTH CAROLINA.

[*Official number*, 199.]

Latitude	35° 13′
Longitude	80° 51′
Elevation of barometer above mean sea-level	837.85 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for one year	29.241
Mean annual barometer (reduced to sea-level) for one year	30.050
Mean annual temperature for one year	60° .7
Mean annual rainfall for one year	44.34 inches.

Established October 6, 1878.

Office, Traders' National Bank building, northeast corner of Tryon and Trade streets.

Sergeant D. O'Donohue has been in charge during the year. He has no assistant. The station was inspected in February.

Extracts from the observer's semi-annual reports:

The local paper publishes the afternoon bulletin and the local observations in the next day's issue. It also publishes the summary of Form 22, monthly, and other meteorological data of interest, such as unusual rainfalls, winds, &c. Increased interest is manifested in the daily reports. During the past six months frequent inquiries have been made at this office as to the probable character of the weather by pic-nic parties, persons going into the country, &c.; and the indications furnished were in every instance verified. The more intelligent classes place the greatest reliance upon the weather reports.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	2,860
Number of Forms 22 issued during the year ending June 30, 1880	36
Total	2,896

CHATTANOOGA, TENNESSEE.

[*Official number*, 208.]

Latitude	35° 04′
Longitude	85° 15′
Elevation of barometer above mean sea-level	783.20 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for one year	29.310
Mean barometer (reduced to sea-level) for the year ending June 30, 1880	30.089
Mean temperature for the year ending June 30, 1880	62°.7
Rainfall for the year ending June 30, 1880	66.55 inches.

Established January 8, 1879.

Office, Hamilton County court-house.

Private B. L. Goulding has been in charge of this station during the year. The station was inspected in October and favorably reported upon. Highest water in river, 37 feet 7 inches, occurred March 18 and 19, 1880; lowest water, 0 feet 2 inches, October 6, 7, 9, and 10, 1879.

Extracts from the observer's semi-annual reports:

> Daily bulletins have been continuously posted in the post-office and filed for reference in this office. The Times has regularly published, in attractive form, the daily and monthly weather reports furnished, and the weekly Commercial the monthly reports, for the benefit of their respective readers. A monthly report of the height of the river has also been furnished Major King, U. S. Engineer Corps, for use in his office since July 1, 1879.
>
> The interest taken in the Signal Service continues to increase. Those classes most benefited appear to be river men, merchants, and pork-packers.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	2,080
Number of Forms 22 issued during the year ending June 30, 1880	36
Total	2,116

CHEYENNE, WYOMING TERRITORY.

[*Official number*, 68.]

Latitude	41° 12′
Longitude	104° 42′
Elevation of barometer above mean sea-level	6,089.37 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for 7 years	24.013
Mean annual barometer (reduced to sea-level) for eight years	29.952
Mean annual temperature for eight years	44°.7
Mean annual rainfall for eight years	10.29 inches.

Established November 1, 1870.

Office, Seventeenth, between Ransom and Dodge streets.

Sergeant J. H. Smith was relieved August 23 by Sergeant E. McGovern, and transferred to Charleston. There has been no assistant at this station since December 31. The station was inspected in November and found in fair condition.

Extracts from the observer's semi-annual reports:

Daily local reports and monthly abstracts are furnished to the two daily papers printed here, and regularly published by them.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	1,748
Number of Forms 22 issued during the year ending June 30, 1880	24
Total	1,772

CHICAGO, ILLINOIS.

[*Official number*, 37.]

Latitude	41° 52′
Longitude	87° 35′
Elevation of barometer above mean sea-level	660.92 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.304
Mean annual barometer (reduced to sea-level) for eight years	29.993
Mean annual temperature for eight years	49°.1
Mean annual rainfall for eight years	35.27 inches.

Established November 1, 1870.

Office, Major Block, southeast corner Madison and La Salle streets.

Sergeant J. G. Lynch was relieved from charge of this station, January 9, by Sergeant J. Mitchell, and transferred to New York city. Five assistants have been ordered to, and six relieved from, this station during the year. It has not been inspected during the year. Six hundred and thirteen post-offices have been regularly supplied with the Farmers' Bulletins.

Extracts from the observer's semi-annual reports:

The reports are much utilized by business men generally.

During the winter season reports of the weather are of the greatest benefit to packers and fruit and oyster dealers, and are often taken as evidence in courts. The co-operation of the different railroads with the Signal Service has advanced the interest taken in the service and its workings a great deal in the last six months, and the accuracy with which the indications are made out has gained them favor with the public.

The first vessel that entered port the present year was the propeller Nashua, from Milwaukee, which reported on the 1st of January, and cleared on the 2d. Navigation, however, may be said to have commenced on the 1st of April with the opening of insurance.

Navigation closed (except for Goodrich Transportation Company) December 16.

Forty-four cautionary signals were displayed at the station during the year.

The sergeant remarks as follows in reference to some of these displays:

August 24 and 25.—This signal was not justified at the station, yet from facts learned from marine sources it was justified upon the lake in this vicinity.

October 17 and 18.—This signal, although not justified at the station, was justified on the lake and outer bay. The Donnelly sailed during the display, and was compelled to return on account of brisk head winds.

October 29 and 30.—No sailing vessel left during the display; mariners report a heavy gale on the lake and a high sea.

November 19 and 20.—This signal, although not justified at the station, was fully justified on the lake. The schooner Clara Parker in attempting to gain the harbor was driven ashore. Ten vessels left port during the display and all were obliged to put back.

April 20.—Storm unusually severe; no damage as far as known to shipping.

April 29.—Several vessels left port lightly laden, but encountering rough weather outside had to return.

PUBLICATIONS.

Number of Farmers' Bulletins issued during the year ending June 30, 1880	194,848
Number of Bulletins (manifold) issued during the year ending June 30, 1880	10,433
Number of Local Reports issued during the year ending June 30, 1880	1,846
Number of Forms 22 issued during the year ending June 30, 1880	153
Total	207,280

CHINCOTEAGUE, VIRGINIA.

[*Official number*, —.]

Latitude	37° 55′
Longitude	75° 20′
Elevation of barometer above mean sea-level	18.50 feet.

Established March 16, 1880.

Office, Life-Saving Station No. 7, Assateague Beach.

Private B. A. Blundon has been in charge of this station since its establishment. He has one assistant.

It was inspected in March, 1880, and found in good order. The station is located on what is known as "Old Fishing Point," on Assateague Beach, between two very dangerous shoals, viz, Turner Shoals on the southwest, which make out to sea for a distance of three miles or more, and Ship Shoals on the southeast, which extend out to sea some four or five miles.

Extracts from the observer's semi-annual reports:

> The captains of vessels and business men of Chincoteague Island place the greatest reliance in the cautionary signals, and take great interest in the service.
>
> Fourteen cautionary signals and twelve cautionary off-shore signals were displayed at this station since its opening.

The observer remarks as follows in reference to the display of signals:

> *April* 13.—Schooner C. H. Madison left harbor for sea, totally disregarding the cautionary signal flying at the time, and on reaching Williams Shoals was blown ashore, where she remained for several hours.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	8
Total	8

CINCINNATI, OHIO.

[*Official number*, 65.]

Latitude	39° 6′
Longitude	84° 26′
Elevation of barometer above mean sea-level	620.42 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.384
Mean annual barometer (reduced to sea-level) for eight years	30.031
Mean annual temperature for eight years	55°.5
Mean annual rainfall for eight years	42.39 inches.

Established November 1, 1870.

Office, Pike's Opera House, southeast corner of Fourth and Vine streets.

Sergeant N. Gorom was relieved from charge of this station December 10, 1879, and transferred to San Francisco. Sergeant R. B. Watkins was ordered to assume charge February 19, 1880. During the interval between the departure of Sergeant Gorom and the arrival of Sergeant Watkins, Private C. N. Kitchel was in charge. Three assistants have been ordered to, and three relieved from, this station during the year. Highest water in the river, 53 feet 3 inches, occurred February 17; lowest water, 2 feet 5 inches, October 23. During the year, five hundred and forty-three post-offices have been regularly supplied with the Farmers' Bulletin. The station has not been inspected during the year.

Navigation was suspended, at intervals, during the latter part of September and October, and the 1st of November, on account of the very low water, the river not having been as low in about twenty years.

Extracts from the observer's semi-annual reports:

> The pork-packers and provision dealers watch the reports closely, and, by a little study, are enabled to take advantage of any change in the weather favorable to their business.
>
> The coal men, river men, and shippers generally, are greatly interested in our river reports, and often take advantage of information derived therefrom.
>
> The records are often called for and used as evidence in the courts and in some cases verdicts are rendered in accordance therewith.
>
> The Commercial's city editor says the reports are eagerly noted. The newspapers in Cincinnati take a deep interest in the service, and devote generous space in their columns to the reports; the river reports particularly.
>
> Business men interested in the weather probabilities for the next day or two, and desirous of obtaining facts about rainfall, temperature, &c., often visit the office and remark that the service benefits them greatly, pecuniarily, by the reliable information furnished them.

PUBLICATIONS.

Number of Farmers' Bulletins issued during the year ending June 30, 1880	177,434
Number of Bulletins (manifold) issued during the year ending June 30, 1880.	7,734
Number of Local Reports issued during the year ending June 30, 1880	1,744
Number of Forms 22 issued during the year ending June 30, 1880	132
Number of Forms 26 issued during the year ending June 30, 1880	2,754
Total	189,798

CLEVELAND, OHIO.

[*Official number*, 34.]

Latitude	41° 30′
Longitude	81° 47′
Elevation of barometer above mean sea-level	689.70 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.287
Mean annual barometer (reduced to sea-level) for eight years	30.007
Mean annual temperature, for nine years	49°.1
Mean annual rainfall for nine years	38.50 inches.

Established November 1, 1870.

Office, northeast corner of Superior and Water streets.

Sergeant D. Cuthbertson was relieved November 26, 1879, by Sergeant James B. Newlin, and ordered elsewhere. Two assistants have been ordered to, and two relieved from, this station during the year. The office was moved to another room in the same building on July 26. It was inspected in September and in June. The inspector reported everything in a satisfactory condition.

Navigation closed on December 9, and the lights at the entrance to the harbor put out, but the river and lake continued unobstructed by ice until the morning of the 18th, when it froze over but was soon cleared by tugs. Navigation opened on March 9. The steamer Northwest, from

Detroit, arrived on March 9 and sailed March 10, being the first arrival and departure of regular line boat of the season.

The display of cautionary signals was suspended from December 25, 1879, until March 15, 1880.

Extracts from the observer's semi-annual reports:

Press reports have been furnished regularly to the four leading newspapers of the city and are given prominent places.

The advantage derived by the public from the reports of the service and the display of cautionary signals has been in many instances very marked. Those most interested are vessel owners, dealers in all kinds of perishable goods and produce, ice dealers, those about to go on journeys, railroad men, &c.

Whenever cautionary signals are displayed the office is generally thronged with vessel men and reporters seeking information in regard to the expected storm.

On one occasion a number of captains visited the office at 4 a. m. to obtain information in reference to the storm then raging, and at another time, upon his arrival at the office at 6.30 a. m. the sergeant found several captains in waiting, all seeking information of the storm. On several occasions information was furnished the street commissioner to guide him in lighting the street lamps at night.

Forty-six cautionary signals were displayed during the year.

The sergeant reports as follows relative to the display of signals:

July 7.—This signal was generally heeded. A number of small vessels remained in port; no disasters.

July 11.—The severest storm since the terrible winter storm of 1877.

August 15 *to* 17.—This storm was very severe on the lake. Only one vessel ventured out on the 16th, viz, the City of Montreal, one of the largest steamers on the lakes. After going out about five miles she had to return. All admit that the warning prevented many disasters, and the timely display is highly commended.

September 2 *to* 4.—This warning gave entire satisfaction to all classes of the community, especially to those interested in shipping. All vessels remained in harbor; lake very rough.

September 7.—A large fleet of vessels remained in port. Captains visiting the office report a severe storm on the lake; no disasters reported.

September 21 *to* 25.—This warning gave general satisfaction to all classes of the community; lake reported very rough after the northwest wind.

October 22 *to* 24.—Over fifty vessels remained in port from Wednesday until Saturday. A large number of captains and others visiting the office admit that the warning prevented many disasters. A very severe storm reported on the lake.

October 28.—The most severe storm of the season; not a vessel ventured out, and not one seen on the lake for twenty-four hours. The warning gave general satisfaction, and doubtless prevented many disasters.

November 17.—The warning was timely and generally heeded, and satisfaction expressed by all interested in shipping.

November 19 *to* 21.—The storm was very severe. A large number of vessels remained in harbor owing to the timely warning. The schooner Sumatra was driven ashore near union depot.

November 26 *to* 29.—The most severe storm of the season. A number of fences and trees were damaged by the gale. The display favorably commented upon by captains and owners of vessels.

March 21 *to* 24.—Signal displayed too long in advance; no vessels left port during display except one, the captain of which thought he could make Kelley's Island before the storm, but was obliged to put into Black River; several captains visited the office.

March 26 *to* 29.—No disasters at this port. The propellers Chicago and Consort went ashore on Gull's Reef, but were towed off by tugs.

Considerable interest was taken in the signal by lake captains.

April 16.—A severe gale; several collisions in the harbor; slight damage. A number of vessels which went out while the signal was up put back with damaged sails and riggings. One tug lost her tow, but afterward recovered it. The chimney of the river custom-house was blown down.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	8,084
Number of Local Reports issued during the year ending June 30, 1880	1,445
Number of Forms 15 issued during the year ending June 30, 1880	7,563
Number of Forms 22 issued during the year ending June 30, 1880	174
Total	17,266

COLORADO SPRINGS, COLORADO.

[*Official number*, 109.]

Latitude	38° 55′
Longitude	104° 58′

Established November 12, 1873, as a supply station to Pike's Peak. No meteorological observations are taken.

COLUMBUS, OHIO.

[*Official number*, 187.]

Latitude	39° 57′
Longitude	83° 3′
Elevation of barometer above mean sea-level	804.60 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for one year	29.212
Mean annual barometer (reduced to sea-level) for one year	30.043
Mean annual temperature for one year	53°.7
Mean annual rainfall for one year	31.26 inches.

Established July 1, 1878.

Office, Huntingdon Block, southeast corner of High street and Broadway.

Sergeant. D. D. Stansell has been in charge during the year. The station has not been inspected.

Extracts from the observer's semi-annual reports:

> Interest in the service continues unabated. The more direct benefits derived from the weather reports at this point are probably realized by the raisers and shippers of wheat, but the reports command a general interest, and the office receives many calls for information by the general public.
>
> The city newspapers continue the regular publication of the weather reports, which are read with great interest by every one, and the service is highly complimented by all who are interested enough to visit the office, and by those who read and watch the reports.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	3,978
Number of Local Reports issued during the year ending June 30, 1880	391
Number of Forms 22 issued during the year ending June 30, 1880	24
Total	4,393

CORSICANA, TEXAS.

[*Official number*, 107.]

Latitude	32° 5′
Longitude	96° 30′
Elevation of barometer above mean sea-level	445.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for five years	29.560
Mean annual barometer (reduced to sea-level) for five years	30.007
Mean annual temperature for five years	65°.6
Mean annual rainfall for five years	38.75 inches.

Established September 15, 1874.

Office, Commercial Building, corner of Collins and Beacon streets.

Sergeant H. F. McFarland has been in charge during the year. He has no assistant. The station was inspected in March. The inspector reported everything in a satisfactory condition.

Extracts from the observer's semi-annual reports:

Very little interest is manifested in the service here, as the majority of the people have never taken sufficient interest in its workings to find out and appreciate the benefit to be derived from it.

The H. and T. C. R. R. Co. have on several occasions been supplied with data to be used in suits against the road, and in several instances the information furnished has proved of great benefit.

PUBLICATIONS.

Number of Local Reports issued during the year ending June 30, 1880	119
Number of Forms 22 issued during the year ending June 30, 1880	38
Total	157

DAVENPORT, IOWA.

[*Official number*, 51.]

Latitude	41° 32′
Longitude	90° 38′
Elevation of barometer above mean sea-level	603.83 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.377
Mean annual barometer (reduced to sea-level) for eight years	30.017
Mean annual temperature for eight years	49°.6
Mean annual rainfall for eight years	34.93 inches.

Established May 24, 1871.

Office, First National Bank building, southwest corner of Main and Second streets.

Sergeant M. McGauran has been in charge during the year. He has no assistant.

The station has not been inspected.

Highest water in the river, 18 feet 5 inches, occurred June 26; lowest water, 1 foot 1 inch, September 14 to 30.

Extracts from the observer's semi-annual reports:

The usual interest is taken in the service by all classes of citizens. The "indications" are read by everybody, and the average high percentage of verifications elicits favorable comment.

Many gentlemen have informed me that on receiving the daily papers the weather reports are always the first news items looked for. In no State probably is the subject given more attention than in this one. The river closed on December 19, 1879, and opened January 8, 1880. The Belle of Belleview, the first boat of the season, arrived March 8, 1880.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	2,046
Number of Local Reports issued during the year ending June 30, 1880	68
Number of Forms 22 issued during the year ending June 30, 1880	60
Total	2,174

DELAWARE BREAKWATER, DELAWARE.

[*Official number*, ——.]

Latitude	38° 48′
Longitude	75° 5′
Elevation of barometer above mean sea-level	20.00 feet.

Established January 28, 1880.

Office, second building from west-northwest extremity of Delaware Breakwater.

Sergeant S. W. Naylor was ordered to assume charge of this station

December 27. On June 23 he was transferred to Norfolk and the station placed in charge of Private William Bolton. Four assistants have been ordered to, and three relieved from, this station during the year.

The station was inspected in March and everything reported in a satisfactory condition.

Upon the establishment of this station the display station at Lewes, Del., was discontinued.

An important duty at this station is that of reporting by telegraph the arrival and departure of vessels to the Philadelphia Maritime Exchange and interested parties.

Forty cautionary signals and twenty-eight cautionary off-shore signals were displayed during the year at this station.

The observer reports as follows relative to the display of signals:

February 2 *to* 4.—American brig Quango struck the ice break during the night while coming into harbor, breaking a hole in her bottom and beginning to fill immediately; crew abandoned her and were rescued by a schooner's crew near by. Brig went ashore five miles north of Plumb Point; was pumped out by wrecking crew from Lewes and taken to Philadelphia on the 6th.

February 5.—Schooner reported aground on Brandywine shoals; wrecking steamers North America and Pioneer went to rescue, but without success.

April 18.—Schooner Wm. R. Drury reported ashore on Brandywine shoals; was taken off by the wrecking crew from Lewes, Del., April 20. This morning British bark Queen of Ceylon was washed ashore on Cape Henlopen; hauled off by tug North America 12.50 p. m. without damage.

June 1.—Schooner Wm. Conners, Capt. Thos. Morrisey, from Bangor, Me., with lumber for Philadelphia, struck on the breakwater at 1.30 a. m.; wind N. E. and heavy sea; crew of five men saved; steamer North America summoned to her assistance by Sergeant Naylor at 3.30 a. m. The schooner was finally got off at 3 p. m. with the assistance of the wreckers from Lewes, Del.; schooner total loss; deck load washed overboard, but most of it was saved.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	12
Total	12

DENVER, COLORADO.

[*Official number*, 76.]

Latitude	39° 45′
Longitude	105° 4′
Elevation of barometer above mean sea-level	5,271.12 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	24.775
Mean annual barometer (reduced to sea-level) for eight years	29.994
Mean annual temperature for eight years	49°.2
Mean annual rainfall for eight years	15.42 inches.

Established November 19, 1871.

Office, Broadwell Block, corner Sixteenth and Larimer streets.

Sergeant A. C. Dobbins has been in charge during the year. There has been no assistant at the station since November 6, 1879. It was inspected in November, and, with some exceptions, was reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

The press has been furnished with the local weather reports and the monthly means and other data which have been published regularly. Much interest is taken in these reports. The office is visited by parties desiring to compare barometers and for information referring to the climate of the city and State.

The interest manifested is general, and the benefits derived from our reports as a means of information cannot be estimated.

PUBLICATIONS.

Number of Local Reports issued during the year ending June 30, 1880	951
Number of Forms 22 issued during the year ending June 30, 1880	60
Total	1,011

DES MOINES, IOWA.

[*Official number*, 189.]

Latitude	41° 35′
Longitude	93° 40′
Elevation of barometer above mean sea-level	849.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for one year	29.146
Mean annual barometer (reduced to sea-level) for one year	30.011
Mean annual temperature for one year	50°.1
Mean annual rainfall for one year	32.82 inches.

Established August 1, 1878.

Office, McCain's Block, corner of Sixth and Walnut streets.

Sergeant P. Connor has been in charge during the year. There is one assistant at this station.

Sixty-two post-offices have been regularly supplied with the daily Farmers' Bulletin.

The station was inspected in August and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

The river was closed completely by ice December 13.

The ice broke up for the season in the Des Moines River on January 9, 1880.

The service was represented at the State fair held here during the first week of September.

PUBLICATIONS.

Number of Farmers' Bulletins issued during the year ending June 30, 1880	18,162
Number of Bulletins (manifold) issued during the year ending June 30, 1880	876
Number of Forms 22 issued during the year ending June 30, 1880	48
Total	19,086

DETROIT, MICHIGAN.

[*Official number*, 36.]

Latitude	41° 21′
Longitude	83° 7′
Elevation of barometer above mean sea-level	645.30 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.319
Mean annual barometer (reduced to sea-level) for eight years	29.985
Mean annual temperature for nine years	47°.5
Mean annual rainfall for nine years	33.72 inches.

Established November 1, 1870.

Office, Bank Block, corner Griswold and Congress streets.

Sergeant C. F. R. Wappenhans has been in charge during the year. There is one assistant at the station; also a civilian printer.

The station was inspected in June and reported in a very satisfactory condition. During the year three hundred and thirty-five post-offices have been regularly supplied with the Farmers' Bulletin.

Navigation closed December 11 and opened March 9.

The display of cautionary signals was discontinued December 25, and resumed March 15.

The office is connected with the Board of Trade, and various public offices, by telephone.

Extracts from the observer's semi-annual reports:

By the introduction of a telephone in this office the diffusion of meteorological data has increased in a marked degree. The list of those who desire to be informed of all orders in regard to the hoisting or lowering of cautionary signals now numbers twenty-four. All these orders are immediately sent to the press. Three firms desire and receive the direction and force of the wind at the various lake ports on receipt of the morning and afternoon reports. Whenever the order "Up Signal" indicates the approach of stormy weather, the inquiries by vessel owners and agents as to strength and direction of wind at stations on the lakes, where their vessels are estimated to be, are very frequent.

During the time of harvest of winter and spring wheat, when the price of that cereal is mainly governed by the presence or absence of rain in those regions where the harvest is progressing, the information sought, as to rain, has been very frequent, and the addition of the reports from the southwest covering the wheat region has been of incalculable value to the grain merchants on Change.

The interest taken in the Signal Corps and its published meteorological data has certainly not diminished. In the latter part of winter and during the spring the records are in demand, and meteorological information requested by merchants and shippers of grain, and during the season of navigation by vessel owners and captains, travelers, and the large lumber firms. These are followed, on the approach of winter, by produce merchants, pork men, and gatherers and dealers in ice.

By means of the tabulated reports and the maps at the Board of Trade, vessel owners watch the course of their distant vessels on the lakes, as the direction and force of wind as reported thereon permits them to estimate whether the vessel's voyage will be shortened by a favorable, or lengthened by a contrary, wind prevailing at its estimated position.

Forty-two cautionary signals were displayed during the year at this station.

The sergeant reports as follows in reference to one of these displays:

September 2 *to* 4.—Many vessels remained anchored in the river during the display. The Cleveland steamers remained at their ports, and steamers of the Union, Anchor, and Ensign lines were ordered to stop at this point. Numerous disasters are reported on the lakes.

PUBLICATIONS.

Number of Farmers' Bulletins issued during the year ending June 30, 1880	38,759
Number of Bulletins (manifold) issued during the year ending June 30, 1880	5,042
Number of Local Reports issued during the year ending June 30, 1880	936
Number of Forms 22 issued during the year ending June 30, 1880	78
Total	44,815

DODGE CITY, KANSAS.

[*Official number*, 106.]

Latitude	37° 39′
Longitude	100° 8′
Elevation of barometer above mean sea-level	2,512.50 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for five years	27.386
Mean annual barometer (reduced to sea-level) for five years	29.641
Mean annual temperature for five years	53°.6
Mean annual rainfall for five years	17.47 inches.

Established September 15, 1874.

Office, southeast corner of Walnut and Second avenue.

Sergeant W. H. Clendenon was in charge until August 20, when he was relieved by Private J. W. Everly, and transferred elsewhere. With the exception of from November 6, 1879, to February 10, 1880, there has been no assistant at this station.

It was inspected in November, 1879, and June, 1880. In both instances the inspector reported the office in good order and the duties fairly performed.

Extracts from the observer's semi-annual reports:

> A fair amount of interest in the service continues to be manifested by the citizens of this town and surrounding country, and the reports are looked upon as reliable and to be of great benefit in the future. While, perhaps, there has been (since and during the late drought) less interest manifested by the grangers than heretofore, there has been an increased interest manifested by cattle owners, not only in the State, but from Texas and Colorado, and this office is visited more by them than by any other class of people for information relating to rainfall. The Kansas state board of agriculture is furnished with monthly weather reports from this station upon blanks supplied by the secretary.
>
> The office is frequently visited by strangers, especially land-seekers, who, having a natural desire to know as much about the climate of this region as possible, and recognizing the Signal Service as the most reliable agency through which information can be obtained, are prompt to avail themselves of its assistance. Monthly mean reports are furnished regularly to eleven newspapers published in this city and towns along the line of the Topeka and Santa Fé Railroad. These reports are largely read by the public, who by the interest they manifest in them give the strongest proof of the favorable estimation in which the service is held and of their belief in its increasing usefulness.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	138
Total	138

DUBUQUE, IOWA.

[*Official number*, 98.]

Latitude	42° 30′
Longitude	90° 44′
Elevation of barometer above mean sea-level	665.13 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for six years	29.304
Mean annual barometer (reduced to sea-level) for six years	30.000
Mean annual temperature for six years	48°.5
Mean annual rainfall for six years	37.53 inches.

Established July 10, 1873.

Office, Sullivan's Block, southwest corner Sixth and Main streets.

Sergeant J. Harvey Smith has continued in charge during the year. There is no assistant at this station. It has not been inspected during the year.

Highest water in the river, 22 feet 10 inches, occurred June 23; lowest water, 1 inch, October 1 and 2.

The river was frozen over and navigation closed December 17. The first boat, in the spring, left March 5; the first arrived March 18.

Extracts from the observer's semi-annual reports:

> During the recent high water in the Mississippi River the river bulletins were eagerly scanned by the river men and the citizens generally, and were universally conceded to be of great value.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	2,236
Number of Local Reports issued during the year ending June 30, 1880	1,190
Number of Forms 22 issued during the year ending June 30, 1880	31
Number of Forms 26 issued during the year ending June 30, 1880	1,572
Total	5,029

DULUTH, MINNESOTA.

[*Official number*, 40.]

Latitude	46° 48′
Longitude	92° 8′
Elevation of barometer above mean sea-level	664.09 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.290
Mean annual barometer (reduced to sea-level) for eight years	29.970
Mean annual temperature for nine years	40°.2
Mean annual rainfall for nine years	33.45 inches.

Established November 1, 1870.

Office, Edmonds' Block, southeast corner Superior and Lake avenues.

Sergeant Henry Bessant was in charge until March 10, when he was relieved by Private G. W. Scott, and ordered to Breckenridge. There is no assistant at the station. It has not been inspected during the year.

Extracts from the observer's semi-annual reports:

Great interest is manifested in the service by all classes of citizens, but principally among the shippers and mariners, and the office is frequently visited by such to ascertain the indications of the wind and weather generally.

The interest manifested by the business community is on the increase, and great reliance is placed upon the display of cautionary signals; vessels rarely leave port without consulting the office as to the probable direction of the wind, &c.

The Chamber of Commerce takes great interest in the service and in this office.

Navigation closed with the arrival of the propeller J. L. Hurd, December 3, 1879.

Harbor frozen December 12. The first boat of the season, steamer Quebec, arrived May 1.

Thirty-eight cautionary signals were displayed during the year at this station.

The display of signals was suspended December 25, 1879, and resumed March 15, 1880.

The sergeant remarks as follows in reference to these displays:

September 25.—The schooner Monticello, during the fog on the 28th, went ashore on Minnesota Point, but was gotten off without damage.

May 6.—Steamer City of Winnipeg damaged by encountering drifting ice.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

EASTPORT, MAINE.

[*Official number*, 94.]

Latitude	44° 55′
Longitude	66° 54′
Elevation of barometer above mean sea-level	61.25 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for six years	29.878
Mean annual barometer (reduced to sea-level) for six years	29.936
Mean annual temperature for six years	41°.3
Mean annual rainfall for six years	48.57 inches.

Established April 1, 1873.

Office, custom-house building, northwest corner Washington and Water streets.

Corporal D. C. Murphy was in charge until May 6, when he was relieved by Private J. B. Wells, and transferred to Mount Washington. There is no assistant at this station.

It was inspected in August and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

The usual interest is manifested in the service by persons whose business interests are affected by atmospheric changes.

The International Steamship Company and the fish merchants derive great benefit from the display of signals and bulletins.

Fifty-two cautionary signals and sixteen cautionary off-shore signals were displayed during the year at this station.

The observer remarks as follows in reference to some of these displays:

August 18 *to* 20.—This storm was of remarkable energy for this season of the year. Steamers were delayed, experiencing the roughest weather known for years. One English schooner, 32 tons burden, was wrecked on the island of Grand Menan; one small schooner was sunk in harbor, and much damage done to small boats. Fishing gear and lobster ponds about the docks were badly damaged. Trees and fences were blown down and roofs damaged.

September 25.—Steamer New York arrived and departed during the display; eight schooners remained in port; no damage reported.

October 13.—Steamer City of Portland arrived and departed during the display. Fourteen schooners entered port and remained during the display.

October 29.—Twenty schooners remained in port, several of which dragged their anchors; no other damage to shipping reported; considerable damage was done to houses, &c., by the wind and heavy rain.

November 19 *to* 22.—The International steamers were delayed by this storm. Steamer City of Portland arrived during the display and delayed her departure thirteen hours. About twenty-five schooners remained in port; no damage reported.

July 21.—Steamer Woodburg and twenty schooners remained in port. One of the most severe storms of the season; United States mail delayed twenty hours by the drifting snow.

February 24.—Steamer Falmouth was delayed eight hours by the storm; ten schooners remained in port; no damage reported.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	3,667
Number of Local Reports issued during the year ending June 30, 1880	75
Number of Forms 22 issued during the year ending June 30, 1880	48
Total	3,790

ERIE, PENNSYLVANIA.

[*Official number*, 178.]

Latitude	42° 7′
Longitude	80° 10′
Elevation of barometer above mean sea-level	681.08 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for six years	29.289
Mean annual barometer (reduced to sea-level) for six years	29.985
Mean annual temperature for six years	49°. 3
Mean annual rainfall for six years	42.20 inches.

Established May 25, 1873.

Office, Rindernecht's Block, southwest corner Fifth and State streets.

Corporal F. M. Neal has been in charge during the year. One assistant has been ordered to, and one relieved from, this station.

The station was inspected in May. The inspector reported the station in a fair condition.

Extracts from the observer's semi-annual reports:

The service has steadily grown in favor with all classes of citizens.

The shipping interest at this station, the value of which is $1,172,600 (values made by insurance companies), has not met with a single loss during the season. A portion of this good fortune may be attributed to an observance of the warnings given by the Signal Service at cautionary signal stations. The owners of vessels and persons engaged in commerce on the lakes receive the greatest amount of direct benefit from the service. Their experience during the severe storms of last fall has increased their admiration for, as well as their appreciation of, the service. Freight agents and others frequently ask for information which they can get from no other source than the Signal Office records. The press publishes reports furnished by this office.

Forty-five cautionary signals were displayed during the year at this station.

The display of signals was suspended December 25, 1879, and resumed March 15, 1880.

The observer remarks as follows in reference to some of these displays:

October 22 *to* 24.—The steam barge Kusohen and a schooner were disabled during the storm and came into port. A large number of vessels came in for shelter and remained during this display.

November 17.—Schooner Sasco left port during the display; was driven ashore near Fairport, and is a total wreck.

November 19 *to* 21.—Schooner Wacousta was driven ashore in attempting to enter harbor, and will probably prove a total loss. The wreck of a schooner lies six or seven miles southwest of this port; name unknown; all the crew lost. A large number of vessels remained in port during the display.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	5,928
Number of Local Reports issued during the year ending June 30, 1880	361
Number of Forms 15 issued during the year ending June 30, 1880	3,080
Number of Forms 22 issued during the year ending June 30, 1880	24
Total	9,393

ESCANABA, MICHIGAN.

[*Official number*, 49.]

Latitude	45° 46′
Longitude	87° 14′
Elevation of barometer above mean sea-level	611.60 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.327
Mean annual barometer (reduced to sea-level) for eight years	29.968
Mean annual temperature for eight years	40°.7
Mean annual rainfall for eight years	34.31 inches.

Established May 24, 1871.

Office, Adler's Building, northwest corner of Ludington and Dousman streets.

Sergeant L. A. Welsh has remained in charge during the year. Private B. Bunnemeyer was temporarily in charge from November 6 to December 15, 1879, during the illness of Sergeant Welsh. One assistant has been on duty since May 25.

The station has not been inspected during the year.

A weekly summary of the observations has been furnished to the Iron Port, which is the only newspaper published in the city, and has been regularly published therein. The parties mostly benefited by the service in this vicinity are the railroad company, the shippers of iron ore, lumber, &c., and fishermen, all of whom unite in saying that the service is of great benefit to them.

The persons receiving the most benefit from the display of cautionary signals are those engaged in shipping and fishing, of which there are quite a number.

Forty-two cautionary signals were displayed during the year at this station.

The display of signals was suspended December 25, 1879, and was resumed March 15, 1880.

PUBLICATIONS.

Number of Local Reports issued during the year ending June 30, 1880	52
Number of Forms 22 issued during the year ending June 30, 1880	24
Total	76

FORT GIBSON, INDIAN TERRITORY.

[*Official number*, 93.]

Latitude	35° 43′
Longitude	95° 16′
Elevation of barometer above mean sea-level	510.12 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for six years	29.464
Mean annual barometer (reduced to sea-level) for six years	29.984
Mean annual temperature for six years	60°. 1
Mean annual rainfall for six years	34.56 inches.

Established April 1, 1873.

Office, Nash's Building.

Private J. B. Campbell has been in charge during the year. There is no assistant at this station. It has not been inspected during the year.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

FORT MACON, NORTH CAROLINA.

[*Official number*, 220.]

Latitude	34° 42′
Longitude	76° 40′

Established May 23, 1878.

Office, in building formerly occupied by commanding officer.

Private G. H. Thompson was in charge of this station until March 1, when he was relieved by Corporal C. C. Corbin, and transferred to this office. Five assistants have been ordered to, and five relieved from, this station during the year.

Only sunset observations are taken, it having been established as a repair station on the sea-coast telegraph line, and for displaying cautionary signals. It has not been inspected during the year.

Extracts from the observer's semi-annual reports:

> The interest in the display of cautionary signals is steadily increasing, and the displays are of great benefit to mariners entering and clearing at the port of Beaufort.
>
> Fifty-six cautionary signals and thirteen off-shore signals were displayed during the year at this station.

The observer remarks as follows in reference to one of these displays:

> *August* 15 to 18.—The most destructive hurricane ever known in this vicinity. Estimated maximum velocity 100 miles per hour. This section is badly damaged, about 100 poles down; cable at old Top-sail Inlet was broken. The tide rose 4 feet above ordinary high tide. All the wharves and nearly all the pleasure-boats at Beaufort, N. C., have been destroyed. The business portion of the town, on the water front, for the distance of half a mile was completely demolished by heavy seas. It is estimated that the damage to crops in this and Calvert County will exceed $100,000. Morehead City suffered considerably, principally from the wind, destroying boats and damaging residences. About a half mile of the track of the Atlantic and North Carolina Railroad Company at Morehead City, including a bridge built at considerable expense, was destroyed; but one life was lost; no vessels were in harbor during the storm. Cautionary signals were displayed sixty hours in advance of the storm.
>
> A great deal of damage was done at this post; fences blown down, wells filled up, windows smashed in, and chimneys destroyed. The farmers from the suburbs report that the destruction is general throughout the country.

GALVESTON, TEXAS.

[*Official number*, 55.]

Latitude	29° 18′
Longitude	94° 50′
Elevation of barometer above mean sea-level	39.6 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	30.009
Mean annual barometer (reduced to sea-level) for eight years	30.051
Mean annual temperature for eight years	69°.6
Mean annual rainfall for eight years	51.78 inches.

Established April 19, 1871.

Office, custom-house building, Mechanic street.

Sergeant E. O'C. MacInerney has been in charge during the year.

Sergeant MacInerney was promoted from a first-class private January 13.

The station was inspected in March, and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

> Merchants of every class, but more particularly cotton merchants, take a very great interest in the daily bulletins, especially in the report of rainfall, which seems to be the portion of the reports to which they attach the greatest importance.
>
> People of almost every branch of industry consult the weather reports and indications in relation to their business. The butchers come daily, before purchasing ice, to see if a "norther" is on the way. They regulate their purchases by the information they obtain. The same can be said of the large beer dealers.
>
> Owners and captains of vessels trading at this port are always deeply interested in the weather reports and signals, and constantly crowd the office. House painters are taking a deep interest in the reports, and frequently consult them so as to regulate their daily labors on calculations founded on the present and probable condition of the atmosphere.
>
> Twenty-one cautionary signals and twenty-eight cautionary off-shore signals were displayed during the year at this station.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	2,448
Number of Local Reports issued during the year ending June 30, 1880	869
Number of Forms 22 issued during the year ending June 30, 1880	92
Total	3,409

GRAND HAVEN, MICHIGAN.

[*Official number*, 48.]

Latitude	43° 5′
Longitude	86° 18′
Elevation of barometer above mean sea-level	620.25 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.338
Mean annual barometer (reduced to sea-level) for eight years	29.982
Mean annual temperature for eight years	46°.9
Mean annual rainfall for eight years	38.87 inches.

Established May 24, 1871.

Office, Cutler House, corner Washington and Third streets.

Sergeant S. C. Emery was in charge until October 4, when he was relieved by Corporal D. P. Waters, who was relieved by Sergeant G. R. Hancock, January 3. There is no assistant at this station.

Extracts from the observer's semi-annual reports:

> The cautionary signal is displayed from the roof of the Cutler House, which is the best point in the city for such purposes.

The months of November and December were remarkably stormy and of boisterous character, resulting in great damage to shipping at this point. No lives were lost, and no damage reported as resulting from non-display of signals.

Cautionary signals are displayed during the winter months, after the closing of navigation, for the benefit of the Northwestern Transportation Company's steamers plying between this port and Milwaukee, Wis.

Sailing-vessels generally derive direct benefits from signals and seldom sail while the signal is up. The interest in the service comes mainly from sailors, but all classes are interested to a greater or less degree, according to occupation. Fruit dealers are, perhaps, next to sailors in the amount of direct benefits received.

Seventy-five cautionary signals were displayed during the year at this station.

The sergeant remarks as follows in reference to these displays:

September 15.—Storm very severe; a large steamer of the Northwestern Transportation Company could not leave harbor. The Chicago steamer was several hours late.

October 28.—Steamer Amazon wrecked, three schooners driven ashore, and ten schooners made for harbor upon seeing signals.

November 19.—Heaviest sea of season from southwest. Propeller Paine, of Grand Haven, went on beach at 8 a. m. and broke in pieces in half an hour; schooners Margaret Doll, Maple Leaf, and Holmes, scow Reese, and barge C. O. D. went on beach between 2 and 8 a. m., Maple Leaf going to pieces; life-saving crew rescued all the crews; no lives lost. Another schooner with fore-sail gone is anchored one mile out.

February 29.—Tin roof of D. & M. depot torn off.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	38
Total	38

INDIANAPOLIS, INDIANA.

[*Official number*, 43.]

Latitude	39° 47′
Longitude	86° 6′
Elevation of barometer above mean sea-level	746.58 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.240
Mean annual barometer (reduced to sea-level) for eight years	30.010
Mean annual temperature for one year	53°.3
Mean annual rainfall for eight years	45.22 inches.

Established February 10, 1871.

Office, Blackford's Block, southeast corner Meridian and Washington streets.

Sergeant E. Lloyd has remained in charge of this station during the year. Four assistants have been ordered to, and three relieved from, this station. One assistant, Private J. C. Graham, died June 22.

The station has not been inspected during the year.

Extracts from the observer's semi-annual reports:

An abstract of the a. m. bulletins, showing the temperature, wind, and state of weather, has been furnished to the W. U. Telegraph Company, and A. & P. Telegraph Company. This was telegraphed by the above companies, with commercial quotations, to the several minor offices of this district, and also telegraphed by the Gold and Stock Company to the numerous business houses in this city. The midnight "indications" were supplied to the press.

Local records, showing the observations taken at 7 a. m., 2 and 9 p. m., and the monthly Form 22 were also furnished to the press.

The weather reports have been generally utilized by the business men of this community. During the spring and summer months the merchants consult this office whenever they desire to send their agents out on the road, or to ship such commodities as may be injured by sudden changes of temperature. The poultry men have informed me that they rely implicitly on the Signal Service for information as to the most opportune periods for killing and shipping their poultry. The records of this office have been ordered into court to be used in cases under litigation. The persons who are most materially benefited by the service are the pork-packers throughout the State. They depend entirely upon the weather reports to inform them when they can slaughter their hogs without risk. Several houses in the adjoining towns have had the weather "indications" telegraphed to them twice or three times a day during the packing season. Those of the city engaged in this business have had placed in this office a telephone for their convenience, and, if one is to judge from their constantly ringing the telephone bell whenever there is a prospect for a change in temperature, he would be apt to infer that the Signal Service at this point is for the exclusive benefit of the pork-packers of this city. There are some days twenty or thirty calls.

Messrs. Henderson, Park & Co., Martinsville, Ind., and Mr. George W. Steele, of Marion, Ind., have closed their houses for the season, but, before doing so, they telegraphed their thanks to this office, and stated that they had found the "weather indications" remarkably accurate and indispensable.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	6,985
Number of Local Reports issued during the year ending June 30, 1880	660
Number of Forms 15 issued during the year ending June 30, 1880	7,419
Number of Forms 22 issued during the year ending June 30, 1880	142
Total	15,206

INDIANOLA, TEXAS.

[*Official number*, 94.]

Latitude	28° 32′
Longitude	96° 38′
Elevation of barometer above mean sea-level	25.92 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	30.028
Mean annual barometer (reduced to sea-sevel) for seven years	30.048
Mean annual temperature for seven years	70°.2
Mean annual rainfall for seven years	38.07 inches.

Established May 1, 1872.

Office, Schultz Building, Main street.

Sergeant L. Dunne was in charge until May 4, when he was relieved by Private J. W. Byram, and transferred to New Orleans. There is no assistant at this station. It was inspected in March and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

By authority from the Chief Signal Office certain meteorological data, from the time of opening of the station in 1872, has been furnished Dr. J. H. Pope, sanitary inspector, to be embodied in a report to the National Board of Health. Masters of vessels and others have paid marked attention to the signals, and have generally been guided by them.

Great interest is shown by the people, and the greatest confidence placed in the cautionary signals.

Twenty-six cautionary and twenty-nine cautionary off-shore signals were displayed during the year at this station.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	2,390
Number of Local Reports issued during the year ending June 30, 1880	52
Number of Forms 22 issued during the year ending June 30, 1880	118
Total	2,560

ISLAND OF SAINT PAUL, ALASKA.

[*Official number*, 120.]

Latitude	57° 38′
Longitude	169° 50′

Established August 18, 1872.

Reports are very irregularly received from this station, and only at long intervals. Mr. H. W. McIntyre has charge of the instruments and attends to the taking of the observations.

JACKSONVILLE, FLORIDA.

[*Official number*, 73.]

Latitude	30° 24′
Longitude	80° 40′
Elevation of barometer above mean sea-level	22.90 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	30.049
Mean annual barometer (reduced to sea-level) for eight years	30.082
Mean annual temperature for eight years	69°.0
Mean annual rainfall for eight years	54.74 inches.

Established September 11, 1871.

Office, Freedman's Bank Building, southwest corner Pine and Forsyth streets.

Sergeant J. W. Smith has been in charge of this station during the year. He has no assistant. It was inspected in February and reported in a very satisfactory condition.

Extracts from the observer's semi-annual reports:

The amount of interest in the service has greatly increased, especially among seafaring men. The captains, agents, and owners of vessels have visited the office frequently during the past six months, all expressing great confidence in the service, and stating that great benefits have been derived from the information received. There has been a marked increase in the interest and visits of the officers of the Charleston and Savannah steamers. They have expressed great satisfaction with the storm warnings, the individual and general benefits derived, and the saving of life and property.

Persons from distant parts of the country have visited the office frequently, desiring information regarding the climate of the State, invalids, especially those suffering from pulmonary diseases, having made frequent inquiries regarding the hygrometric conditions of the atmosphere for the different months at this place. They say they have read various and conflicting statements regarding the climate of this State, especially so of the hygrometric conditions, some representing it as dry and others as loaded with moisture, and that they had learned to rely on none as correct except the reports of the Signal Service, all others being made in the interest of some land or railroad company. At times, when the extreme temperatures are of great interest, the reports from this office are accepted as correct. The editors of the Daily Florida Union and the Breeze applied to this office for the reports for publication in their respective papers. The reports are now furnished (by direction of the Chief Signal Officer), and I have been informed by the editors that the reports are of great benefit and interest to their subscribers, and that by their publication they have gained many new subscribers.

As the service becomes better known, and the reports understood, the public interest and confidence increases. Owners of vessels and wharves and shippers often call for information regarding the character of the weather at this station; the information to be used in settling disputes regarding the damaging of goods. During the display of the storm signal, and at times when the weather is threatening, the office is visited by captains of vessels, fishermen, and others, for such information as this office can give. An evidence of the appreciation of and confidence in the service, and that the information thus gained is beneficial, is their repeated visits. Many other instances could be cited, proving the great benefits of the service, and the interest manifested.

Four cautionary signals were displayed during the year at this station.

PUBLICATIONS.

Number of Local Reports issued during the year ending June 30, 1880	805
Number of Forms 22 issued during the year ending June 30, 1880	36
Total	841

KEOKUK, IOWA.

[*Official number*, 47.]

Latitude	40° 23′
Longitude	91° 25′
Elevation of barometer above mean sea-level	616.65 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.366
Mean annual barometer (reduced to sea-level) for eight years	29.984
Mean annual temperature for eight years	52°.1
Mean annual rainfall for eight years	38.61 inches.

Established July 16, 1871.

Office, State National Bank building, west corner Second and Main streets.

Sergeant M. J. Shanefelter has been in charge during the year. There is no assistant at this station. It has not been inspected during the year.

The highest water in the river, 18 feet 5 inches, occurred June 29; lowest water, at zero of gauge, December 20.

Extracts from the observer's semi-annual reports:

Navigation closed December 11.

The stage of water has been furnished tri-daily since June 20 to Superintendent Griffin, of the K., St. L. and N. W. R. R. Co., who forwards it over his wires to all stations along the river as far as Saint Louis.

The river, ice, and poultry men, together with the farmers, are the most interested and benefited, and are lavish in their praises of the service, and express perfect satisfaction.

PUBLICATIONS.

Number of Local Reports issued during the year ending June 30, 1880	622
Number of Forms 22 issued during the year ending June 30, 1880	48
Total	670

KEY WEST, FLORIDA.

[*Official number*, 25.]

Latitude	24° 32′
Longitude	81° 48′
Elevation of barometer above mean sea-level	31.70 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	30.026
Mean annual barometer (reduced to sea-level) for eight years	30.053
Mean annual temperature for eight years	77°.2
Mean annual rainfall for eight years	39.65 inches.

Established November 1, 1870.

Office, Louvre Hotel, Front street.

Sergeant F. Z. Gosewisch has been in charge during the year. There is no assistant at this station. It was inspected in February and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

The public generally are interested in shipping, and consequently in the Signal Service, and even the few who depreciate its benefits in fair weather, are generally among the first to seek information from the bulletins and at the office whenever dangerous weather is threatened.

Every person here is more or less interested in vessels, and takes an interest in the reports of the service, the Havana reports being of great use on account of the numerous vessels running between this port and Cuba.

In foul weather all turn to the Signal Office for information, and sea-faring men recognize the importance of this station as one of the keys to the Atlantic coast weather.

Four cautionary signals were displayed during the year at this station.

The sergeant remarks as follows in reference to some of these displays:

October 5.—Every vessel at the wharves hauled into the foul-weather harbor, to save moorings, as soon as the signal was hoisted. The mail steamer Lizzie Henderson, for Cedar Keys, laid over her regular trip.

October 12.—Schooner Express in northwest channel in distress, towed in by steam-launch Nettie, of Light-House Department; sails and anchor gone and rudder broken. Owing to the timely warning no damage was done to the vessels in harbor.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	4,335
Number of Forms 22 issued during the year ending June 30, 1880	24
Total	4,359

KITTYHAWK, NORTH CAROLINA.

[*Official number*, 129.]

Latitude	36° 0′
Longitude	75° 23′
Elevation of barometer above mean sea-level	22.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for five years	30.044
Mean annual barometer (reduced to sea-level) for four years	30.059
Mean annual temperature for four years	59°.4
Mean annual rainfall for four years	63.04 inches.

Established January 15, 1875.

Office, Life-Saving Station No. 12.

Corporal William Davis was in charge until March 5, when he was relieved by Private William Daly, and ordered elsewhere. Six assistants have been ordered to, and six relieved from, this station during the year. It was inspected in February and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

The fishermen on the beach receive great benefit from the display of cautionary signals.

Fifty-seven cautionary and fourteen cautionary off-shore signals were displayed during the year at this station.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

KNOXVILLE, TENNESSEE.

[*Official number*, 42.]

Latitude	35° 56′
Longitude	83° 58′
Elevation of barometer above mean sea-level	980.02 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.065
Mean annual barometer (reduced to sea-level) for eight years	30.065
Mean annual temperature for eight years	56°.0
Mean annual rainfall for eight years	53.54 inches.

Established January 1, 1871.

Office, Custom-House building, northwest corner Prince and Clinch streets.

Private B. F. Hough has been in charge during the year. There is no assistant at this station. It was inspected in December and reported in a fair condition.

Extracts from observer's semi-annual reports:

> The citizens and public generally evince increasing confidence in the "Indications." The information furnished to those engaged in trade is fully appreciated and is especially valuable to physicians, mechanics, pork-packers, and butchers. Great interest is taken in the reports by the citizens, and the lumbermen are especially benefited as they are able to take advantage of favorable weather for logging.

PUBLICATIONS.

Number of Local Reports issued during the year ending June 30, 1880	612
Number of Forms 22 issued during the year ending June 30, 1880	60
Total	672

LA CROSSE, WISCONSIN.

[*Official number*, 87.]

Latitude	43° 48′
Longitude	91° 23′
Elevation of barometer above mean sea-level	701.94 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.257
Mean annual barometer (reduced to sea-level) for seven years	29.987
Mean annual temperature for seven years	46°.9
Mean annual rainfall for seven years	36.63 inches.

Established October 15, 1872.

Office, Anderson's building, corner Main and Second streets.

Sergeant G. R. Hancock was in charge until January 3, when he was relieved by Sergeant S. C. Emery, and transferred to Grand Haven. There is no assistant at this station.

The river closed December 12, and ice broke up March 18.

Extracts from the observer's semi-annual reports:

> The local observations, a synopsis of the monthly mean reports and the telegraphic reports are furnished the daily papers. These papers also print the "indications" for the Northwest. The Signal Service has, like the telegraph, become an absolute necessity among commercial people.
>
> During the spring term of court the river records of this office were asked for as testimony in a very important case between the Black River Lumber Company and the land owners on the river. The case involved a large amount of money, claimed as damages, and the records were accepted by the court on the ground that they were official and were kept in accordance with an act of Congress.
>
> The brewers have received much valuable information to facilitate the shipment of beer. Their losses have been great in some instances from the fact of their beer freezing while *en route* to customers, they having failed to get the temperatures west and north of this station.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	1,510
Number of Local Reports issued during the year ending June 30, 1880	754
Number of Forms 22 issued during the year ending June 30, 1880	45
Total	2,309

LEAVENWORTH, KANSAS.

[*Official number*, 52.]

Latitude	39° 19′
Longitude	94° 58′
Elevation of barometer above mean sea-level	841.89 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29. 147
Mean annual barometer (reduced to sea-level) for eight years	29. 983
Mean annual temperature for eight years	52°. 7
Mean annual rainfall for eight years	39. 60 inches.

Established May 21, 1871.

Office, No. 315 Delaware street.

Sergeant S. W. Rhode was in charge until December 1, when he was relieved by Sergeant A. W. Browne, and ordered to the central office. There is one assistant at this station. It was inspected in December and June and reported in a satisfactory condition.

Forty-five post-offices have been regularly supplied with the Farmers' Bulletin during the year.

The highest water in the river, 18 feet 9 inches, occurred July 1 and 2; the lowest, 2 feet 1 inch, December 10.

Extracts from the observer's semi-annual reports:

> The public interest manifested in the service continues to increase. During March and April, when severe wind storms were quite frequent, great numbers of persons called at the office for information in regard to the storms. Whenever the weather presents a threatening or stormy appearance, the people call at the office to obtain information as to the atmospheric conditions.
>
> During the latter part of December there were numerous inquiries made by persons engaged in packing ice, as to the prospects for a rise in temperature, &c., and the indications were studied with great interest by these parties, and their operations were almost entirely governed by the predictions.

PUBLICATIONS.

Number of Farmers' Bulletins issued during the year ending June 30, 1880	22, 878
Number of Local Reports issued during the year ending June 30, 1880	936
Number of Forms 22 issued during the year ending June 30, 1880	132
Total	23, 946

LITTLE ROCK, ARKANSAS.

[*Official number*, 230.]

Latitude	34° 40′
Longitude	92° 12′
Elevation of barometer above mean sea-level	298. 15 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	29. 725
Mean annual barometer (reduced to sea-level) for the year ending June 30, 1880	30. 068
Mean annual temperature for the year ending June 30, 1880	64°. 6
Mean annual rainfall for the year ending June 30, 1880	49. 43 inches.

Established July 1, 1879.

Office, Stoddard Bank Building, southeast corner Markham and Main streets.

Sergeant William Line was in charge until September 18, when he was relieved by Private Thomas Cleary, who was relieved March 12 by Sergeant W. U. Simons. There is no assistant at this station. It was inspected in February and reported in a satisfactory condition.

The highest water, 12 feet 8 inches, occurred March 14; the lowest water, 2 feet 9 inches, below zero of gauge, October 12 to 22.

Extracts from the observer's semi-annual reports:

A general interest is being developed in the service by all parties here, and daily requests are made for more reports.

Those most interested in the service are the cotton brokers, who are desirous of having reports from the cotton regions, and from points along the courses of the Mississippi and Ohio Rivers where cotton is being shipped; also the railroad companies, and those concerned in immigration, are anxious to have reports from this station published in the Northern papers, and especially those of Saint Louis, believing that such reports would show an agreeable climate, for this section, and be an effective advertisement.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	1,547
Number of Local Reports issued during the year ending June 30, 1880	419
Number of Forms 22 issued during the year ending June 30, 1880	33
Total	1,999

LOGANSPORT, INDIANA.

[*Official number*, 124.]

Established July 15, 1874.

Office, Snider's Block, 412 Market street.

Corporal C. B. Whiting has been in charge during the year. He has no assistant.

There are no meteorological instruments at the station and no observations are taken, the work consisting mainly of the printing of the Farmers' Bulletin. One hundred and eighty-five post-offices have been regularly supplied with the Farmers' Bulletin during the year.

It is scarcely necessary to say that the service is growing more and more in favor.

Increased interest is manifested by the citizens of this county. Especially at the harvesting season do the farmers take a decided interest in the reports.

PUBLICATIONS.

Number of Farmers' Bulletins issued during the year ending June 30, 1880	62,400
Total	62,400

LOS ANGELES, CALIFORNIA.

[*Official number*, 141.]

Latitude	34° 3′
Longitude	188° 16′
Elevation of barometer above mean sea-level	350.07 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for two years	29.636
Mean annual barometer (reduced to sea-level) for two years	29.977
Mean annual temperature for two years	60°.4
Mean annual rainfall for two years	19.13 inches.

Established July 1, 1877.

Office, Ducommun Building, northeast corner Main and Commercial streets.

Sergeant J. M. Frantz was in charge of this station until February 19, when he was relieved by Sergeant E. F. Kubel, and transferred to Red Bluff. There is no assistant at this station. It was inspected in October and found in a satisfactory condition.

Extracts from the observer's semi-annual reports:

A synopsis of Form 22 is published regularly by the Express and Herald. These reports are read with interest by all classes of citizens.

Members of the Chamber of Commerce visit the office, examine the instruments, and apparently take great interest in what they see.

The rainy season for 1879 and 1880 began October 13, 1879, and up to January 1, 1880, 11.90 inches had fallen. Heavy frosts, the latter part of December, 1879, proved disastrous to budding trees of young nurseries in certain localities. The interest taken in the service is largely on the increase. Visitors are more numerous, and are anxious to see the various instruments and have their uses explained to them. Health-seekers want facts regarding temperature, moisture, winds, &c.

I find that nearly all of the residents and visitors are interested in the rainfall records of this office.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	1,879
Number of Local Reports issued during the year ending June 30, 1880	1,017
Number of Forms 22 issued during the year ending June 30, 1880	36
Total	2,932

LOUISVILLE, KENTUCKY.

[*Official number*, 64.]

Latitude	38° 18′
Longitude	85° 52′
Elevation of barometer above mean sea-level	530.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.479
Mean annual barometer (reduced to sea-level) for eight years	30.029
Mean annual temperature for eight years	56°.6
Mean annual rainfall for seven years	48.36 inches.

Established September 11, 1871.

Office, Courier-Journal Building, southeast corner Fourth and Green streets.

Sergeant W. R. Stansbury has been in charge of the station throughout the year. One assistant has been ordered to and one relieved from this station. It was inspected in October and reported in a satisfactory condition.

Highest water in the river, 30 feet 6 inches, occurred February 18; lowest water, 1 foot 11 inches, October 9 to 15.

Extracts from the observer's semi-annual reports:

The public interest in the service continues unabated, and the weather reports are published in the fullest manner by all newspapers.

The usefulness of the service generally, and the value of this office to the citizens of Louisville, has frequently been evinced by the occurrences of the past six months. The peculiarity of the seasons embraced in this period has rendered the weather reports of even more general interest than usual, and newspaper men constantly obtain information for incorporation in their articles, independent of the regular local reports furnished all papers by this office. Tobacco dealers have used reports furnished by the service to great advantage in the buying and selling of this article. The courts have received the Signal Service reports as evidence, and the observer has been called several times to testify during the past year.

Pork and provision dealers always consult the reports of the service in weather dangerous to their business, and are guided by them.

Doctors use the data furnished by the service in their studies of diseases and the effect of weather changes thereon. Frequent visits have been made to this office by members of the medical profession for data.

So general is the interest in, and benefit from, the service that the Signal Office is looked upon as a necessity by all classes here.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	3,495
Number of Local Reports issued during the year ending June 30, 1880	3,235
Number of Forms 22 issued during the year ending June 30, 1880	156
Number of Forms 26 issued during the year ending June 30, 1880	2,506
Total	9,392

LYNCHBURG, VIRGINIA.

[*Official number*, 44.]

Latitude	37° 30′
Longitude	79° 2′
Elevation of barometer above mean sea-level	646.50 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.366
Mean annual barometer (reduced to sea-level) for eight years	30.051
Mean annual temperature for eight years	57°.1
Mean annual rainfall for eight years	41.86 inches.

Established May 24, 1871.

Office, First National Bank Building, 135 Main street.

Private Henry White was in charge of this station until April 1, when he was relieved by Private G. V. Russell, and transferred to this office. Private Russell was relieved, for discharge, June 21, by Private W. B. Hester.

The station was inspected in December, and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

> The interest taken in the work of the service is wide-spread and increasing. All classes, from sportsmen and pleasure-seekers to dealers in perishable goods and planters, study the reports and "indications," and many call at the office to get additional information of the state of the instruments before carrying out their plans. Wholesale pork and oyster dealers, and the tobacco raisers, derive the greatest benefit. The proposed publication of the "indications" along the line of the Atlantic, Mississippi and Ohio Railroad has called forth many expressions of approval.
>
> The press also regards the service with great favor, cheerfully lending all possible assistance in the way of publishing "indications," local reports, and items of general interest.

PUBLICATIONS.

Number of Local Reports issued during the year ending June 30, 1880	606
Number of Forms 22 issued during the year ending June 30, 1880	24
Total	630

MADISON, WISCONSIN.

[*Official number*, 190.]

Latitude	43° 3′
Longitude	89° 30′
Elevation of barometer above mean sea-level	949.19 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for one year	29.007
Mean annual barometer (reduced to sea-level) for one year	29.997
Mean annual temperature for one year	47°.9
Mean annual rainfall for one year	35.23 inches.

Established September 29, 1878.

Office, Brown's Block, east corner Pinkney street and Washington avenue.

Sergeant C. A. Shaw has been in charge during the year. There is no assistant at this station.

Extracts from the observer's semi-annual reports:

> The interest in the observations continues.
>
> Several visitors with barometers have availed themselves of the opportunity of testing their instruments with a standard.
>
> The newspaper reports of local observations seem to be well received.
>
> The State Journal publishes the daily "indications." These "indications" are also to be found at the post-office, in the official form, and at the railway depot, taken by the station operator and posted conspicuously.

PUBLICATIONS.

Number of Local Reports issued during the year ending June 30, 1880	616
Number of Forms 22 issued during the year ending June 30, 1880	36
Total	652

MARQUETTE MICHIGAN.

[*Official number*, 50.]

Latitude	46° 33′
Longitude	87° 36′
Elevation of barometer above mean sea-level	669.90 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.255
Mean annual barometer (reduced to sea-level) for seven years	29.959
Mean annual temperature for eight years	41°.4
Mean annual rainfall for eight years	30.96 inches.

Established May 1, 1871.

Office, Adams' Block, northwest corner Spring and Front streets.

Sergeant J. T. O'Keeffe was in charge of this station until January 9, when he was relieved by Sergeant James Gilligan, and transferred to Pike's Peak. There is no assistant at this station. It has not been inspected during the year.

Navigation closed December 5, and was resumed April 28.

Extracts from the observer's semi-annual reports:

Vessel owners and masters take great interest in the service, and very few vessels leave harbor when the signal is displayed. Several of the vessel masters never leave here without visiting the office. The citizens of this place also take much interest in the service, and place great confidence in the reports.

The press furnishes a liberal amount of space for the publication of the weather reports.

Thirty-six cautionary signals were displayed during the year. The display of signals was discontinued at this station December 25, 1879, and resumed March 15, 1880.

PUBLICATIONS.

umber of Local Reports issued during the year ending June 30, 1880	21
Number of Forms 22 issued during the year ending June 30, 1880	24
Total	45

MEMPHIS, TENNESSEE.

[*Official number*, 62.]

Latitude	35° 7′
Longitude	90° 7′
Elevation of barometer above mean sea-level	320.84 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.754
Mean annual barometer (reduced to sea-level) for eight years	30.070
Mean annual temperature for eight years	60°.7
Mean annual rainfall for eight years	53.98 inches.

Established February 28, 1871.

Office, Guy McClellan building, northeast corner Court and Front streets.

Sergeant R. R. Martin was in charge of this station until July 28, when he was transferred to Davenport, and Private R. T. Dabney placed in charge. Corporal D. T. Flannery assumed charge of the station December 22, Private Dabney remaining as assistant. It was inspected in February and reported in fair condition.

During the year sixteen post-offices have been regularly supplied with the Farmers' Bulletin.

Highest water in the river, 34 feet 4 inches, occurred March 23 and 28; lowest water, 1 foot 11 inches, November 12 and 15.

Extracts from the observer's semi-annual reports:

Lumbermen, river-men, planters, merchants, lawyers, doctors, the general public, and the press never fail to seek the office for information. The cotton dealers are most benefited by the reports.

The Chamber of Commerce manifest great interest in reports furnished them, and special mention has been made of the weekly rainfall statement of the cotton belt furnished by the central office. The river and railroad interests derive great benefit from Signal Service reports.

Since the epidemic of yellow fever the office has been visited frequently by medical and sanitary experts in search of data, and in all instances they have been furnished with the information.

PUBLICATIONS.

Number of Farmers' Bulletins issued during the year ending June 30, 1880	3,866
Number of Bulletins (manifold) issued during the year ending June 30, 1880	5,757
Number of Local Reports issued during the year ending June 30, 1880	612
Number of Forms 15 issued during the year ending June 30, 1880	1,266
Number of Forms 22 issued during the year ending June 30, 1880	96
Number of Forms 26 issued during the year ending June 30, 1880	3,189
Total	14,786

MILWAUKEE, WISCONSIN.

[*Official number*, 38.]

Latitude	43° 3′
Longitude	87° 54′
Elevation of barometer above mean sea-level	697.07 feet.
Mean annual barometer (corrected for temperature and instrumental error only) seven years	29.266
Mean annual barometer (reduced to sea-level) for eight years	29.998
Mean annual temperature for nine years	45°.1
Mean annual rainfall for nine years	34.79 inches.

Established November 1, 1870.

Office, Mitchell's building, corner Michigan and East Water streets.

Sergeant William Finn has been in charge of this station during the year. Four assistants have been ordered to, and four relieved from, this station. It has not been inspected during the year.

Extracts from the observer's semi-annual reports:

The service continues high in the estimation of the community. As reported on previous occasions the classes who derive most benefit from the service are those having shipping interests, grain dealers, pork packers, and dealers in goods that may become damaged in shipment. Representatives of these different interests have frequently acknowledged their obligations to the service.

During atmospheric disturbances, especially in the fall months, the number of vessel men who call at this office is very large, and it is gratifying to note their increased confidence in the service.

The office maintains friendly relations with the press, which has always shown a readiness to do anything in its power to advance the service.

Seventy cautionary signals were displayed during the year at this station.

The sergeant reports as follows in reference to the display of signals:

July 3.—This storm was accompanied by rain and severe thunder and lightning. Telegraph lines were blown down in many places near the city, and trees torn up. A large amount of damage from flooding occurred in the lower portions of the city. The schooner E. J. McVey, laden with lumber, water-logged some distance south of this place, lost about two-thirds of her cargo.

September 25 *to* 30.—Steamer Amazon, from Grand Haven to this port, was driven a long distance out of her course during the storm.

October 17.—Schooner E. M. Davidson reported ashore on Pilot Island; schooner R.

J. Skidmore went ashore near Manistee, and scow Frankie Wilcox reported water-logged off the same port.

November 2.—Propeller Menomonee ran on the beach 24 miles north of this place during the severest portion of the storm. Several other small disasters are reported from different parts of Lake Michigan.

November 19.—This storm was considered one of the most severe that has occurred on the lakes for years. The only disasters in this section occurred near Little Sturgeon Bay, where the schooners North Star and Elida ran ashore. A very large number of vessels took shelter at different points along this shore. On the other side of the lake the disasters were serious and many.

December 9.—Steamer Minneapolis left for Grand Haven during the display, but was obliged to put back.

May 29 *to* 31.—The schooner C. S. Davis sprung a leak and went ashore in thick weather south of this place; released with little injury.

June 4 *to* 7.—A large fleet put in here on the morning of the 6th for shelter. Three vessels are known to have been dismasted a short distance outside of harbor, and several were damaged in canvas and spars.

June 13 *to* 16.—Schooner Marion Discion caught in the gale between Racine and Kenosha, sprung a leak, capsized, and soon after drifted ashore.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	5,481
Number of Local Reports issued during the year ending June 30, 1880	826
Number of Forms 15 issued during the year ending June 30, 1880	3,409
Number of Forms 22 issued during the year ending June 30, 1880	134
Total	9,850

MOBILE, ALABAMA.

[*Official number*, 27.]

Latitude	30° 42′
Longitude	87° 59′
Elevation of barometer above mean sea-level	39.48 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	30.045
Mean annual barometer (reduced to sea-level) for eight years	30.084
Mean annual temperature for eight years	66°.7
Mean annual rainfall for eight years	62.96 inches.

Established November 7, 1870.

Office, southeast corner Government and Royal streets.

Sergeant Charles Dill was in charge of this station until June 21, when he was relieved by Sergeant Ossian Aldrich, and ordered to Fort Whipple, Virginia, for medical treatment. There is one assistant at this station. It was inspected in March and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

The committee appointed by the Board of Trade and Cotton Exchange continue their official visits of inspection. The office of the United States Engineers, located here, has repeatedly made inquiries for data of various minor importance, and have several times sent aneroid barometers to be tested. The leading daily newspapers give a large amount of space to the data furnished by the Signal Office, and have expressed gratitude for the benefit to the circulation of the paper from its publication.

On the 21st of November, 1879, a bench-mark was established for the city by request and co-operation of this office.

The interest in the working of this office manifested by the Cotton Exchange and Board of Trade is not abating but increasing, and a general desire is expressed on their part to have a greater number of reports (especially from the cotton belt) furnished to this office.

The papers publish weekly a synopsis of the Weekly Weather Chronicle, and, monthly, the summary contained upon Form 22.

A monthly report furnished to the Board of Health is published in connection with their mortuary report.

Eight cautionary signals and one cautionary off-shore signal were displayed during the year at this station.

The sergeant reports as follows in reference to the display of signals:

The display of cautionary signals for the storm of August 23 was fully appreciated. Wherever your observer and assistant went they were interviewed by citizens for information bearing upon the outlook. No damage was done in the city except the flooding of streets, but in the adjacent country the gale was quite destructive, demolishing a neighboring town (Biloxi), prostrating trees and fences, and causing the death of two persons. The rivers rose rapidly, and in the bay a rough sea was experienced. The schooner Marshall, from Boston, Mass., consigned to Gage & Co., was wrecked, and, with cargo, proved a total loss.

August 31 *to September* 2.—No serious damage was done in the immediate vicinity of this station; no vessels left port during the display.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	3,842
Number of Local Reports issued during the year ending June 30, 1880	767
Number of Forms 15 issued during the year ending June 30, 1880	1,348
Number of Forms 22 issued during the year ending June 30, 1880	24
Total	5,981

MONTGOMERY, ALABAMA.

[*Official number*, 26.]

Latitude	32° 22′
Longitude	86° 23′
Elevation of barometer above mean sea-level	219.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.860
Mean annual barometer (reduced to sea-level) for seven years	30.083
Mean annual temperature for seven years	65°.4
Mean annual rainfall for seven years	55.35 inches.

Established November 9, 1870; closed December 18, 1870; re-established September 5, 1872.

Office, No. 10 Market street.

Private Hill C. Smyth has been in charge during the year. There is no assistant at this station. It was inspected in March and reported in good order.

Extracts from the observer's semi-annual reports:

The amount of interest taken in the published reports and the workings of the service generally continues as formerly.

The class of persons most directly benefited by the weather reports are those engaged in cotton buying, selling, and planting.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	3,438
Number of Local Reports issued during the year ending June 30, 1880	467
Number of Forms 22 issued during the year ending June 30, 1880	36
Total	3,941

MORGANTOWN, WEST VIRGINIA.

[*Official number*, 92.]

Latitude	39° 36′
Longitude	79° 52′
Elevation of barometer above mean sea-level	962.62 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	28.971
Mean annual barometer (reduced to sea-level) for six years	30.018
Mean annual temperature for six years	53°.6
Mean annual rainfall for six years	45.57 inches.

Established January 25, 1873.

Office, Old College Building.

Private J. J. McLean was in charge of this station until March 5, when he was relieved by Corporal John B. Merrill.

The station has not been inspected during the year.

Highest water, 20 feet 3 inches, occurred February 14; lowest, 2 inches, July 2.

Extracts from the observer's semi-annual reports:

> Weekly and monthly meteorological reports have been regularly published in the Weekly Post and the New Dominion. Much interest is taken in the service by all classes, but particularly by river men, who frequently consult the records.
>
> No instructions have been given in signalling or telegraphy during the year, but a class is now formed and will be under instruction during the ensuing term.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

MOUNT WASHINGTON, NEW HAMPSHIRE.

[*Official number*, 46.]

Latitude	44° 16′ 25″
Longitude	71° 16′ 26″
Elevation of barometer above mean sea-level	6,285.60 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	23. 627
Mean annual barometer (reduced to sea-level) for eight years	29. 960
Mean annual temperature for eight years	26°. 4
Mean annual rainfall for eight years	78. 88 inches.

Established December 1, 1870.

Office in a house on the summit especially built for the purpose by the Signal Service, U. S. Army.

Sergeant W. S. Jewell was in charge of this station until May 6, when he was relieved by Corporal D. C. Murphy. There is one assistant at this station. It was inspected in August and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

> Five copies of Form 22 are furnished monthly to the following papers: Boston Daily Journal and Evening Traveler; Hartford (Conn.) Times; White Mountain Republic, of Littleton, N. H; and the Globe, of Lisbon, N. H. Extreme changes in the weather are also telegraphed to the press as heretofore.
>
> The benefits derived from the telephone have been great, as we use it as a test for our mountain wire, thereby saving many unnecessary trips down the mountain.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	84
Total	84

NASHVILLE, TENNESSEE.

[*Official number*, 63.]

Latitude	36° 11′
Longitude	86° 53′
Elevation of barometer above mean sea-level	507. 00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29. 533
Mean annual barometer (reduced to sea-level) for eight years	30. 062
Mean annual temperature for eight years	59°. 8
Mean annual rainfall for nine years	49. 72 inches.

Established November 1, 1870.

Office, States Insurance Building.

Corporal D. P. Waters was in charge of this station until October 4, when he was relieved by Sergeant S. C. Emery. Sergeant Emery was relieved January 3, and Corporal Waters again placed in charge. On June 2 Corporal L. N. Jesunofsky relieved Corporal Waters, who was ordered to this office for discharge. One assistant has been ordered to, and one relieved from, this station during the year. Ninety-seven post-offices have been regularly supplied with the Farmers' Bulletin. Highest water, 46 feet 6 inches, occurred March 17; lowest, 5 inches, October 3.

The station was inspected in December and reported in a very unsatisfactory condition.

Extracts from the observer's semi-annual reports:

> The press publish the "Indications" and meteorological reports furnished from this office.
>
> The cotton merchants study the reports with the greatest interest. The bulletins posted in the Merchant's Exchange receive the same close scrutiny as heretofore; steamboat and river men also pay close attention to the river bulletins.

PUBLICATIONS.

Number of Farmers' Bulletins issued during the year ending June 30, 1880	32,518
Number of bulletins (manifold) issued during the year ending June 30, 1880	5,626
Number of Local Reports issued during the year ending June 30, 1880	710
Numbers of Forms 22 issued during the year ending June 30, 1880	132
Number of Forms 26 issued during the year ending June 30, 1880	2,701
Total	41,687

NEW HAVEN, CONNECTICUT.

[*Official number*, 96.]

Latitude	41° 17′
Longitude	72° 57′
Elevation of barometer above mean sea-level	103.52 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.914
Mean annual barometer (reduced to sea-level) for seven years	30.021
Mean annual temperature for seven years	50° .5
Mean annual rainfall for seven years	54.01 inches.

Established December 10, 1872.

Office, Insurance Building, 370 Chapel street.

Sergeant W. A. Glassford was in charge of this station until November 13, when he was relieved by Private W. E. Schneider, and promoted to be a second lieutenant in the Signal Corps.

Private Schneider was relieved by Sergeant W. D. Wright, December 8.

The station was inspected in July and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

> Information is conveyed to both steamboat wharves by telephone when signals are ordered up or down, and no effort is spared to give all interested parties the fullest information. Press reports are furnished by telephone, daily, except Saturdays, to the Palladium and Journal and Courier, and the indications for this section of the country are posted daily, except Sundays, at the post-office and in front of the office building.
>
> Much interest is manifested in the service by the citizens; their intelligent and appreciative comments are very gratifying.
>
> Forty-eight cautionary and twenty-five cautionary off-shore signals were displayed during the year at this station.

PUBLICATIONS.

Number of Local Reports issued during the year ending June 30, 1880	822
Number of Forms 22 issued during the year ending June 30, 1880	71
Total	893

NEW LONDON, CONNECTICUT.

[*Official number*, 14.]

Latitude	41° 22′
Longitude	72° 9′
Elevation of barometer above mean sea-level	46.59 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.988
Mean annual barometer (reduced to sea-level) for eight years	30.021
Mean annual temperature for eight years	49°.2
Mean annual rainfall for eight years	47.31 inches.

Established January 10, 1871.

Office, custom-house, Bank street.

Sergeant John K. Payne has been in charge during the year. There is one assistant at this station. It was inspected in July and not found in a satisfactory condition.

Extracts from the observer's semi-annual reports:

Cautionary signals have become well understood by the public, and are used like the almanac and the mails, by the most active and intelligent business men. Masters and pilots visit the office for information, and bring their aneroids for adjustment.

About fifty (frequently poor instruments) have been set with the station barometer.

All classes of people read the "Indications" and the daily local report which is regularly published.

Forty-three cautionary and twenty-six cautionary off-shore signals were displayed during the year at this station.

The sergeant remarks as follows in reference to the display of signals:

August 18 *to* 19.—Wire down and delay of nine hours and ten minutes occurred. Railway trains have been delayed, and telegraph lines blown down by the gale. Many large trees, one over two hundred years old, blown down, and a stone weighing four hundred and sixty-five pounds thrown from the corner of Saint James' church. Farmers report great damage to their crops. The wooden pier near the Piquot House entirely destroyed by the high tides and wind. A large number of vessels detained in harbor by the display. Steamers kept up fires, and every precaution was taken to guard against the expected gale. Many minor disasters.

November 3.—Weather bad outside, and the harbor well filled with vessels.

November 19 *to* 21.—Schooner Emma L. Cottingham went ashore on Ten Tree Island and sunk.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	3,838
Number of Local Reports issued during the year ending June 30, 1880	313
Number of Forms 15 issued during the year ending June 30, 1880	936
Number of Forms 22 issued during the year ending June 30, 1880	48
Total	5,135

NEW ORLEANS, LOUISIANA.

[*Official number*, 28.]

Latitude	29° 58′
Longitude	90° 07′
Elevation of barometer above mean sea-level	52.47 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	30.006
Mean annual barometer (reduced to sea-level) for eight years	30.062
Mean annual temperature for eight years	68°.9
Mean annual rainfall for eight years	65.44 inches.

Established November 1, 1870.

Office, in the custom-house.

Sergeant George H. Rohé was in charge until May 4, when he was relieved by Sergeant L. Dunne. There is one assistant at this station.

The river observations were taken from the new gauge September 1.

The instrument shelter was removed to the third floor of the custom-house on September 8. The office was moved to an adjoining room on the same floor on November 25.

Highest water, 10 inches above high water of 1874, occurred April 24; lowest water, 4 feet 4 inches, November 22.

The station was inspected in March and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

The interest of the members of the Cotton Exchange in the reports continues to increase. The sugar planters have recently manifested an increased appreciation of the value of the service. The newspapers devote considerable space to the reports furnished them. The midnight and river bulletins are published in the three morning papers, while the German and French papers publish the afternoon weather and river bulletins. A weekly and monthly summary and a report of the local observations are also published.

Seven cautionary and two cautionary off-shore signals were displayed during the year at this station.

Extract from special reports relative to cautionary signals:

August 31 *to September* 2.—In the city the damage to buildings, fences, signs, &c., will probably be covered by $15,000. Damage to boats in harbor estimated at $10,000. A fleet of coal-boats lying above the city was generally damaged; out of 68 boats 43 were sunk, involving a loss estimated at $215,000. Three barges of the Mississippi Valley Transportation Company, in tow of the tug John Gilmore, were sunk about 12 miles above Baton Rouge. These barges were loaded with grain, and the loss is estimated at $103,000. William Bust, the pilot of the John Gilmore, was drowned while attempting to reach the shore from one of the barges. The steamboat Trenton capsized at Conrad Point, between this city and Baton Rouge, and, with cargo, will prove a total loss. At Morgan City the damage is estimated at $30,000. At Berwick, on the opposite side of Berwick's Bay, the damage is $15,000. The damages to the buildings on the sugar plantations in the southwestern part of the State is very great. The damage to the sugar and cotton crops is variously estimated. The most reliable estimates place it at 10 per cent. The damage to the rice crop is slight. Trains on the Chicago, Saint Louis and New Orleans Railroad were delayed by a wash-out of 6 miles in length. The signal was hoisted full 12 hours before the storm became severe.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	6,821
Number of Local Reports issued during the year ending June 30, 1880	1,125
Number of Forms 22 issued during the year ending June 30, 1880	99
Number of Forms 26 issued during the year ending June 30, 1880	5,467
Total	13,512

NEWPORT, RHODE ISLAND.

[*Official number*, 130.]

Latitude	41° 29′
Longitude	71° 19′
Elevation of barometer above mean sea-level	44.40 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for four years	29.957
Mean annual barometer (reduced to sea-level) for four years	30.000
Mean annual temperature for four years	50°.1
Mean annual rainfall for four years	50.81 inches.

Established August 1, 1875.

Office, custom-house, southeast corner Thames and Franklin streets.

Sergeant William McGillivray has been in charge during the year. There is no assistant at this station. It was inspected in July and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

The interest heretofore manifested in the service still continues and is greatest among those engaged in shipping. There are numerous applications for latest "Indications." These inquiries are usually made by seamen and travelers.

Fifty-one cautionary and twenty-nine cautionary off-shore signals were displayed during the year at this station.

The sergeant remarks as follows in reference to these displays:

July 8.—Nearly all the vessels in harbor were obliged to cast double anchors. Heavy rain and fog during display; no disasters.

August 18.—Two fishing smacks and one sloop were wrecked, and an old steamer was sunk at wharf. Several other minor accidents are reported.

September 25.—United States steamer Minnesota anchored in the outer harbor, drifted ashore near Fort Adams; she was gotten off without serious damage.

February 19.—Storm very severe, several vessels detained. The frame-work of the cassino building (in process of erection) suffered some damage; no marine disasters reported.

April 13.—About 6 p. m. an unknown schooner sunk off Old Field's Point; nothing saved; no disasters reported in this vicinity.

PUBLICATIONS.

Number of Local Reports issued during the year ending June 30, 1880	412
Number of Forms 22 issued during the year ending June 30, 1880	72
Total	484

NEW RIVER INLET, NORTH CAROLINA.

[*Official number*, 138.]

Latitude	34° 30′
Longitude	77° 23′

Established May 18, 1876, as a repair station.

Office, observatory of Dr. E. W. Ward's dwelling.

Private Ransom White was in charge until December 1, when he was relieved by Private J. C. Ashton and ordered to this office. There is no assistant at this station.

Extracts from the observer's semi-annual reports:

There are a number of small coasting vessels that ply between Wilmington, N. C., and this place, and the captains of these vessels are furnished with the weather "Indications" by telegraph from this office.

The farmers in this vicinity take a lively interest in the service.

NEW YORK CITY, NEW YORK.

[*Official number*, 15.]

Latitude	40° 42′ 43″
Longitude	74° 0′ 3″
Elevation of barometer above mean sea-level	164.33 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.870
Mean annual barometer (reduced to sea-level) for eight years	30.033
Mean annual temperature for nine years	51°.2
Mean annual rainfall for nine years	43.30 inches.

Established November 1, 1870.

Office, Equitable Building, 120 Broadway.

Sergeant Alois Donhauser was in charge until January 9, when he was relieved by Sergeant J. G. Lynch. Sergeant Lynch's management of the station was not satisfactory to this office and he was relieved March 17 by Sergeant E. B. Garriott and transferred to Pittsburg. Two assistants have been ordered to, and two relieved from, this station during the year.

Seven hundred and nineteen post-offices have been regularly supplied with the Farmers' Bulletin.

The station was inspected in July, 1879, and June, 1880, and was found in a satisfactory condition.

Extracts from the observer's semi-annual reports:

> The various mercantile and maritime bodies, principal among which are the Maritime, Produce, and Cotton Exchanges and the Chamber of Commerce, continue to manifest the greatest interest in the service. The Maritime Exchange is the headquarters for sea-faring men, and all reports and information relating to the weather are of particular interest to its members. Efforts are being made to connect this office with their rooms by telephone in order that information can be more quickly transmitted. The interest taken in the service by the community at large is manifested by the number of reporters from the daily papers who frequent the office for weather notes and items contained in the reports. Bankers, oyster dealers, produce merchants, &c., send their clerks to this office daily to copy such data of the daily bulletin as may be of special importance to them. Records of past years continue to find their way into the various courts and are oftentimes of great importance. Constant requisitions are made by steamship companies, railroad companies, bankers, brokers, &c., for data past and present. The graphic map continues to be looked upon as one of the most important and practical publications of the service.
>
> Fifty-three cautionary and twenty-three cautionary off-shore signals were displayed during the year at this station.

PUBLICATIONS.

Number of Farmers' Bulletins issued during the year ending June 30, 1880	227, 454
Number of Bulletins (manifold) issued during the year ending June 30, 1880	9, 883
Number of Local Reports issued during the year ending June 30, 1880	1, 055
Number of Forms 22 issued during the year ending June 30, 1880	360
Number of Forms 26 issued during the year ending June 30, 1880	2, 548
Total	241, 300

NORFOLK, VIRGINIA.

[*Official number*, 30.]

Latitude	36° 51′
Longitude	76° 19′
Elevation of barometer above mean sea-level	54.50 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	30. 017
Mean annual barometer (reduced to sea-level) for eight years	30. 064
Mean annual temperature for eight years	58°. 7
Mean annual rainfall for eight years	52.83 inches

Established January 1, 1871.

Office, corner Main and Gray streets.

Sergeant T. F. Townsend was in charge until January 28, when he was relieved by Sergeant C. A. Smith. Sergeant Smith was relieved March 5 by Corporal Wm. Davis, who was relieved June 23 by Sergeant S. W. Naylor. Three assistants have been ordered to, and three relieved from, this station during the year.

Extracts from the observer's semi-annual reports:

> The interest in the service is generally increasing. The cautionary signals are looked upon with general interest, and very few vessels leave port while signals are displayed.
>
> The office is consulted daily by all classes, and especially those contemplating a trip by land or water.
>
> Cape Henry vessel reports, that are received through the chief signal officer at this office, are of great benefit to the different steamship companies, as they can anticipate the time of the arrival of their vessels in Norfolk.

The storm of August 18 made a complete wreck of this section as well as the southern portion of the coast telegraph line, causing an interruption of telegraphic communication for a short time. With this exception it has been well maintained and all weather and wreck reports promptly reported. The value of the forecasts at this station is best illustrated by the frequent special reports asked for from the central office by ship owners and captains when about undertaking the transportation of disabled vessels, or any voyage wherein bad weather would be dangerous. The eagerness with which the "Indications" and other reports are read and consulted attest the confidence of the public. The advantage and facilities afforded by the coast wire for the saving of life and property is duly appreciated by all.

Thirty-two cautionary and eight cautionary off-shore signals were displayed during the year at this station.

Extracts from special reports relative to the display of signals:

August 18.—Maximum velocity for five minutes was at the rate of 72 miles per hour. The most severe and destructive wind and rain storm that has visited this section for over half a century. Wharves raised and washed away by the high tide, trees uprooted, houses unroofed and blown down by the violence of the storm. The wooden portion of the spire of the Baptist church, some 80 or 90 feet in height, was blown down; loss estimated between $3,000 and $4,000. The damage to property in the city is variously estimated at from $150,000 to $200,000. A fearful record of about fifteen minutes' work of the tempest. The schooner Marion Hubbard went aground and stove to pieces; schooner Annie E. Adams, lumber-laden, bound for Baltimore, was driven ashore. Several unknown vessels are reported in distress in Hampton Roads.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	4,059
Number of Local Reports issued during the year ending June 30, 1880	1,736
Number of Forms 15 issued during the year ending June 30, 1880	3,915
Number of Forms 22 issued during the year ending June 30, 1880	56
Total	9,766

NORTH PLATTE, NEBRASKA.

[*Official number*, 105.]

Latitude	41° 8′
Longitude	100° 53′
Elevation of barometer above mean sea-level	2,841. 00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for five years	27. 065
Mean annual barometer (reduced to sea-level) for five years	29. 613
Mean annual temperature for five years	48° .1
Mean annual rainfall for five years	18.27 inches.

Established September 18, 1874.

Office, court-house.

Sergeant H. U. Jones has been in charge during the year. There is no assistant at this station. It was inspected in October and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

The interest taken by the public generally is steadily increasing, but the land department of the Union Pacific Railroad Company receives perhaps the most direct and substantial benefit from the Signal Service, as the weather reports appear to show the steady increase of rainfall west of the one-hundredth meridian, and the company is thus enabled to sell land to settlers in a section of country which heretofore has been considered unfit for agricultural purposes, owing to the lack of moisture.

The record of the rainfall seems to be most considered and talked about, and is copied and preserved by numerous individuals for future reference.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	3,021
Number of Forms 22 issued during the year ending June 30, 1880	24
Total	3,045

OLYMPIA, WASHINGTON TERRITORY.

[*Official number*, 148.]

Latitude	47° 02′
Longitude	122° 56′
Elevation of barometer above mean sea-level	36.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for two years	29.947
Mean annual barometer (reduced to sea-level) for two years	29.986
Mean annual temperature for two years	49° .7
Mean annual rainfall for two years	68.89 inches.

Established July 1, 1877.

Office, Grainger Building, southwest corner Fifth and Main streets.

Sergeant John Dascomb has been in charge during the year. There is no assistant at this station. It was inspected in September and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

At present and during the past six months commerce has been limited to two small steamers plying between this port and Seattle, Washington Territory, and the semi-monthly visit of the Pacific Mail Steamship Company's steamer from San Francisco.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	3,886
Number of Forms 22 issued during the year ending June 30, 1880	24
Total	3,910

OMAHA, NEBRASKA.

[*Official number*, 67.]

Latitude	41° 16′
Longitude	96° 0′
Elevation of barometer above mean sea-level	1,113.34 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	28.887
Mean annual barometer (reduced to sea-level) for eight years	29.950
Mean annual temperature for eight years	49° .8
Mean annual rainfall for eight years	33.62 inches.

Established November 1, 1870.

Office, custom-house, corner Fifteenth and Dodge streets.

Sergeant Charles Dill was in charge of this station until December 10, when he was relieved by Sergeant L. M. Dey and transferred to Mobile. He has one assistant.

The station was inspected in August and reported in a satisfactory condition.

Highest water in the river, 16 feet 3 inches, occurred July 1 and 2; lowest water, 2 feet 1 inch, March 16.

Extracts from the observer's semi-annual reports:

River free from ice on March 20. Navigation was not resumed until April. On the 23d of that month the steamer Red Cloud arrived from Saint Louis.

On April 18 the river gauge was adjusted to correspond to the readings of the bridge gauge.

The office continues to receive many visitors who are in quest of reliable information regarding meteorological changes and conditions.

The office continues to have the support of the local press, of the citizens generally, and of commission and stock men particularly; the latter named always being guided in large commercial transactions by the record at this office and the "Indications" as issued from the central office.

The Omaha Daily Herald and the Republican have published daily press reports and a monthly meteorological summary.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	4,686
Number of Forms 22 issued during the year ending June 30, 1880	78
Total	4,764

OSWEGO, NEW YORK.

[*Official number*, 31.]

Latitude	43° 28′ 32″
Longitude	76° 35′ 05″
Elevation of barometer above mean sea-level	304.25 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.692
Mean annual barometer (reduced to sea-level) for eight years	29.997
Mean annual temperature for nine years	47°.1
Mean annual rainfall for nine years	35.04 inches.

Established November 1, 1870.

Office, Grant Block, southeast corner First and Bridge streets.

Sergeant J. O. Barnes was in charge until December 10, when he was relieved by Sergeant S. W. Beall and transferred to Albany. One assistant has been ordered to, and one relieved from, this station during the year. It was inspected in August and reported in a satisfactory condition.

Navigation closed December 5, 1879, and was resumed March 21, 1880.

Extracts from the observer's semi-annual reports:

Confidence is placed in the cautionary signal displays by seamen, and the warning generally heeded.

Shipping men and merchants derive the most benefits from the service at this station.

All classes of citizens come to the office to inquire about the weather, and vessel men who are interested pay close attention to the *manifold* bulletins.

The Palladium, Times, and Syracuse Evening Herald are each furnished with a copy of the morning bulletin. The Palladium and Times also publish a local report.

Thirty-four cautionary signals were displayed during the year at this station.

The display of signals ceased December 25, 1879, and was resumed March 15, 1880.

The sergeant reports as follows in reference to the display of signals:

November 19 *to* 21.—Schooner Donunson sailed on the 19th, encountered the storm, and in attempting to put back to this harbor lost her bearings and went ashore about three miles up the lake and will prove a total loss; valued at $2,500; insured for $1,000.

April 10.—Schooner David Andrews, Captain McCrimmon, bound from Napance to Toronto, disabled and driven ashore four miles from Oswego. Vessel and cargo of 10,000 bushels of rye a total loss. Schooner J. J. Hill came in during the storm and was driven against the bridge, carrying away her boom.

April 16.—The schooner Great Western, bound from Toronto to this port, with lumber, encountered the gale, losing part of her cargo, her boat, and part of her canvas.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	4,420
Number of Local Reports issued during the year ending June 30, 1880	956
Number of Forms 22 issued during the year ending June 30, 1880	36
Total	5,412

OCEAN CITY, MARYLAND.

Latitude	38° 20′
Longitude	75° 3′

Established January 13, 1880.

Corporal J. C. Rickli has been in charge since the establishment of the station. There are no meteorological instruments at the station, it being a repair station of the sea-coast telegraph line. It was inspected in March and found in a satisfactory condition.

Extracts from the observer's semi-annual reports:

> The winter and spring having been remarkably mild, no wrecks have occurred in this vicinity.
>
> The "Indications" have, whenever practicable, been posted up in a conspicuous place, and are highly appreciated by the public.

PEMBINA, DAKOTA TERRITORY.

[*Official number*, 86.]

Latitude	49° 0′
Longitude	97° 5′
Elevation of barometer above mean sea-level	791.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for six years	29.136
Mean annual barometer (reduced to sea-level) for five years	29.965
Mean annual temperature for five years	35°.9
Mean annual rainfall for six years	21.03 inches.

Established November 1, 1872.

Office, Second, near Hutsman street.

Sergeant James Cassidy has been in charge during the year. He has no assistant.

The station has not been inspected during the year.

The office was moved on March 30, 1880, to Second, near Hutsman street. The present office is much more suitable than the old one, both as regards the comfort of the observer and the exposure of the instruments.

Since April 28 no telegraphic reports have been sent, owing to the fact that the line which crosses the Red River was broken by a passing steamboat and has not been repaired.

Extracts from the observer's semi-annual reports:

> The year that has just ended was an unusual one in many respects. The rainfall for the spring and summer months was much less than usual, but still was sufficient for agricultural purposes.
>
> There is a great deal more interest taken in the service than formerly, as the rowdy element is in a great measure disappearing before the influx of a better class of citizens.
>
> A weekly weather report is furnished the Pembina Pioneer.

PUBLICATIONS.

Number of Local Reports issued during the year ending June 30, 1880	55
Number of Forms 22 issued during the year ending June 30, 1880	24
Total	79

PENSACOLA, FLORIDA.

[*Official number*, 231.]

Latitude	30° 25′
Longitude	87° 12′
Elevation of barometer above mean sea-level	29.75 feet.

Established October 27, 1879.

Office, southwest corner Palafox and Saragossa streets.

Sergeant R. R. Martin has been in charge of this station since its establishment. He has no assistant.

This was formerly a display station of the Signal Service. It was inspected in March and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

Since the office has been opened it has been visited by a very large number of citizens of all classes, who seem to take a very great amount of interest in the service, and who have, one and all, expressed themselves much pleased with the establishment of a signal station at this place, the commercial interests of which are already well developed and rapidly growing in importance. The most important branch of business here at present is the lumber trade, Florida furnishing immense supplies. Pensacola has become one of the great centers for its distribution, and sends forth annually immense quantities of hewn and sawed timber to the North and to Europe. It is not unusual to see over a hundred large vessels in the harbor at one time, consequently shippers and mariners are most directly interested in and benefited by the service.

The bulletins are daily consulted, and the monthly summaries published by the press attract special attention. The display of cautionary signals is highly appreciated by those most interested—masters of vessels, fishermen, &c., as well as by the public generally. Some of the displays attracted special attention, notably that of April 29, which caused considerable alarm and excitement among the citizens (because of the violent cyclones that had so recently swept over the West and Southwest, scattering death and destruction in their paths). Parents sent to the schools and brought their children home; several merchants closed their places of business and awaited with fear and trembling the coming storm which the signal portended. All classes express confidence in the service; those most directly benefited are shippers and mariners.

Six cautionary and one cautionary off-shore signal were displayed during the year at this station.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	1,923
Number of Forms 22 issued during the year ending June 30, 1880	16
Total	1,939

PHILADELPHIA, PENNSYLVANIA.

[*Official number*, 17.]

Latitude	39° 57′
Longitude	75° 10′
Elevation of barometer above mean sea-level	52.42 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	30.008
Mean annual barometer (reduced to sea-level) for eight years	30.048
Mean annual temperature for nine years	53°.1
Mean annual rainfall for eight years	42.93 inches.

Established January 1, 1871.

Office, Chamber of Commerce building, 133 South Second street.

Sergeant C. A. Smith was in charge until February 6, when he was relieved by Sergeant T. F. Townsend and transferred to Norfolk. Six assistants have been ordered to, and five relieved from, this station during the year. It has not been inspected since the date of last report.

Eight hundred and twenty-seven post-offices have been regularly supplied with the Farmers' Bulletin during the year.

The room occupied as an office proper is still donated, free of rent, by the Commercial Exchange Association.

Extracts from the observer's semi-annual reports:

In January telegraphic communication was opened with Delaware Breakwater, from which point, and Cape May, reports of the movements of shipping and items of maritime interest have been received and furnished the Maritime Exchange, Shipmasters' and Vessel Owners' Association, and the Philadelphia Exchange, who furnish the information received to the newspapers and general public, thus widely disseminating news of interest that has heretofore been exclusive.

The courtesies of the different newspapers have been extended to the office at all times, and a disposition evinced to advance the interests of the service, and to give space in their columns for the publication of anything of interest or profit to the public.

The value of the service is too general to specify any particular body that is benefited more than another. At the office we are, perhaps, brought more directly in contact with the grain interests, as every sale or purchase is based on meteorological conditions, and all bulletins are eagerly sought and studied.

The observer was summoned and testified in court from the office records twice during the half year. As illustrating the variety of subjects on which the weather records are brought directly or indirectly to bear, one of these cases was a famous divorce suit, tried in November last. The other was a suit for damages against the Philadelphia and Reading Railroad Company on account of injuries sustained by excursionists on that road on October 4, 1877, during the prevalence of the cyclone of that date. Extracts from the records were furnished to parties for avowed use in the courts once during the half year. Several extracts have also been furnished to different parties for unknown uses.

PUBLICATIONS.

Number of Farmers' Bulletins issued during the year ending June 30, 1880	258,999
Number of Bulletins (manifold) issued during the year ending June 30, 1880	5,512
Number of Local Reports issued during the year ending June 30, 1880	2,184
Number of Forms 15 issued during the year ending June 30, 1880	5,355
Number of Forms 22 issued during the year ending June 30, 1880	163
Total	272,213

PIKE'S PEAK, COLORADO.

[*Official number*, 99.]

Latitude	38° 48′
Longitude	104° 59′
Elevation of barometer above mean sea-level	14,150.62 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for six years	17.744
Mean annual barometer (reduced to sea-level) for six years	29.957
Mean annual temperature for six years	19°.3
Mean annual rainfall for six years	30.68 inches.

Established November 1, 1873.

Office, summit Pike's Peak.

Corporal Edmund Davis was in charge of the station until January 9, when he was relieved by Sergeant J. T. O'Keeffe and transferred elsewhere. One assistant has been ordered to, and two relieved from, this station during the year.

The station was inspected in November. The management of the office was not such as to be satisfactory, and Corporal Davis was soon after relieved and eventually discharged from the service.

The supply station at Colorado Springs is also under the charge of the sergeant at Pike's Peak.

Extracts from the observer's semi-annual reports:

> Tourists, prospectors, ranchmen, and cattle men are the persons most benefited, and all of them testify to the advantages derived from the reports.
>
> There is little local benefit derived from this station, but a full monthly report is published in the local papers and the citizens of Colorado Springs seem to take quite an interest in it.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

PIOCHE, NEVADA.

[*Official number*, 140.]

Latitude	37° 57′
Longitude	114° 26′
Elevation of barometer above mean sea-level	6,220.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for two years	24. 045
Mean annual barometer (reduced to sea-level) for one year	29. 803
Mean annual temperature for two years	51° .9
Mean annual rainfall for two years	7.70 inches.

Established July 29, 1877.

Office, McCannon street.

Private J. J. Fitzgerald was in charge until September 24, when he was relieved by Private Edmond Quann and ordered to Fort Whipple for promotion. Private Quann was relieved January 31 by Private S. J. Delavan and ordered to Fort Whipple for medical treatment, where he was soon after discharged the service. There is no assistant at the station. It was inspected in August and reported in a satisfactory condition.

Private Delavan has not given satisfaction in the management of this station.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

PITTSBURGH, PENNSYLVANIA.

[*Official number*, 41.]

Latitude	40° 32′
Longitude	80° 2′
Elevation of barometer above mean sea-level	776.08 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29. 207
Mean annual barometer (reduced to sea-level) for eight years	30. 005
Mean annual temperature for eight years	51°. 9
Mean annual rainfall for eight years	36.58 inches.

Established November 1, 1879.

Office, First National Bank building, north corner Fifth avenue and Wood street.

Sergeant E. B. Garriott was in charge until March 11, when he was relieved by Sergeant J. G. Lynch and transferred to New York City. Four assistants have been ordered to, and four relieved from, this station during the year. On October 14 the office was moved to an adjoining room in the same building. It was inspected in May and reported in a satisfactory condition.

Highest water in the river, 21 feet 7 inches, occurred February 14; lowest water, 1 foot 1 inch below zero of gauge, October 20.

The six months ending December 31 were remarkable in river annals for the unprecedented continuance of low stages of water. On July 27, 28, and 29 the river attained a sufficient depth to allow coal flats to go down; from this date low water continued until the middle of November, when another temporary rise occurred. During the entire month of December the rivers were sufficiently high for navigation.

Three hundred and twelve post-offices have been regularly supplied with the Farmers' Bulletin during the year.

Extracts from the observer's semi-annual reports:

> The interest manifested by the general public in the office publications is not as much as at some other stations, but it is progressing steadily. The greatest benefits are derived by wheat speculators, particularly during the summer and early autumn months, when the market is essentially dependent on the state of the weather. Shippers and importers of perishable goods are also interested, and have learned to study the weather reports before making their shipments or ordering their supplies.
>
> The publication of the weather reports by the press of this city has materially increased during the past six months, more space being given and fuller reports published, much to the satisfaction of the community at large. The members of the press take the liveliest interest in the service as is shown by the numerous editorials favorably commenting upon it. The river reports are of considerable benefit to those interested in river navigation. The "Indications" and weather reports are of interest and benefit to all classes.

PUBLICATIONS.

Number of Farmers' Bulletins issued during the year ending June 30, 1880	105,695
Number of Bulletins (manifold) issued during the year ending June 30, 1880	6,009
Number of Local Reports issued during the year ending June 30, 1880	712
Number of Forms 22 issued during the year ending June 30, 1880	586
Number of Forms 26 issued during the year ending June 30, 1880	1,452
Total	114,054

PORT HURON, MICHIGAN.

[*Official number*, 17.]

Latitude	42° 58′
Longitude	82° 29′
Elevation of barometer above mean sea-level	632.86 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for five years	29.320
Mean annual barometer (reduced to sea-level) for five years	29.975
Mean annual temperature for five years	45°.5
Mean annual rainfall for five years	33.07 inches.

Established July 25, 1874.

Office, City Hall building, corner Broad and Huron avenues.

Sergeant Joseph E. Mayhew was in charge until July 26, when he was relieved by Sergeant W. O. Bailey and discharged the service. Two assistants have been ordered to, and two relieved from, this station during the year. It was inspected in June and reported in a satisfactory condition.

Navigation closed December 14 and was resumed March 22.

Extracts from the observer's semi-annual reports:

> Since September 1, 1879, this office has prepared and furnished (through the O. C. S. O.) the Michigan State Board of Health with a Monthly Meteorological Register, comprising all the principal data relating to the station's meteorology, including a report upon ozone observations; data intended for publication in the annual report of the board.
>
> The display of cautionary signals during the season just passed has been of inestimable service to vessel owners and mariners generally, particularly to those going from Buffalo to Chicago. When "Up-Signals" are displayed the office is repeatedly visited by vessel captains, and, as a rule, upon learning that dangerous winds are anticipated, they delay sailing until after the storm has apparently passed or cautionary signal lowered. I have been informed that when sailing up the Saint Clair River they are invariably upon the lookout for the signal as they approach this port, and when it is up rarely venture beyond this place. I have never met any one connected with this class who did not pronounce the reports and cautionary warnings as indispensable to their interests, and it is a source of much gratification to notice the unlimited and fully established confidence with which mariners and the shipping interests generally regard these timely warnings.

The officers of the Northern Transit Company have manifested a decided interest in the labors of the service, and pronounce the published weather reports as indispensable to their interest.

On June 23, 1880, the cautionary signal indicator was changed from F. W. Parson's dock office to the Marine Reporter's office, which is located upon the dock, and is a common headquarters for tug captains and mariners generally.

Fifty cautionary signals were displayed during the year at this station.

The display of signals ceased December 25, 1879; resumed March 15, 1880.

The sergeant reports as follows in reference to the display of signals:

July 11.—The storm of this date was very severe and destructive; several buildings were unroofed and a portion of the Methodist Episcopal church destroyed. Numerous shade trees were blown down; the telegraph lines in this vicinity are reported down. Damage in the city estimated at $25,000.

September 2 to 4.—During the display the office was visited by several captains and other persons interested in vessels expecting to leave port. Barge Geo. S. King started out, but upon encountering the gale upon the lake put back and remained in harbor during the display. Propeller Bertschey was shipwrecked and lost off Port Austin; no lives lost; life-saving crew did excellent work during this storm.

October 22 to 24.—A schooner (name unknown) was caught in the storm six miles off Crawford's Quarry, and lost her fore and mizzen masts. Schooner O. M. Bond was washed ashore at Sand Beach. The tow-barge Tecumseh lost her main-mast during the gale and returned to this port.

November 19.—Storm very severe on the lake. A number of shipwrecks, with several lives lost, are reported from Sand Beach Harbor. Several vessels sailed while the signal was up, but meeting a rough sea were forced to put back.

November 22.—Dismasted vessel reported ashore near Port Austin.

April 9.—A number of vessels put out of port, and after a short run up shore turned back. Schooner Home washed ashore near Port Hope.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	2,015
Number of Local Reports issued during the year ending June 30, 1880	306
Number of Forms 22 issued during the year ending June 30, 1880	36
Total	2,357

PORTLAND, MAINE.

[*Official number*, 12.]

Latitude	43° 40′
Longitude	70° 16′
Elevation of barometer above mean sea-level	45.39 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.933
Mean annual barometer (reduced to sea-level) for eight years	29.972
Mean annual temperature for eight years	46°.1
Mean annual rainfall for eight years	38.61 inches.

Established January 15, 1871.

Office, custom-house building, corner Pearl and Fore streets.

Sergeant Will T. Boyd was in charge until September 27, when he was relieved by Sergeant John Laurens and transferred to Smithville, N. C. One assistant has been ordered to, and one relieved from, this station during the year. It was inspected in August, and the work was found to be satisfactorily performed.

The display stations of Section No. 7 are under the immediate supervision of the sergeant at this station, all signal orders being transmitted through him.

Extracts from the observer's semi-annual reports:

The interest taken by shipping men and merchants in the Signal Service weather reports continues unabated, and the reports have been principally beneficial to these classes. The records of the station have frequently been consulted for legal purposes, and on one occasion (April 9, 1880) were produced in court as evidence.

The office is now connected by telephone with all the principal institutions and business houses in Portland, the expenses having been paid by a number of steamboat men and merchants interested in securing the latest weather reports.

Forty-four cautionary and twenty-two cautionary off-shore signals were displayed during the year at this station.

The sergeant reports as follows in reference to the display of signals:

November 3.—During the storm schooner Leesburg went ashore on Cape Elizabeth crew of five men supposed to have been lost. Several disasters of minor importance occurred in this vicinity.

March 23 to 26.—Schooner Octavia Dow, lying in harbor, dragged her anchor and went ashore on the breakwater; no other damage reported in this vicinity.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	4,153
Number of Forms 15 issued during the year ending June 30, 1880	2,595
Number of Forms 22 issued during the year ending June 30, 1880	54
Total	6,802

PORTLAND, OREGON.

[*Official number*, 74.]

Latitude	45° 30′
Longitude	122° 27′ 30″
Elevation of barometer above mean sea-level	67.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for two years	29.972
Mean annual barometer (reduced to sea-level) for eight years	30.080
Mean annual temperature for eight years	53°.2
Mean annual rainfall for eight years	53.43 inches.

Established November 1, 1871.

Office, Oregon and Washington Mortgage Savings Bank building, No. 48 First street.

Corporal R. R. Herman has been in charge during the year. He has no assistant. One assistant has been ordered to, and two relieved from, this station.

Navigation to the sea was continued throughout the winter season. Navigation between this city and the Cascades of the Columbia River closed December 23, 1879, and reopened January 3, 1880.

Highest water in the river, 27 feet 1 inch, occurred June 30; lowest water, 1 foot 3 inches, October 31.

The station was inspected in November and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

The Daily Morning Oregonian and the other daily newspapers publish the reports regularly.

The press has evinced more interest in the service than heretofore.

The destructive wind storm of January 9, 1880, had the effect of increasing the public interest in the Signal Service reports, and for some time after the storm an unusual number of citizens visited this office.

The wharves along the river are erected on piles; each has two floors, and any sudden rise in the river necessitates the removal of wares from the lower floors or lower wharves. In this respect the special river reports have proven of great value.

The records of the office have been used as evidence in the county court, and many inquiries are made at this office for meteorological data.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	5,012
Number of Local Reports issued during the year ending June 30, 1880	104
Number of Forms 22 issued during the year ending June 30, 1880	72
Total	5,188

PORTSMOUTH, NORTH CAROLINA.

[*Official number*, 137.]

Latitude	35° 2′
Longitude	76° 4′

Established April 23, 1876, as a repair station; partial observations commenced May 9, 1876.

Office, in United States Marine Hospital Building.

Private Louis Leonardy was in charge until December 12, when he was relieved by Private T. J. Kenan, who was relieved by Private R. Graham, March 16. There is no assistant at the station.

It has been continued as a repair station, but partial meteorological observations are taken and forwarded by mail weekly.

The station was inspected in February and found in fair condition.

Extracts from the observer's semi-annual reports:

The line on this repair section has been thoroughly patrolled and kept in good condition. Schooner L. A. Van Brunt was driven ashore three miles north of Ocracoke during hurricane of August 18; wreck station was opened for her, but as line was only working as far north as Kittyhawk and south to Lookout, no assistance could be rendered.

Ship Jacob Trumpy came ashore fourteen miles south of station December 13, 1879; wreck station was opened; particulars telegraphed to the central office and owners notified.

PUBLICATIONS.

Number of Forms 15 issued during the year ending June 30, 1880	24
Total	24

PUNTA RASSA, FLORIDA.

[*Official number*, 59.]

Latitude	26° 36′
Longitude	82° 14′
Elevation of barometer above mean sea-level	13.08 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	30.065
Mean annual barometer (reduced to sea-level) for eight years	30.074
Mean annual temperature for eight years	73°.5
Mean annual rainfall for eight years	45.03 inches.

Established August 15, 1871.

Office, International Ocean Telegraph Company's building.

Sergeant A. W. Browne was in charge until October 3, when he was relieved by Private W. J. Evans and transferred to Leavenworth. There is no assistant at the station.

Extracts from the observer's semi-annual reports:

The interest in the service and the benefits derived by the public are for the most part confined to masters of vessels in the cattle trade, plying between this port, Key West, and the island of Cuba. These parties occasionally make inquiries in regard to the weather, but it is always to know what the "Indications" are, or what the weather is at some other port. Owing to the fact that neither "Indications" nor reports are received, it has been impossible to furnish information of much value.

This station is furnished with a telescope, which has been of practical benefit in enabling the observer to inform interested parties of the arrival of vessels several hours in advance of their reaching the wharf, thus giving the cattle shippers time to have their cattle ready for shipment upon the arrival of the vessels.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

RED BLUFF, CALIFORNIA.

[*Official number*, 143.]

Latitude	40° 10′
Longitude	122° 16′
Elevation of barometer above mean sea-level	338.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for two years	29.616
Mean annual barometer (reduced to sea-level) for two years	29.967
Mean annual temperature for two years	63°.6
Mean annual rainfall for two years	41.32 inches.

Established July 1, 1877.

Office, Crandall's Hall, Main street.

Sergeant R. B. Watkins was in charge until February 19, when he was relieved by Sergeant J. M. Frantz and transferred to Cincinnati. There is no assistant at the station. It was inspected in November and reported in a satisfactory condition.

River observations were taken from December 15, 1879, to March 15, 1880. The highest water, 17 feet 5 inches, occurred December 20; lowest water, 11 inches, February 8.

Extracts from the observer's semi-annual reports:

The interest taken in the service is not confined to any particular class; all are alike interested in so far that there is a desire by most every one to know the amount of rainfall, the velocity of the wind, the highest and lowest temperature, and for everything pertaining to the weather this office is considered authority.

The service is fully appreciated by ranchmen and stock-raisers, and by the public generally.

Bulletin-boards are eagerly watched.

The Evening Sentinel publishes local reports daily and a portion of the monthly summary.

Frequent visits are made to the office by reporters for amounts of rainfall, which items are of great value to the public.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	5,683
Number of Local Reports issued during the year ending June 30, 1880	363
Number of Forms 22 issued during the year ending June 30, 1880	44
Total	6,090

ROCHESTER, NEW YORK.

[*Official number*, 32.]

Latitude	43° 08′
Longitude	77° 51′
Elevation of barometer above mean sea-level	588.94 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.372
Mean annual barometer (reduced to sea-level) for eight years	29.975
Mean annual temperature for nine years	46°.9
Mean annual rainfall for nine years	38.15 inches.

Established November 1, 1870.

Office, Power's Building, corner Main and State streets.

Sergeant James Gilligan was relieved January 9 and ordered to Marquette, and the assistant, Private J. C. Walshe, placed in charge. One assistant has been ordered to and one relieved from this station during the year.

Lake navigation closed December 5 and was resumed March 20.

The river was frozen over at Charlotte Harbor on December 21, 1879, and navigation on the Erie Canal was officially declared closed on December 6, 1879.

The station was inspected in September and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

> The daily and weekly newspapers of the city continue to publish in a neat and compact form all weather reports and "Indications," together with local reports and telegraphic items furnished relating to meteorological changes. They also publish notices referring to the success of the Weather Bureau and the value of its labors to the country at large. All telegrams relating to the display of cautionary signals, either at this point or elsewhere, have been furnished to the newspapers and to parties interested, such as ship-owners and shippers, importers, &c.
>
> The office has been visited very often by persons seeking information as to the "Indications," references to the weather for past years, and information on miscellaneous subjects connected with meteorology. They belonged to nearly every class in the community, and comprised merchants, shippers, importers, traders, doctors, farmers, lawyers, builders, manufacturers, ship captains, and officials of the common council and board of water-works.
>
> During the winter months the office was visited daily by several ice-dealers and the reports carefully consulted in reference to the "ice crop." Several vessels remained in Charlotte Harbor during the displays of cautionary signals, particularly during the months of November and December, 1879, and the masters often visited this office for the purpose of ascertaining, if possible, the duration and extent of the storms, and expressed their confidence in the warnings and their determination to be guided to a large extent by them.
>
> No disasters have been noted during the year in this neighborhood.
>
> Thirty-seven cautionary signals were displayed during the year at this station.
>
> The display of signals ceased December 25, and was resumed March 15, 1880.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	4,736
Number of Local Reports issued during the year ending June 30, 1880	2,824
Number of Forms 15 issued during the year ending June 30, 1880	197
Number of Forms 22 issued during the year ending June 30, 1880	120
Total	7,877

ROSEBURG, OREGON.

[*Official number*, 146.]

Latitude	43° 10′
Longitude	123° 16′
Elevation of barometer above mean sea-level	537.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for two years	29.493
Mean annual barometer (reduced to sea-level) for two years	30.061
Mean annual temperature for two years	52°.4
Mean annual rainfall for two years	40.97 inches.

Established July 15, 1877.

Office, Jackson street, between Oak and Washington streets.

Sergeant R. R. Rodgers has been in charge during the year. He has no assistant.

The station was inspected in September and found in a satisfactory condition.

Extracts from the observer's semi-annual reports:

> The weekly papers have published with great care a correct summary of Form 22.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	2,236
Number of Forms 22 issued during the year ending June 30, 1880	60
Total	2,296

SACRAMENTO, CALIFORNIA.

[*Official number*, 144.]

Latitude	38° 35′
Longitude	121° 31′
Elevation of barometer above mean sea-level	69.60 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for two years	29.899
Mean annual barometer (reduced to sea-level) for two years	29.981
Mean annual temperature for two years	60°.9
Mean annual rainfall for two years	22.91 inches.

Established July 1, 1877.

Office, Fratt's Building, southeast corner Second and K streets.

Sergeant M. M. Sickler has been in charge during the year. There is no assistant at the station. It was inspected in November and found in a satisfactory condition.

November 28 the office was removed from the St. George Building to room No. 14 Fratt's Building, southeast corner Second and K streets.

Extracts from the observer's semi-annual reports:

> Since the new office was occupied there has been a marked increase in the number of visitors and the local interest in the service.
>
> The Sacramento Daily Bee continues to publish the local reports and reports from San Francisco, Winnemucca, and Salt Lake, and a summary of Form 22 monthly.
>
> The Daily Record Union publishes the "Indications," "Local" report, and summary of Form 22. Both of these publish from time to time such special items and extracts from the monthly review as may be of local interest to their readers.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	2,964
Number of Local Reports issued during the year ending June 30, 1880	657
Number of Forms 15 issued during the year ending June 30, 1880	879
Number of Forms 22 issued during the year ending June 30, 1880	58
Total	4,558

SALT LAKE CITY, UTAH.

[*Official number*, 70.]

Latitude	41° 10′
Longitude	112° 0′
Elevation of barometer above mean sea-level	4,354.54 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for five years	25.640
Mean annual barometer (reduced to sea-level) for six years	29.965
Mean annual temperature for five years	52°.4
Mean annual rainfall for five years	18.83 inches.

Established March 22, 1874.

Office, Wasatch Building, southeast corner of Main and Second South streets.

Sergeant John Craig has been in charge during the year. He has no assistant. The station was inspected in November and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

> Monthly abstracts and local reports (daily) are furnished regularly to and published by the local press.
>
> The interest in the service is increasing.
>
> The citizens seem to be mostly interested in the amount of precipitation and the temperatures at the various stations of observation.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	1,792
Number of Local Reports issued during the year ending June 30, 1880	677
Number of Forms 22 issued during the year ending June 30, 1880	60
Total	2,529

SANDUSKY, OHIO.

[*Official number*, 184.]

Latitude	41° 27′
Longitude	82° 43′
Elevation of barometer above mean sea-level	638.50 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for two years	29.339
Mean annual barometer (reduced to sea-level) for two years	30.008
Mean annual temperature for two years	51°.6
Mean annual rainfall for two years	40.31 inches.

Established August 2, 1877.

Office, West House Hotel, southwest corner Water street and Columbus avenue.

Sergeant W. A. Massey has been in charge during the year. One assistant has been ordered to, and one relieved from, this station. It was inspected in June and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

There can be no doubt as to the great advantage resulting from the display of signals at this point, as in this immediate vicinity occur some of the severest storms known on the lakes. The signal can be seen readily from Kelley's Island (with a glass), distant 12 miles, between which and Sandusky pass the greater number of lake craft between the east and west ends of Lake Erie, and the great estimation in which these warnings are held has been confirmed by conversations with many lake captains, and by the fact that a sailing vessel never leaves port during a display unless the captain is convinced that the storm has passed.

The storm warning being generally justified at this point, their display convinces those interested that any preparations necessary should be made at once.

The weather reports have latterly come into very great favor among the farmers, ice, coal, and pork men, and now many more than ever before consult the bulletins and "Indications." The interest in the service in all its workings cannot be increased.

Fifty-three cautionary signals were displayed during the year at this station.

The display of signals ceased December 25; resumed March 15, 1880.

The sergeant reports as follows in reference to the display of signals:

July 11.—Maximum velocity 72 miles per hour. Considerable damage was done in the city and vicinity; trees uprooted, chimneys blown down, and several large buildings unroofed. Schooner Geo. H. Warmington was struck by lightning but not seriously damaged. Several small boats tied along the docks broke loose and were blown away. Steamer Grace McMillan, with 400 excursionists, was caught in the gale but escaped without damage.

August 16.—Steamer Ferris had a hole stove in hull at Lakeside by being driven against wharf. Steam-yacht from Toledo beached at Put-in-Bay Island. Yacht Phaon, from Port Huron, capsized and was beached on Cedar Point.

October 29.—Canadian schooner Mary Lydia was sunk.

November 17.—A small boat capsized in bay; occupant saved. Yacht Flora, with a gunning party of five on board, had a hole stove in her bow; party rescued by propeller from Johnson Island. Neither steam nor sailing vessels left or entered harbor during the display.

November 24.—Sailboat Elvira, of Port Clinton, was picked up in lake off Kelley's Island; no trace of her crew has been found.

April 18 *to* 20.—Steam-propeller Eagle experienced a rough time between middle buoys and Put-in-Bay Island; shipped several seas that nearly extinguished her fires.

April 29.—The steamers Gazelle and Ferris did not come over from the island as usual on account of the severe storm.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	5,090
Number of Local Reports issued during the year ending June 30, 1880	300
Number of Forms 15 issued during the year ending June 30, 1880	2,418
Number of Forms 22 issued during the year ending June 30, 1880	36
Total	7,844

SANDY HOOK, NEW JERSEY.

[*Official number*, 112.]

Latitude	40° 28′
Longitude	74° 1′
Elevation of barometer above mean sea-level	29.25 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for six years	30.013
Mean annual barometer (reduced to sea-level) for six years	30.026
Mean annual temperature for six years	51°.6
Mean annual rainfall for six years	54.76 inches.

Established December 10, 1873.

Office, building of the Atlantic and Pacific Telegraph Company.

Corporal William Stein was in charge of this station until June 22, when he was relieved by Private G. W. Taylor, and ordered to this office for discharge. Four assistants have been ordered to, and three relieved from, this station during the year.

Extracts from the observer's semi-annual reports:

This station has continued to receive all the reports of passing vessels made by the Cape Henry Signal Station, which, over a loop connecting this office with the Maritime Exchange at New York City, are repeated to that point, as also are all the reports of wrecks, &c., furnished by the central office, which latter, in addition to other business, are also transmitted to the sergeant in charge of the New York Signal Station. Much attention is paid to the cautionary signals at this point by out-going vessels, and it is seldom that vessels leave the bay when the signal is displayed. They will often return to the bay, if under way, upon the hoisting of the signal, excepting when the off-shore signals are hoisted, the meaning of which seems to be well understood by the mariners as indicating westerly or northwesterly winds, which, if not blowing a gale, are most favorable for vessels going out.

The morning and evening "Indications," which are received daily at this station, are furnished to the Ordnance Department at this point, and are posted in front of the ordnance office.

Seventy-nine cautionary and fifty cautionary off-shore signals were displayed during the year at this station.

The observer reports as follows in reference to the display of signals:

November 19 *to* 22.—Schooner Mary Chitton, from New York, with general cargo, bound to Cinidad, Bolivia, dragged ashore on West Beach, half a mile below Sandy Hook main light. After the wind abated the vessel was floated off and proceeded on her way.

February 2 *to* 4.—Schooner Stephen Harding, of Damariscotta, Me., and the brig Custalia, of Richmond, Me., were driven ashore; no loss of life.

February 29.—Steamship State of Nevada run aground at 12.30 a.m.; was floated at 10.45 p.m., and proceeded on her way to New York.

April 13.—Schooner Xebec, from Porto Rico to New York, with cargo of molasses, went ashore one mile south of station at 2.45 a. m., 14th, and was floated at 6.50 a. m., same day.

PUBLICATIONS.

Number of Forms 15 issued during the year ending June 30, 1880	556
Number of Forms 22 issued during the year ending June 30, 1880	26
Total	582

SAN FRANCISCO, CALIFORNIA.

[*Official number*, 29.]

Latitude	37° 47′ 35″
Longitude	122° 26′ 15″
Elevation of barometer above mean sea-level	60.37 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for two years	29.948
Mean annual barometer (reduced to sea-level) for eight years	30.025
Mean annual temperature for eight years	56°.0
Mean annual rainfall for eight years	23.20 inches.

Established March 8, 1871.

Office, Merchants' Exchange, California street.

Sergeant C. E. Brinsmade was in charge until December 10, when he was relieved by Sergeant N. Gorom, and discharged the service on account of physical disability. There is one assistant at this station who has been on duty during the year.

The station was inspected in September and reported in a satisfactory condition.

Ninety-six post-offices have been regularly supplied with the Farmers' Bulletin during the year.

Extracts from the observer's semi-annual reports:

The number of steamers taking the simultaneous observations for publication in the International Bulletin has been largely increased during the year. These reports are now collected from all steamers of the Pacific Mail, Occidental and Oriental, Pacific Coast, Oregon Railroad and Navigation, and California and Mexican S. S. Lines, examined, errors corrected, and then forwarded to the office of the Chief Signal Officer.

Some interest is manifested in the service by the public, but its workings appear to be but little known. Those consulting the reports at the Merchants' Exchange are interested in the shipping; those at the Produce Exchange are engaged in buying or shipping provisions, cereals, &c. The members of the Produce Exchange complain that the reports now furnished by the service do not show the climatic conditions of points in the San Joaquin and other great grain-producing valleys of this coast. Reliable rainfall reports from these sections are very desirable and much sought for, as most of the industries of this State depend upon the annual amount of rainfall.

Reports are furnished to four daily and three weekly papers for publication, and fourteen copies of Form 22 are furnished to the press monthly.

The meteorological committee of the Chamber of Commerce have visited the office regularly each month, and have taken much interest in the same.

PUBLICATIONS.

Number of Farmers' Bulletins issued during the year ending June 30, 1880	29,127
Number of Bulletins (manifold) issued during the year ending June 30, 1880	2,890
Number of Local Reports issued during the year ending June 30, 1880	1,700
Number of Forms 22 issued during the year ending June 30, 1880	212
Total	33,929

SAVANNAH, GEORGIA.

[*Official number*, 22.]

Latitude	32° 5′
Longitude	81° 8′
Elevation of barometer above mean sea-level	86.86 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	30.006
Mean annual barometer (reduced to sea-level) for eight years	30.089
Mean annual temperature for eight years	66°.6
Mean annual rainfall for eight years	55.20 inches.

Established January 1, 1871.

Office, Commercial Building, corner Bay and Drayton streets.

Sergeant P. C. Guthrie has been in charge of the station during the year. One assistant has been ordered to, and one relieved from, this station.

The station was inspected in February and reported in a satisfactory condition. Certain necessary instructions were given the observer.

Extracts from the observer's semi-annual reports:

The classes of citizens appearing to derive the greatest amount of benefit from and mostly interested in the information furnished by the Signal Service are members of the Cotton Exchange, planters, mariners, commission merchants, and lawyers; also many travelers journeying by water. All classes whose business or pleasures are affected by the weather are interested in the service.

Ten cautionary signals and one cautionary off-shore signal were displayed during the year at this station.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	5,655
Number of Local Reports issued during the year ending June 30, 1880	541
Number of Forms 22 issued during the year ending June 30, 1880	60
Total	6,256

SHREVEPORT, LOUISIANA.

[*Official number*, 72.]

Latitude	32° 30′
Longitude	93° 45′
Elevation of barometer above mean sea-level	205.26 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.844
Mean annual barometer (reduced to sea-level) for eight years	30.053
Mean annual temperature for eight years	65° .6
Mean annual rainfall for eight years	49.97 inches.

Established September 3, 1871.

Office, Martin's Building, corner Milam street and Martin's Lane.

Sergeant E. F. Brady has been in charge during the year. Since October 13 there has been no assistant at this station. From April 10 to May 4, during the illness of the observer, Private J. W. Byram was in charge.

The highest water in the river, 23 feet, occurred April 3; lowest water, 3 feet 6 inches below zero of the gauge, November 1 to 4.

September 30, Major Wilson, employé of the United States Engineer Corps, placed the zero of the river gauge at low-water of 1879, which is 2 feet 8 inches below the low-water mark of 1878.

Extracts from the observer's semi-annual reports:

The river men and members of the Cotton Exchange highly appreciate the value of the daily river reports, and great interest has been awakened in the service among the business men of this section.

The press continues its former ready support of the service, and in addition to the ordinary full weather report each issue of both papers contains the river report in full.

The office is often visited by persons in quest of information relative to weather changes likely to ensue.

The value and utility of the data collected in this office is known to the medical profession and is sometimes practically utilized by them.

PUBLICATIONS.

Number of Local Reports issued during the year ending June 30, 1880	405
Number of Forms 22 issued during the year ending June 30, 1880	46
Number of Forms 26 issued during the year ending June 30, 1880	1,746
Total	2,197

SMITHVILLE, NORTH CAROLINA.

[*Official number*, 133.]

Latitude	33° 55′
Longitude	78° 1′
Elevation of barometer above mean sea-level	32.70 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for four years	30.054
Mean annual barometer (reduced to sea-level) for four years	30.086
Mean annual temperature for four years	63° .4
Mean annual rainfall for four years	56.80 inches.

Established October 15, 1875.

Office on Front street.

Sergeant R. Seyboth was in charge until September 27, when he was relieved by Sergeant W. T. Boyd and transferred to Baltimore. Three assistants have been ordered to, and two relieved from, this station during the year. It was inspected in February and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

The service is well thought of by the pilots and fishermen who reside, here and also by all mariners who come to this port. The signals are closely observed as a general thing, and the facilities for sending and receiving reports by telegraph are greatly appreciated by the shipping men here, and through the use of the Signal Service telegraph line between Smithville and Wilmington they are saved much delay and annoyance.

Thirty-five cautionary and seven cautionary off-shore signals were displayed during the year at this station.

The sergeant reports as follows in reference to the display of signals:

August 15 *to* 19.—British bark Indiana remained in port owing to signals; German bark Mary (581 tons), anchored between inner and outer bars, was driven ashore and lost all of her masts.

February 2 *to* 4.—Schooner A. F. Randolph, from Bridewater, N. S., in ballast, went ashore at the Fingers, near Baldhead light; Captain Warner and crew of five men were saved; vessel will be a total loss.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

SPRINGFIELD, ILLINOIS.

[*Official number*, 228.]

Latitude	39° 48′
Longitude	89° 48′
Elevation of barometer above mean sea-level	644.27 feet.
Mean barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	29.369
Mean barometer for the year ending June 30, 1880	30.040
Mean temperature for the year ending June 30, 1880	56°.6
Amount rainfall for the year ending June 30, 1880	34.85 inches.

Established July 1, 1879.

Office, corner Sixth and Monroe streets.

Sergeant T. B. Jennings has been in charge during the year. He has no assistant.

The office was moved from the third story of the Springer Building to Room 8, third story of the post-office building, southeast corner Sixth and Monroe streets, on the 28th of July.

The station was inspected in December and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

> The public generally has manifested a considerable interest in the service.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 188	4,467
Number of Forms 22 issued during the year ending June 30, 1880	45
Total	4,512

SPRINGFIELD, MASSACHUSETTS.

[*Official number*, 110.]

Latitude	42° 6′
Longitude	72° 36′
Elevation of barometer above mean sea-level	120.54 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for five years	25.876
Mean annual barometer (reduced to sea-level) for five years	29.988
Mean annual temperature for five years	49°.7
Mean annual rainfall for five years	47.74 inches.

Established July 19, 1873.

Office, Hayne's Opera House building, southeast corner Main and Pynchon streets.

Sergeant H. R. Hathaway has been in charge during the year. He has no assistant.

The station was inspected in August and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

> The records on file at the station have been frequently consulted by shipping men and the railroad authorities in this vicinity. The meteorological committee, members of the press, and citizens generally have been very courteous, and seem to take a decided interest in the service.
>
> The posting of weather "Indications" in the Boston and Albany Railroad depot has been a popular feature with the citizens.
>
> The Daily Republican and the Daily Union regularly publish the "Indications" and local tabular weather reports.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

SAINT LOUIS, MISSOURI.

[*Official number*, 66.]

Latitude	38° 37′ 28″
Longitude	90° 15′ 16″
Elevation of barometer above mean sea-level	567.57 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.468
Mean annual barometer (reduced to sea-level) for eight years	30.031
Mean annual temperature for eight years	55°.5
Mean annual rainfall for eight years	39.67 inches.

Established November 1, 1870.

Office, Saint Louis Life Insurance building, northwest corner Sixth and Locust streets.

Sergeant J. H. Weber has been in charge during the year. Three assistants have been ordered to, and three relieved from, this station.

The station was inspected in December and reported in a satisfactory condition.

Highest water in the river, 22 feet 2 inches, occurred June 30; lowest water, 3 feet 6 inches, December 26.

Three hundred and sixty-eight post-offices have been regularly supplied with the Farmers' Bulletin during this year.

Extracts from the observer's semi-annual reports:

> Two large weather maps are displayed, as heretofore, in the Merchants' and Cotton Exchanges. These maps are continually consulted by the merchants.
>
> A monthly statement of the stage of water in the river at this point has been furnished to Capt. O. H. Ernst, Engineer Corps, U. S. A., in this city, since May, 1880.

The following resolution was adopted by the Merchants' Exchange:

> *Resolved by the board of directors of the Merchants' Exchange of Saint Louis*, That we, in our representative as well as individual capacity, give expression to our deep sense of appreciation of what has already been accomplished in this direction in the past; that we cannot speak in terms of too high commendation of the admirable system that seems to have pervaded and animated the service in all its branches and ramifications since its creation; that we ascribe its efficiency, as evidenced by tangible and visible results, and which has been largely enhanced from year to year, to wise legislation and competent administration, through discipline and perfect system; that we feel proud of an organization, the equal of which is not to be found elsewhere on the face of the globe, and to which the older nations of Europe look as a model worthy of their study and imitation; that we hope to see its sphere of usefulness still further extended in the future by the fostering care of Congress; that we heartily recommend and indorse all proper legislation in furtherance of this object, and that we repose the most implicit and unfaltering confidence in the executive and organizing ability of the Chief Signal Officer, whose long experience in the service entitles his counsels and suggestions to be sought and heard in relation to any improvements to be ingrafted upon the system as it now exists.

PUBLICATIONS.

Number of Farmers' Bulletins issued during the year ending June 30, 1880	150,423
Number of Bulletins (manifold) issued during the year ending June 30, 1880	8,622
Number of Local Reports issued during the year ending June 30, 1880	2,853
Number of Forms 15 issued during the year ending June 30, 1880	2,496
Number of Forms 22 issued during the year ending June 30, 1880	331
Number of Forms 26 issued during the year ending June 30, 1880	2,296
Total	167,021

SAINT MARK'S, FLORIDA.

[*Official number*, 24.]

Latitude	30° 10′
Longitude	84° 12′
Mean annual barometer (reduced to sea-level) for four years	30.068
Mean annual temperature for four years	66°.3
Mean annual rainfall for four years	67.49 inches.

Established November 10, 1874; discontinued October 30, 1879, and instruments and records removed to Cedar Keys.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	8
Total	8

SAINT MICHAEL'S, ALASKA.

[*Official number*, 119.]

Latitude	63° 48′
Longitude	161° 60′

Established June 28, 1874.

Office, southernmost building of Alaska Commercial Company. No report from this station has been received.

Extracts from the observer's semi-annual reports:

The past winter has been one of unusual severity, not so much from a great depression of the temperature at one time but from long continued cold weather, accompanied by high winds or gales and snows, especially in February and March. January was very cold but far less windy than the preceding and following months.

The oldest natives say they do not remember another winter combining such an extraordinary snow-fall with low temperatures and heavy gales.

The winter was very severe throughout the country as far as can be ascertained, the temperature falling to 69° below zero at Fort Reliance, 400 miles southeast of Fort Yukon, although at both these places the temperatures were very severe, yet the snowfall only reached about 6 inches in depth on a level up to January 1, 1880, and 14 inches up to the time spring set in, in April. From the mouth of the Sanana River down the Yukon, and along the sea-coast from the mouth of the Kuskoquim River to Cape Prince of Wales, Behring's Straits, during the months of February and March, there were experienced a series of intensely cold gales accompanied by falling or drifting snow, which reached a depth of from 5 to 8 feet on a level, and of which remains still linger in the form of large drifts.

The natives narrowly escaped a destructive famine, and in some cases were forced to eat their dogs and the tanned sealskin covers of their boats, while numbers of their dogs died of starvation.

The spring was extremely late, the ice remained an unbroken sheet far to seaward up to the 20th of June, and up the Yukon to Fort Reliance the season was from ten to fifteen days later than usual.

All migratory birds arrived eight to ten days behind time, and even now the grass has but just begun shading the hillsides with green, and hardy flowers are scattered here and there over the ground.

SAINT PAUL, MINNESOTA.

[*Official number*, 39.]

Latitude	44° 53′
Longitude	93° 5′
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.109
Mean annual barometer (reduced to sea-level) for seven years	29.937
Mean annual temperature for eight years	43°.8
Mean annual rainfall for nine years	29.57 inches.

Established November 1, 1870.

Office, Ingersoll Block, corner Third and Wabasha streets.

Sergeant O. S. M. Cone has been in charge during the year. An assistant was on duty at this station until March 6, since which time the sergeant has performed the duties of the station without assistance.

The highest water in the river, 15 feet 3 inches, occurred June 17; lowest water, 10 inches, September 28.

The station has not been inspected during the year.

The highest water known here since 1875 occurred on June 17, and measured 15 feet 3 inches above bench-marks. The low lands opposite the station were flooded, and many residents had to move out of their homes during the high water. The river gauge used at this station was destroyed by a steamboat on June 19, 1880, and was replaced by a new one on June 30.

Navigation on the Mississippi River was considerably interrupted during the latter part of the season by low water. The first steamboat up the river arrived at Saint Paul on April 21, 1879, while the last boat to leave this point was the Cheever, on October 25, 1879, making 187 days of steamboat navigation. The river was clear of ice on March 26, 1879, and not completely frozen over until December 8, 1878.

Extracts from the observer's semi-annual reports:

The citizens of this vicinity continue to manifest much interest in the weather reports and "Indications," as published in the daily papers, and the manifold bulletins. The city of Saint Paul has gained three lawsuits during the last six months by the records of the weather at Saint Paul being submitted as evidence.

The depth of water in the river, as shown by river gauge, is consulted daily by many people interested in river navigation, and is also published in the daily papers. Considerable interest is manifested in the reports of the weather at this station; most particularly by the wheat and grain speculators and the members of the Chamber of Commerce.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	6,909
Number of Local Reports issued during the year ending June 30, 1880	728
Number of Forms 22 issued during the year ending June 30, 1880	90
Total	7,727

THATCHER'S ISLAND, MASSACHUSETTS.

[*Official number*, 125.]

Latitude	42° 36′
Longitude	70° 34′
Elevation of barometer above mean sea-level	48.12 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for four years	29.940
Mean annual barometer (reduced to sea-level) for four years	29.992
Mean annual temperature for four years	47°.4
Mean annual rainfall for four years	48.59 inches.

Established December 26, 1875.

Office, Signal Service Building, central part of the island.

Private E. C. Goss has been in charge during the year. He has no assistant.

The station was inspected in August and reported in a fair condition.

Extracts from the observer's semi-annual reports:

When the cautionary signal is hoisted at this station all passing vessels within sight of the island invariably make for harbor, either in Gloucester or Rockport, and remain until the signal is lowered before venturing out to sea. This precaution is so strictly adhered to by vessels of every description, passing near this station, that the percentage of wrecks is very small. The fishing and coasting trade derives the greatest amount of benefit from the reports. The service is growing in popularity, and the same confidence is placed in the reports, by the public, as in previous years. The telegraph line and cable between the island and Rockport has been in good condition throughout the year.

Fifty-one cautionary and twenty-nine cautionary off-shore signals were displayed during the year at this station.

The sergeant reports as follows in reference to the display of signals:

August 18.—Steamer Star of the East, while off this island, had her port paddle box carried away and hurricane deck badly damaged.

October 19.—A large number of vessels were passing the island, bound north, when the signal was being hoisted; they immediately put about and made for Gloucester. Schooner Octavia A. Dow, of Monhegen, Me., engaged in shore mackerel fishing, had her foremast carried away while off the island during the gale, and put into Gloucester for repairs.

January 2.—Schooner F. J. Wonson, Captain Spun, went ashore this morning near Rockford; was taken off by the wrecking steamer S. E. Wetherill, and towed to Gloucester for repairs; schooner slightly damaged, with loss of rudder.

February 3.—Schooner Abbie Bursley, Capt. William B. Baker, from Georgetown, Me., for Philadelphia, Pa., cargo, ice, went ashore at Lanesville, near Rockport, during the gale; crew of eight men were taken off by Lanesville fishermen before the life-saving men arrived; vessel belongs to Barnstable, Mass.; partly insured; lies in bad position, and will probably become a total loss.

March 24.—Schooner Mary A. Rice, Captain Clay, owned by E. B. Gardner and others, of Bucksford, Me., bound from New York to Newburyport, Mass., while passing the island was struck by a severe squall, which carried away mast and all running rigging. Revenue cutter notified, came after vessel, took her in tow and carried her to Gloucester.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

TOLEDO, OHIO.

[*Official number*, 35.]

Latitude	41° 40′
Longitude	83° 32′
Elevation of barometer above mean sea-level	651.19 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.326
Mean annual barometer (reduced to sea-level) for eight years	29.991
Mean annual temperature for nine years	50°.4
Mean annual rainfall for nine years	30.84 inches.

Established November 1, 1870.

Office, Finlay Block, southeast corner Summit and Madison streets.

Sergeant Allen Buell has been in charge during the year. One assistant has been ordered to, and one relieved from, this station.

Navigation closed December 20, and opened March 13.

Extracts from the observer's semi-annual reports:

The newspapers take great interest in the service. The Commercial is now publishing a full tabulated report of the midnight observations. The Blade publishes the morning observations. It can be said that the service has been of marked benefit to our merchant marine. No violent storm doing damage has passed over the station, for which a signal has not been ordered. Navigation opened March 13, 1880, although boats had been arriving and departing nearly all winter. The observer has been subpœnaed to appear in court with the records of the office to testify in commercial cases.

In many instances vessels have been detained in port by the cautionary signal. Fifty-one cautionary signals were displayed during the year at this station.

The sergeant reports as follows in reference to the display of signals:

July 11.—Storm very severe in surrounding country, trees blown down, telegraph wires broken, crops injured, and much damage by lightning; no casualties are reported at this station.

August 15.—The signal had the effect of keeping all vessels in port; those on the lake during the storm were damaged; no casualties are known to have occurred.

August 24 *to* 26.—The shipping had ample warning and no disasters are reported. Steamers and vessels remained in port; heavy sea reported on Lake Erie on the night of the 24th.

September 1 *to* 4.—Storm very severe on the lake during the entire display; no casualties reported. A few steamers were more or less damaged, and the steamer McMillan had her wheel-house stove in.

November 9.—Heavy winds are reported from Southern Michigan on the morning of the 3d, uprooting trees and blowing down telegraph poles, &c. A large fleet of vessels in port awaiting a favorable wind.

November 19 *to* 21.—Storm very severe on the lake. Fishermen report considerable damage to their nets, &c. Much damage done to fences and telegraph poles in the surrounding country; numerous disasters on the lakes.

November 26 *to* 29.—No damage at this station by the storm. Very few, if any, vessels left port without consulting this office; storm very severe on the lake.

April 16.—Storm very severe. The steamer Granite State attempted to go out during the display of the signal, but had her bulwarks stove in and her cargo damaged to some extent. The schooner Storker slipped her cables and went ashore, but was gotten off all right.

June 5.—Steamer Waite was the only vessel that left port on the 6th. She made a trip to the island and reports a very rough passage. A large fleet of vessels sought shelter in bay; no damage or disasters.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	4,199
Number of Forms 22 issued during the year ending June 30, 1880	121
Total	4,320

UMATILLA, OREGON.

[*Official number*, 147.]

Latitude	45° 55′
Longitude	119° 21′
Elevation of barometer above mean sea-level	184.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for two years	29.658
Mean annual barometer (reduced to sea-level) for two years	30.143
Mean annual temperature for two years	53° .7
Mean annual rainfall for two years	9.16 inches.

Established July 15, 1877.

Office, on bank of California River; township, 5 N.; range, 28 E.; section 17.

Private J. B. Wells was in charge until August 23; Private J. A. Perkins from August 23 to January 19; and Private R. P. Sibley from January 19 to date.

An assistant was temporarily on duty from October 10 to November 19, during the illness of Private Perkins.

Navigation closed on the Upper Columbia River December 19, and was resumed January 19, which was about one month earlier than usual.

The highest water, 21 feet 4 inches, occurred July 1, 1879; lowest water, 2 feet 1 inch, November 30 and December 1.

The station was inspected in September. The inspector reported that the duties had been negligently performed, and the observer, Private Perkins, was relieved from duty and discharged from the Signal Corps.

Extracts from the observer's semi-annual reports:

> Emigrants in coming to this section of the country to locate find the Signal Office a source of considerable benefit to them in ascertaining the amount of rainfall, and other general items regarding the climate of this section of Oregon.
>
> Daily observations of the river gauge in the Columbia River are made, and weekly reports of the same are furnished Col. G. L. Gillespie, Corps of Engineers, U. S. A., Portland, Oreg., and Lieut. C. F. Powell, Engineer Corps, U. S. A., Cascade Locks, Oreg.
>
> Since the 1st of May a weekly statement of the actual barometer readings has been furnished Mr. D. Chaplin, La Grande, Oreg., for the purpose of comparison in surveying for the Oregon Railroad and Navigation Company.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

UNALASHKA, ALASKA.

[*Official number*, 186.]

Latitude	53° 25′
Longitude	166° 49′

Established August 18, 1878; observations commenced August 22, 1878.

Mr. H. M. McIntyre is the observer.

No reports have been received.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

VICKSBURG, MISSISSIPPI.

[*Official number*, 61.]

Latitude	32° 23′
Longitude	90° 54′
Elevation of barometer above mean sea-level	243.46 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.832
Mean annual barometer (reduced to sea-level) for seven years	30.098
Mean annual temperature for eight years	65° .8
Mean annual rainfall for eight years	56.67 inches.

Established September 10, 1871.

Office, northwest corner Washington and Crawford streets.

Sergeant J. A. Cody has been in charge during the year. Two assistants have been ordered to, and three relieved from, this station.

The duties are now performed by the sergeant without assistance.

Highest water in the river, 43 feet 2 inches, occurred April 8; lowest water, 3 feet 4 inches, October 17 and 23.

The station has not been inspected during the year.

Extracts from the observer's semi-annual reports:

> The interest taken in the service continues to increase. Every day the office is visited by parties inquiring how the weather compares with that of 1878. For the information of the public the Vicksburg Daily Herald publishes, monthly, a comparative statement of the weather for 1878 and 1880. The interest manifested by all in the river reports during high water is very great indeed.
>
> Morning weather bulletins are regularly posted in the Cotton Exchange.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	3,127
Number of Local Reports issued during the year ending June 30, 1880	317
Number of Forms 22 issued during the year ending June 30, 1880	24
Number of Forms 26 issued during the year ending June 30, 1880	2,149
Total	5,617

VIRGINIA CITY, MONTANA.

[*Official number*, 77.]

Latitude	45° 20′
Longitude	112° 3′
Elevation of barometer above mean sea-level	5,810.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for two years	24.216
Mean annual barometer (reduced to sea-level) for seven years	29.708
Mean annual temperature for seven years	40°.6
Mean annual rainfall for seven years	16.52 inches.

Established November 25, 1871.

Office, Thompson's Building, corner Wallace and Jackson streets.

Sergeant E. McGovern was in charge until August 23, when he was relieved by Private J. M. Clifford. There is no assistant at this station. It has not been inspected during the year.

Extracts from the observer's semi-annual reports:

No reports are received at this station.
There is one paper but it does not publish the local reports.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

VISALIA, CALIFORNIA.

[*Official number*, 146.]

Latitude	36° 20′
Longitude	119° 16′
Elevation of barometer above mean sea-level	348.15 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for two years	29.615
Mean annual barometer (reduced to sea-level) for two years	29.981
Mean annual temperature for two years	62°.6
Mean annual rainfall for two years	8.59 inches.

Established July 1, 1877.

Office, Palace Hotel, northeast corner Main and Court streets.

Private J. T. Cochran has been in charge during the year.

The station was inspected in October and reported in a satisfactory condition.

The office was moved February 26, 1880, from the Town Hall to the rooms formerly occupied in the Palace Hotel.

Extracts from the observer's semi-annual reports:

More interest is taken in the service during the winter than at any other time of the year, for all are anxious to know whether the season will be wet or dry, and a great number of inquiries are made respecting the barometer and rainfall.

Weekly and monthly local reports are furnished the papers.

No telegraphic reports are received here.

The telegraphic observations are promptly bulletined.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	1,827
Number of Local Reports issued during the year ending June 30, 1880	104
Number of Forms 22 issued during the year ending June 30, 1880	47
Total	1,978

WASHINGTON, DISTRICT OF COLUMBIA.

[*Official number*, 19.]

Latitude	38° 53′
Longitude	77° 1′
Elevation of barometer above mean sea-level	105.56 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.954
Mean annual barometer (reduced to sea-level) for nine years	30.058
Mean annual temperature for nine years	55°.1
Mean annual rainfall for nine years	42.73 inches.

Established November 1, 1870.

Office, 1719 and 1721 G street N. W.

Sergeant James B. Newlin continued in charge of the station work until December 1, 1879, when he was relieved by Sergeant Theo. V. Van Heusen, who continues to perform these important duties in a most efficient and commendable manner. The comparison of the data upon the different forms with the original records, as forwarded from the Signal Service stations, the correction of errors made by observers, the briefing and filing of the large number of records annually received, the issuing of circulars and instructions, the translation of the weather reports received in cipher, by telegraph, tri-daily, from each station, the enciphering, for telegraphic transmission, of the data for the weather maps published in the New York Graphic, the preparation of data for scientific and other purposes, the compilation of statistics for publication, &c., have been the principal duties of the force in the station room, and have kept it constantly employed.

PUBLICATIONS.

Weather Chronicle	614
Number of Farmers' Bulletins issued during the year ending June 30, 1880	138,789
Number of Bulletins (manifold) issued during the year ending June 30, 1880	12,387
Number of Local Reports issued during the year ending June 30, 1880	1,595
Number of Forms 15 issued during the year ending June 30, 1880	12,512
Number of Forms 22 issued during the year ending June 30, 1880	334
Number of Maps issued during the year ending June 30, 1880	104,950
Total	271,181

WILMINGTON, NORTH CAROLINA.

[*Official number*, 20.]

Latitude	34° 11′
Longitude	78° 10′
Elevation of barometer above mean sea-level	73.54 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	30.009
Mean annual barometer (reduced to sea-level) for eight years	30.078
Mean annual temperature for eight years	62°.8
Mean annual rainfall for eight years	59.33 inches.

Established January 1, 1871.

Office, northwest corner Front and Princess streets.

Sergeant J. M. Watson has been in charge during the year. Three assistants have been ordered to, and three relieved from, this station.

The section of coast line and telegraph equipments at this station were inspected in August.

The station was inspected in August and was reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

A great deal of interest is taken in the service, the reports are closely studied by many, and the reports of signals displayed and lowered at other stations, as well as special reports of wrecks (which are received here as special messages and regularly bulletined on arrival), are closely watched by the mariners, and published in the daily papers. Very favorable comment was made in regard to the signals displayed for the very severe gale of August 18, several captains of vessels saying they would never again go to sea when a signal was displayed.

Twenty-six cautionary and seven cautionary off-shore signals were displayed during the year at this station.

The sergeant reports as follows in reference to the display of signals:

August 15 *to* 18.—The damage in the city was mostly confined to the prostration of fences, chimneys, and the upper limbs of trees. A portion of a two-story dwelling-house was blown down, also a brick wall. Schooner H. W. McColly broke loose from her moorings and drifted below Market street. The German bark Fritz von der Lanchen broke from her moorings. The Swedish brig Thor had her sails split and rigging cut; the latter damage being inflicted by a piece of tin covering blown from Worth & Worth's shed. The German bark Marie went ashore on the Middle Ground during the storm. The pilot-boat Henry Waterman is ashore on Bald Head, and the Rose Scarborough at Gander Hill. The British bark Kate Bonsfield is ashore above Battery Island, but will be gotten off without difficulty.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	5,512
Number of Forms 15 issued during the year ending June 30, 1880	759
Number of Forms 22 issued during the year ending June 30, 1880	60
Total	2,331

WINNEMUCCA, NEVADA.

[*Official number*, 139.]

Latitude	41° 00′
Longitude	119° 21′
Elevation of barometer above mean sea-level	4,345.25 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for two years	25.632
Mean annual barometer (reduced to sea-level) for two years	29.992
Mean annual temperature for two years	49°.8
Mean annual rainfall for two years	8.06 inches.

Established July 1, 1877.

Office, Central Pacific Hotel.

Sergeant E. F. Kubel was in charge until February 19, when he was relieved by Corporal John R. Williams. There is no assistant at this station. It was inspected in November and reported in a satisfactory condition.

Extracts from the observer's semi-annual reports:

The Daily Silver State publishes a synoptic review of Form 22, a daily record of the maximum and minimum temperature of the preceding day, and the morning bulletin.

Drovers interested in cattle shipment consult the weather reports to determine as to the expediency of transferring stock from place to place; exposure to cold weather at points on the road between stock-yards generally resulting in loss of stock.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	1,499
Number of Forms 22 issued during the year ending June 30, 1880	134
Total	1,633

WOOD'S HOLL, MASSACHUSETTS.

[*Official number*, 60.]

Latitude	41° 33′
Longitude	70° 40′
Elevation of barometer above mean sea-level	34.37 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	29.973
Mean annual barometer (reduced to sea-level) for seven years	30.206
Mean annual temperature for seven years	48°.6
Mean annual rainfall for seven years	46.29 inches.

Established January 1, 1873.

Office, Fish building.

Private J. D. Sumet was in charge until March 5. His management of the station was so unsatisfactory to this office that he was relieved by Sergeant John Healy, and transferred to Boston as assistant.

The station was inspected in July, and the inspector reported it in fair condition.

Full observations are taken at this station, but not reported by telegraph except when specially called for.

No reports are received from other stations.

Extracts from the observer's semi-annual reports:

This being a station for the display of cautionary signals, those interested in shipping are more benefited than other classes by the service. Hundreds of coasters and other vessels pass through Vineyard Sound daily in full sight of the signal flagstaff on Nobsque Point, and when the cautionary signal is flying many vessels can be seen making for Vineyard Haven and other harbors in this vicinity.

Forty-eight cautionary and twenty-eight cautionary off-shore signals were displayed during the year at this station.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	34
Total	34

YANKTON, DAKOTA.

[*Official number*, 95.]

Latitude	42° 45′
Longitude	97° 30′
Elevation of barometer above mean sea-level	1,228.44 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for six years	28.716
Mean annual barometer (reduced to sea-level) for five years	30.003
Mean annual temperature for five years	45°.4
Mean annual rainfall for six years	28.25 inches.

Established April 1, 1873.

Office, Bruce's Block, corner Third and Capitol streets.

Sergeant P. J. Huneke was in charge until March 10, when he was relieved by Corporal T. A. Taylor. There is no assistant at this station. One was on duty, temporarily, during the illness of the observer, from February 10 to March 26.

The office was moved to Bruce's Block on August 1.

The station has not been inspected during the year.

On June 1 a river gauge was placed in position on river front at corner of Pine and Second streets. This was put up at the request of the Peck and Coulson Steamship Company, for the annual June rise, and proved very useful to them.

Highest water in the river, 12 feet 2 inches, occurred July 1, 1879; lowest water, 10 inches, March 16.

Extracts from the observer's semi-annual reports:

Those deriving the greatest benefits from the service at this point are steamboat men and river men, to whom the river reports are very useful during the summer. Considerable interest has been taken this summer, by citizens, in the temperature and rainfall data.

The Press and Dakotaian continue to publish reports, giving stage of water, maximum temperatures, and rainfall during the day; also to publish the "Indications" for this section received with press reports.

No reports of any description are received at this station.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

ATKA, ALASKA.

Latitude	52° 10′ 30″
Longitude	174° 9′ 30″

Established May 4, 1879; observations commenced May 7, 1879.

No reports received.

FLYING-STATION AT LIFE-SAVING STATION NO. 5, FALSE CAPE, NORTH CAROLINA.

[*Official number*, 219.]

Latitude	36° 38′ 15″
Longitude	73° 53′ 00″

Established May 20, 1878.

Office, in United States Life-Saving station.

Private R. H. Paxton has been in charge during the year. He has no assistant.

The station was inspected in February and reported in a satisfactory condition.

The duties of this station are, first, to keep in repair the sea-coast telegraph lines from Cape Henry to Kittyhawk; second, in case of a wreck to proceed to and open telegraph station at a point on the coast near the wreck; to promptly communicate all the particulars to this office; to notify the Life-Saving stations near the wreck, and to render all possible assistance.

The repair man from this station is required to make a weekly trip over the entire section to examine the lines and make all needed repairs.

FLYING-STATION AT SLOOP POINT, NORTH CAROLINA.

[*Official number*, 232.]

Latitude	34° 19′
Longitude	77° 48′

Established May 27, 1878.

Office, small building owned by Mr. D. McMillan.

Corporal C. C. Corbin was in charge of this station until March 15, when he was relieved by Private H. S. Gardiner. One assistant has been ordered to, and one relieved from, this station.

The office has been enlarged and greatly improved during the year.

There are no meteorological instruments at this station.

It was inspected in February and reported in satisfactory condition.

Extracts from the observer's semi-annual reports:

> The regular repair trips have been faithfully performed, and many poles cut off and reset to prevent future trouble.
>
> When I heard of the wreck of the Marian Gage, of Philadelphia, I proceeded at once to the scene. She was ashore south of New River. I arrived at 4 p. m. on the 4th of September, 1879, opened wreck station, reported the disaster by wire to the central office, and rendered all the assistance in my power. I received instructions from office of the Chief Signal Officer on the 6th of September, to discontinue the wreck station. The iron poles, erected where the wooden poles have become too short and worthless, prove to be what has long been wanted on the coast line. Sloop Point section is now in perfect condition.

FLYING-STATION AT LIFE-SAVING STATION NO. 23, LITTLE EGG HARBOR, NEW JERSEY.

[*Official number*, 222.]

Latitude	39° 30′ 5″
Longitude	74° 17′ 28″

Established as a repair station January 20, 1879.

Office, in Life-Saving Station No. 23.

Private J. H. Fox was in charge until March 1, when he was relieved by Private C. W. Chambers, who was relieved April 21 by Private W. Daly. In addition to keeping that section of the telegraph line in repair, the man in charge is obliged, in case of wrecks, to at once place himself in communication with them, to render all aid in his power, and to promptly report the particulars to this office by telegraph.

Sunset observations only are taken, which are forwarded to this office by telegraph, daily, when the observer is not absent on repair duty. A daily journal is kept.

This station has not been inspected during the year.

UNITED STATES TELEGRAPH LINES—TEXAS DIVISION.

Table showing stations on the United States military telegraph line, Texas division, from which reports have been received during the year ending June 30, 1880, *with the kind of reports sent, whether complete or limited.*

Name of station.	Reports commenced.	Reports discontinued.	Number of reports by telegraph (daily).	Character of reports received by mail on Form 4 (weekly).
Bœrne, Tex	(*)	....	1	Complete observations taken four times a day.
Brackettville, Tex	(*)	....	1	Complete observations taken eight times a day.
Brownsville, Tex	(*)	....	4	Complete observations taken four times a day.
Castroville, Tex	(*)	....	1	Do.
Coleman City, Tex	(*)	....	1	Do.
Concho, Tex	(*)	....	1	Do.
Decatur, Tex	(*)	....	1	Do.
Denison, Tex	(*)	....	4	Complete observations taken eight times a day.
Eagle Pass, Tex	(*)	....	4	Complete observations taken four times a day.
Edinburg, Tex	(*)	....	1	Complete observations, except barometric, taken four times a day.
Fort Davis, Tex	(*)	....	4	Complete observations taken four times a day.
Fort Elliott, Tex	Oct 19, 1879	....	1	Do.
Fort Griffin, Tex	(*)	....	4	Do.
Fort McKavett, Tex	(*)	....	1	Do.
Fort Reno, Ind. T	Nov. 1, 1879	....	1	
Fort Sill, Ind. T	(*)	....	4	Complete observations taken four times a day.
Fredericksburg, Tex	(*)	....	1	Do.
Graham, Tex	(*)	....	1	Do.
Henrietta, Tex	(*)	....	1	Do.
Jacksboro', Tex	(*)	....	1	Do.
Laredo, Tex	(*)	....	1	Do.
Mason, Tex	(*)	....	4	Do.
Pilot Point, Tex	(*)	....	1	Do.
Rio Grande City, Tex	(*)	....	1	Do.
San Antonio, Tex	(*)	....	4	Complete observations taken eight times a day.
Santa Maria, Tex	July 1, 1879	....	1	
Stockton, Tex	(*)	....	4	Complete observations taken four times a day.
Supply, Ind. T	Oct. 7, 1879	....	1	
Uvalde, Tex	(*)	....	1	Complete observations taken four times a day.

* Reporting at date of last annual report, June 30, 1879.

Report of stations on the United States military telegraph line, Texas division, compiled from the annual report of Lieut. C. A. Tingle, Second United States Artillery, Acting Signal Officer in charge, and from data on file in the office of the Chief Signal Officer.

BŒRNE, TEXAS.

[*Official number*, 207.]

Latitude	29° 48′
Longitude	98° 39′
Elevation of barometer above mean sea-level	1,333.00 feet.
Mean barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	28.558
Mean annual rainfall for one year	17.87 inches.

Established May 6, 1876; observations commenced August 27, 1876.

Office, in building occupied as store on Main street.

Mr. Eugene Laue, civilian, has been in charge during the year.

This station maintains in repair 35 miles of wire.

Receipts.—This line, $117.70; other lines, $126.37; total, $304.07. Free business, $41.15.

The station has combination telegraph instruments and a complete set of meteorological instruments and repair tools.

A daily sunset observation is forwarded by telegraph.

The station was inspected in May, and found in good condition.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

BRACKETTVILLE, TEXAS.

[*Official number*, 204.]

Latitude	29° 17′
Longitude	100° 51′
Elevation of barometer above mean sea-level	1,050.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	28.833
Mean annual rainfall for two years	21.09 inches.

Established September 1, 1875; observations commenced May 2, 1876.

Office, telegraph building on north hill of city.

Lance Sergeant J. A. Gleason has been in charge during the year. Four assistants have been ordered to, and four relieved from, this station.

This station maintains in repair 41 miles of wire.

Receipts.—This line, $775.13; other lines, $272.97; total, $1,048.10. Free business, $942.72.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

A daily sunset observation is forwarded by telegraph.

The station was inspected in May.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

BROWNSVILLE, TEXAS.

[*Official number*, 174.]

Latitude	26° 00′
Longitude	97° 30′
Elevation of barometer above mean sea-level	43.40 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	29.925
Mean annual rainfall for three years	32.34 inches.

Established August 25, 1875; observations commenced September 14, 1875.

Office, Elizabeth street, adjoining custom-house.

Private J. Williams has been in charge during the year.

This station maintains in repair 15 miles of wire.

Receipts.—This line, $1,081.51; other lines, $72.45; total, $1,153.96. Free business, $602.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station was inspected in April and found in good condition.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

CALLAHAN CITY, TEXAS.

Established April 2, 1880.

Civilian C. A. Doty has been in charge since date of establishment.

This station maintains in repair 40 miles of wire.

Receipts.—This line, $43.30; other lines, $64.42; total, $107.92.

The station is supplied with a set of telegraph instruments and repair tools.

No meteorological observations are taken.

CAMBRIDGE, TEXAS.

[*Official number*, 150.]

Latitude	33° 42′
Longitude	98° 00′

Established June 17, 1875; closed January 5, 1878; re-opened June 1, 1878; observations commenced January 22, 1876; discontinued January 5, 1878; re-opened July 1, 1879; closed April 15, 1880.

Civilian W. M. Weddington was in charge until closing of station.

Receipts.—This line, $83.56; other lines, $82.23; total, $165.79.

There are no meteorological instruments at this station.

CANTONMENT, INDIAN TERRITORY.

Established September 13, 1879.

Civilian W. S. Hibbard has been in charge since date of establishment.

This station maintains in repair 55 miles of wire.

Receipts.—This line, $47.37; other lines, $123.10; total, $170.47. Free business, $89.14.

The station is supplied with a full set of telegraph instruments and repair tools.

No meteorological observations are taken.

CASTROVILLE, TEXAS.

[*Official number*, 149.]

Latitude	29° 25′
Longitude	98° 50′
Elevation of barometer above mean sea-level	686.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	29.215
Mean annual rainfall for two years	16.44 inches.

Established September 29, 1875; observations commenced January 22, 1876.

Office, Vance House, southwest corner Main and First streets.

Private Thomas Jones has been in charge during the year.

This station maintains in repair 42 miles of wire.

Receipts.—This line, $237.56; other lines, $62.75; total, $300.31. Free business, $52.14.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

A daily sunset observation is forwarded by telegraph.

The station was inspected in May and found in satisfactory condition.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

COLEMAN CITY, TEXAS.

[*Official number*, 151.]

Latitude	31° 55′
Longitude	99° 10′
Elevation of barometer above mean sea-level	Not determined.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	28.207
Mean annual rainfall for two years	23.69 inches.

Established April 1, 1877; observations commenced July 1, 1877.

Office, U. S. M. T. building, southeast corner Commercial avenue and Live Oak street.

Private G. S. Livingston has been in charge during the year.

This station maintains in repair 53 miles of wire.

Receipts.—This line, $271.69; other lines, $392.90; total, $664.59. Free business, $29.39.

The station has a complete set of meteorological and combination telegraph instruments and repair tools.

A daily sunset observation is forwarded by telegraph.

The station was inspected in March and found in excellent condition.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

CONCHO (FORT CONCHO), TEXAS.

[*Official number*, 152.]

Latitude	31° 22
Longitude	100° 20′
Elevation of barometer above mean sea-level	1,754.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	28.134
Mean annual rainfall for two years	21.60 inches.

Established October 10, 1875; observations commenced March 19, 1877.

Office, near post trader's store.

Private E. G. Prince was in charge until April 14, when he was relieved by Private A. J. Henry. Two assistants have been ordered to, and two relieved from, this station.

This station maintains in repair 92 miles of wire.

Receipts.—This line, $918.96; other lines, $575.60; total, $1,494.56. Free business, $840.06.

The station has a complete set of meteorological and telegraph instruments and repair tools.

A daily sunset observation is forwarded by telegraph.

The station was inspected in March.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

DAVIS (FORT DAVIS), TEXAS.

[*Official number*, 163.]

Latitude	30° 30′
Longitude	103° 45′
Elevation of barometer above mean sea-level	4,918.00 feet. (?)
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	25.209
Mean annual rainfall for one year	21.41 inches.

Established December 24, 1877; observations commenced April 3, 1878.

Office, adobé building, just outside of reservation.

Private A. Coleman was in charge until October 25; Private F. Belford from October 25 until January 1, and Private R. J. Somers from February 1 to date. A civilian messenger is employed at this station. An assistant, civilian, was on duty from November 27 to February 19.

This station maintains in repair 175 miles of wire.

Receipts.—This line, $407.83; other lines, $131.92; total, $539.75. Free business, $607.05.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station was inspected in April and found in fair condition.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

DECATUR, TEXAS.

[*Official number*, 153.]

Latitude	33° 10′
Longitude	97° 30′
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	28.716
Mean annual rainfall for two years	26.81 inches.

Established February 1, 1876; observations commenced April 1, 1877.

Civilian Operator W. W. Holmes was in charge until May 17, when he was relieved by Private E. A. Thomas. There is no assistant at this station.

This station maintains in repair 37 miles of wire.

Receipts.—This line, $242.52; other lines, $330.83; total, $573.35. Free business, $27.01.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

A daily sunset observation is forwarded by telegraph.

The station was inspected in March and not found in a satisfactory condition. A change in the observer was subsequently made.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

DENISON, TEXAS.

[*Official number*, 154.]

Latitude	33° 50′
Longitude	96° 40′
Elevation of barometer above mean sea-level	767.40 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for four years	29.211
Mean annual barometer (reduced to sea-level) for two years	29.984
Mean annual temperature for two years	64° 3
Mean annual rainfall for four years	39.08 inches.

Established December 16, 1874; observations commenced September 1, 1875.

Office, Munson's Building, southwest corner of Gandy street and Rusk avenue.

At this station are the headquarters of the officer in charge.

Sergeant Herrmann Frey was in charge of the meteorological work until May 6, when he was relieved by Sergeant Will Stromberger, who had been acting as chief clerk. Sergeant W. T. Blythe is in charge of the operating room. There are two assistants at this station.

This station maintains in repair 40 miles of wire.

Receipts.—This line, $1,592.05. Free business, $247.35.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Eight full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station was inspected in March and found in excellent condition.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

EAGLE PASS, TEXAS.

[*Official number*, 155.]

Latitude	28° 40′
Longitude	100° 15′
Elevation of barometer above mean sea-level	710.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	29.223
Mean annual rainfall for two years	22.16 inches.

Established January 19, 1875; observations commenced November 26, 1875.

Office, Northeast corner Jefferson and Ford streets.

Private F. Belford was in charge until October 25, when he was relieved by Private A. Coleman. A civilian messenger is on duty at this station.

This station maintains in repair 44 miles of wire.

Receipts.—This line, $891.12; other lines, $307.27; total, $1,198.39. Free business, $758.51.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station was inspected in May and found in fair condition.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

EAGLE SPRINGS, TEXAS.

Established April 1, 1879; discontinued November 27, 1879.

Civilian operator E. M. Dunbar was in charge until November 27, when the station was discontinued.

EDINBURG, TEXAS.

[*Official number*, 156.]

Latitude	26° 3′
Longitude	98° 3′
Mean annual rainfall for one year	21.37 inches.

Established September 12, 1875; observations commenced May 27, 1877.

Civilian operator W. H. Taylor has been in charge during the year. He has no assistant.

This station maintains in repair 36 miles of wire.

Receipts.—This line, $126.21; other lines, $37.65; total, $163.86. Free business, $111.66.

The station is supplied with a complete set of telegraph instruments and repair tools, and a partial set of meteorological instruments.

A daily sunset observation is forwarded by telegraph.

The station was inspected in April and found in good condition.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

ELLIOTT (FORT ELLIOTT), TEXAS.

Latitude	35° 31′
Longitude	100° 27′

Established November 29, 1879.

Office, southeast corner of post.

Corporal W. J. Cundall has been in charge of station since its establishment. A civilian messenger is on duty here.

The station maintains in repair 42 miles of wire.

Receipts.—This line, $118.06; other lines, $157.12; total, $275.18. Free business, $196.96.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

A daily sunset observation is forwarded by telegraph.

The station has not been inspected.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	14
Total	14

FREDERICKSBURG, TEXAS.

[*Official number*, 157.]

Latitude	30° 20′
Longitude	98° 40′
Elevation of barometer above mean sea-level	1,614.00 feet.
Mean annual rainfall for two years	20.52 inches.

Established March 14, 1876; observations commenced April 1, 1877.

Office, Nimitz Hotel, Main street.

Private C. F. Tansill has been in charge during the year. He has no assistant.

This station maintains in repair 41 miles of wire.

Receipts.—This line, $283.76; other lines, $188.11; total, $471.87. Free business, $49.41.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

A daily sunset observation is forwarded by telegraph.

The station was inspected in May.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

GRAHAM, TEXAS.

[*Official number*, 183.]

Latitude	33° 01′
Longitude	98° 27′

Established June 16, 1876; observations commenced March 4, 1877.

Private M. McCarty was in charge until July 30; Civilian Floyd Shock, from July 30, 1879, to February 23, 1880; Civilian R. L. Moore, from May 1 to June 3, and Civilian John L. Janes, from June 3 to date. Station was temporarily closed from February 23 to May 1.

This station maintains in repair 30 miles of wire.

Receipts.—This line, $283.76; other lines, $188.11; total, $471.87. Free business, $19.14.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

A daily sunset observation is forwarded by telegraph.

The station was inspected in January and in March.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	14
Total	14

GRIERSON SPRINGS, TEXAS.

Established July 9, 1879.

Corporal J. M. Kistler was in charge until August 20; Private P. M. Wilson, from August 20 to October 2; Private E. C. Imlay, from October 2 to April 22, and Civilian E. F. J. McCarthy, from April 22 to date.

This station maintains in repair 64 miles of wire.

Receipts.—This line, $116.35; other lines, $6.27; total, $122.62. Free business, $95.19.

The station is supplied with a partial set of telegraph instruments and repair tools.

No meteorological observations are taken.

The station has not been inspected during the year.

GRIFFIN (FORT GRIFFIN), TEXAS.

[*Official number*, 158.]

Latitude	32° 53′
Longitude	99° 21′
Elevation of barometer above mean sea-level	1,290.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	28.722
Mean annual rainfall for two years	24.35 inches.

Established July 1, 1875; observations commenced January 22, 1876.

Office, southwest corner of Griffin avenue and Boundary.

Private J. T. Bradley has been in charge during the year.

This station maintains in repair 41 miles of wire.

Receipts.—This line, $361.47; other lines, $459.73; total, $821.20. Free business, $313.05.

The station is supplied with a complete set of meteorological and combination telegraph instruments and repair tools.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station was inspected in January and in March. Although the station was found in fair condition the observer was reduced to the ranks for neglect of duty.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

HENRIETTA, TEXAS.

[*Official number*, 196.]

Latitude	33° 42′
Longitude	98° 00′

Established February 1, 1877; observations commenced February 13, 1878; discontinued May 25, 1878; recommenced February 9, 1879.

Office, northwest corner of the public square.

Private John McCann was in charge until March 10, when he was relieved by Private H. M. Woodward and ordered to Denison for discharge. A civilian operator was on duty at this station from March 10 to 28.

This station maintains in repair 44 miles of wire.

Receipts.—This line, $300.67; other lines, $313.65; total, $614.32. Free business, $37.65.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

A daily sunset observation is forwarded by telegraph.

The station has not been inspected during the year.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

JACKSBOROUGH, TEXAS.

[*Official number*, 159.]

Latitude	33° 10′
Longitude	98° 00′
Elevation of barometer above mean sea-level	1,119.23 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	28. 865
Mean annual rainfall for two years	27.57 inches.

Established May 8, 1875; observations commenced November 8, 1876.

Office, building on northwest corner of block west of the square.

Civilian J. T. Marshall was in charge during the year. An assistant was on duty from September 29 until October 30. A civilian assistant has been on duty from June 14 to date.

This station maintains in repair 58 miles of wire.

Receipts.—This line, $217.89; other lines, $234.06; total, $451.95. Free business, $128.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

A daily sunset observation is forwarded by telegraph.

The station was inspected in March and found in fair condition.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	22
Total	22

LAREDO, TEXAS.

[*Official number*, 160.]

Latitude	27° 32′
Longitude	99° 26′
Elevation of barometer above mean sea-level	400.98 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	29.555
Mean annual rainfall for three years	23.46 inches.

Established December 16, 1875; observations commenced August 6, 1878.

Office, southeast corner of Market Plaza.

Private H. Marsh was in charge until May 6, when he was relieved by Private F. Belford. A civilian messenger and operator and repair man are on duty at this station.

This station maintains in repair 85 miles of wire.

Receipts.—This line, $1,413.39; other lines, $1,056.02; total, $2,469.41. Free business, $243.25.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

A daily sunset observation is forwarded by telegraph.

The station was inspected in April and not found in satisfactory condition. A change in the observer was subsequently made.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

LIVE OAK, TEXAS.

[*Official number*, 228.]

Re-established July 8, 1879, as a repair station.

Private J. A. Perkins was in charge until July 29, when he was relieved by Civilian Operator J. W. Yates.

This station maintains in repair 52 miles of wire.

Receipts.—This line, $23.54; other lines, $1.62; total, $25.16.

No meteorological observations are taken.

The station has a complete set of telegraph instruments and repair tools.

It has not been inspected.

MASON, TEXAS.

[*Official number*, 202.]

Latitude	30° 42′
Longitude	99° 2′
Elevation of barometer above mean sea-level	1,620.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	28.345
Mean annual rainfall for two years	19.08 inches.

Established February 7, 1876; observations commenced February 8, 1876.

Office, Lockhart Building, northwest corner Public Square.

Private R. J. Somers was in charge until January 13; Private F. Belford, from January 13 until May 6, when he was relieved by Sergeant H. Frey.

This station maintains in repair 55 miles of wire.

Receipts.—This line, $147.21; other lines, $102.39; total, $249.60. Free business, $252.57.

The station is supplied with a complete set of meteorological and combination telegraph instruments and repair tools.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station was inspected in June and found in good condition.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

McKAVETT (FORT McKAVETT), TEXAS.

[*Official number*, 161.]

Latitude	30° 48′
Longitude	99° 58′
Elevation of barometer above mean sea-level	1,217.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	27.739
Mean annual rainfall for two years	19.26 inches.

Established October 19, 1875; observations commenced January 22, 1876.

Office, northwest corner Headquarters' Building.

Corporal J. C. Rickli was in charge until July 30; Private M. McCarty, from July 30 to August 29; Private E. C. Imlay, from August 29 to October 2, and Private P. M. Wilson from October 2 to date. He has no assistant. Corporal J. M. Kistler was on duty as repair man from August 20 to December.

This station maintains in repair 54 miles of wire.

Receipts.—This line, $183.79; other lines, $135.40; total, $319.19. Free business, $124.72.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

A daily sunset observation is forwarded by telegraph.

The station was inspected in June and found in fair condition.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1780	24
Total	24

PILOT POINT, TEXAS.

[*Official number*, 162.]

Latitude	33° 20′
Longitude	96° 50′
Elevation of barometer above mean sea-level	800.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	29.220
Mean annual rainfall for one year	6.29 inches.

Established June 18, 1875; observations commenced August 5, 1877. Office, Wilson's Block, northwest corner Public Square.

Private E. F. Reeves was in charge until April 22, when he was relieved by Private E. C. Imlay. There is no assistant at this station.

This station maintains in repair 41 miles of wire.

Receipts.—This line, $108.93; other lines, $168.70; total, $277.63. Free business, $26.41.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

A daily sunset observation is forwarded by telegraph.

The station was inspected in March and found in bad condition. Private Reeves was subsequently discharged the service.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

RENO (FORT RENO), INDIAN TERRITORY.

Latitude	35° 33′
Longitude	98° 1′

Established August 31, 1879.

Civilian A. Shillinglaw was in charge until January 29; Private J. P. Sherry from January 29 to March 5, and Sergeant P. J. Huneke from March 5 to date.

This station maintains in repair 43 miles of wire.

Receipts.—This line, $110.55; other lines, $307.93; total, $418.48. Free business, $180.23.

The station has a complete set of telegraph instruments and repair tools.

No meteorological observations are taken.

The station was inspected in November.

RIO GRANDE CITY, TEXAS.

[*Official number*, 164.]

Latitude	26° 22′
Longitude	98° 45′
Elevation of barometer above mean sea-level	Not determined.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	29.790
Mean annual rainfall for two years	25.32 inches.

Established May 28, 1875; observations commenced March 12, 1876. Office, near headquarters Fort Ringgold.

Corporal H. C. Wineland has been in charge during the year. A civilian messenger has been on duty during the year. A repair man was on duty until May 1. Mr. W. H. Taylor was temporarily on duty from June 12 to June 19.

This station maintains in repair 76 miles of wire.

Receipts.—This line, $558.48; other lines, $469.70; total, $1,028.18. Free business, $455.30.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

A daily sunset observation is forwarded by telegraph.

The station was inspected in April and found in good condition.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

SAN ANTONIO, TEXAS.

[*Official number*, 197.]

Latitude	29° 28′
Longitude	98° 22′
Elevation of barometer above mean sea-level	676.73 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	29.331
Mean annual barometer (reduced to sea-level) for one year	29.865
Mean annual rainfall for two years	31.15 inches.

Established September 22, 1875; observations commenced August 13, 1876.

Office, Yturri street, between Main and Market streets.

Private O. S. Golladay was in charge until May 17, when he was placed in arrest. Private A. J. Henry was placed in charge of the station. A civilian messenger has been on duty during the year. There is one assistant at this station.

This station maintains in repair 29 miles of wire.

Receipts.—This line, $3,390.89; other lines, $107.57; total, $3,498.46. Free business, $1,754.37.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Eight full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station was inspected in May and found in an unsatisfactory condition, and a change in the observer was made.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	1,519
Number of Forms 22 issued during the year ending June 30, 1880	24
Total	1,543

SANTA MARIA, TEXAS.

[*Official number*, 221.]

Established April 25, 1878, as a repair station.

Private J. C. Galloway has been in charge during the year. He has no assistant.

This station maintains in repair 27 miles of wire.

Receipts.—This line, $227.98; other lines, $42.18; total, $270.16. Free business, $105.04.

The station has a set of telegraph instruments and repair tools.

No meteorological observations are taken.

A daily sunset observation is forwarded by telegraph.

The station has not been inspected during the year.

SILL (FORT SILL), INDIAN TERRITORY.

[*Official number*, 165.]

Latitude	34° 40′
Longitude	98° 30′
Elevation of barometer above mean sea-level	1,190.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for four years	28.782
Mean annual rainfall for two years	29.38 inches.

Established June 23, 1875; observations commenced September 9, 1875.

Office, near southeast corner of the post and south of quartermaster's office.

Sergeant John McGlone has been in charge during the year. He has no assistant.

This station maintains in repair 60 miles of wire.

Receipts.—This line, $143.36; other lines, $256.44; total, $399.80. Free business, $423.34.

This station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station has not been inspected.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

STOCKTON (FORT STOCKTON), TEXAS.

[*Official number*, 166.]

Latitude	30° 50′
Longitude	102° 50′
Elevation of barometer above mean sea-level	3,063.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	26.974
Mean annual rainfall for two years	8.80 inches.

Established February 26, 1876; observations commenced November 1, 1876.

Office, one-half mile south of post.

Private J. H. Henry was in charge until April 1, 1880, when he was relieved by Private M. McCarty.

This station maintains in repair 69 miles of wire.

Receipts.—This line, $627.35; other lines, $149.45; total, $776.80. Free business, $781.86.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station was inspected in April and found in fair condition.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

SUPPLY (CAMP SUPPLY), INDIAN TERRITORY.

Latitude	36° 33′
Longitude	99° 32′

Established October 7, 1879.

Private J. P. Sherry was in charge until October 25, civilian C. W. Almy from October 25 to May 6, and Private Harry Marsh from May 6 to date.

This station maintains in repair 71 miles of wire.

Receipts.—This line, $43.91; other lines, $94.99; total, $138.90. Free business, $72.10.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

The station was inspected in December, 1879.

UVALDE, TEXAS.

[*Official number*, 167.]

Latitude	29° 13′
Longitude	99° 40′
Elevation of barometer above mean sea-level	891.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	29.069
Mean annual rainfall for two years	21.58 inches.

Established September 6, 1875; observations commenced May 20, 1876.

Office, a building facing northeast by east.

Private W. Norrington is in charge. He has no assistant. Corporal T. Cleary was on duty from April 20 to June 4.

This station maintains in repair 50 miles of wire.

Receipts.—This line, $287.55; other lines, $85.63; total, $373.18. Free business, $58.48.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

A daily sunset observation is forwarded by telegraph.

The station was inspected in May and found in fair condition.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

WICHITA AGENCY, INDIAN TERRITORY.

Latitude	35° 7′
Longitude	98° 12′

Established December 22, 1879.

Private James P. Sherry has been in charge since establishment. He has no assistant.

This station maintains in repair 34 miles of wire.

Receipts.—This line, $36,66; other lines, $45.66; total, $82.32. Free business, $17.09.

The station has a complete set of telegraph instruments and repair tools.

No meteorological observations are taken.

NEW MEXICO DIVISION.

Table showing stations on the United States military telegraph lines, New Mexico division, from which reports have been received during the year ending June 30, 1880.

Name of station.	Reports commenced.	Reports discontinued.	Number of reports by telegraph, (daily).	Character of reports received by mail on Form 4, (weekly).
Albuquerque, N. Mex	(*)	....	1	
Bernalillo, N. Mex	June 1, 1879	May 1, 1880	....	
El Paso, Tex	(*)	....	4	Complete observations taken four times a day.
Fort Bayard, N. Mex	(*)	....	1	
La Mesilla, N. Mex	(*)	....	4	Complete observations taken four times a day.
Las Cruces, N. Mex	(*)	June 20, 1880	....	
Los Lunas, N. Mex	(*)	....	1	
Santa Fé, N. Mex	(*)	....	4	Complete observations taken seven times a day.
Shakespeare, N. Mex	Nov. 20, 1879	....	1	
Silver City, N. Mex	(*)	....	4	Complete observations taken four times a day.
Socorro, N. Mex	July 1, 1879	....	4	Do.

* Reporting at date of last annual report, June 30, 1879.

Report of stations on the United States military telegraph line, New Mexico division, compiled from the annual report of Lieut. James Allen, Third United States Cavalry, acting signal officer in charge, and from data on file in the office of the chief signal officer:

ALBUQUERQUE, NEW MEXICO.

[*Official number*, 196.]

Latitude	35° 4′
Longitude	106° 40′

Established July 1, 1876.

Private R. G. Linthicum was in charge until September 11; Private H. E. Higgins, from September 11 to October 5; civilian operator, William Baber, from October 5 to November 20; civilian operator, W. M. Smith, from November 20 to June 25, and civilian operator, E. E. Simpson, from June 25 to date. Civilian operator, Robert Reeder, was assistant operator from May 1 to June 18, 1880.

Number of messages during the year.—Sent paid, 3,513; received paid, 2,905; sent free, 798; received free, 528; total, 7,744.

Receipts.—This line, $1,156.30; other lines, $1,040.70; sundry, $8.40; total, $2,205.40.

The station is supplied with a complete set of telegraph instruments and repair tools, and certain meteorological instruments.

No meteorological observations are taken.

A daily sunset observation is forwarded by telegraph.

The repair section of this station extends to Algodones, 24 miles north, and to Isleta, 12 miles south.

ALEMAN, NEW MEXICO.

Latitude	33° 1′
Longitude	107° 00,

Established May 1, 1879, as a repair station. It is 52 miles north of La Mesilla, of which it is a branch office.

Private John Haines, Company E, Fifteenth Infantry, is in charge.

The station is supplied with a complete set of telegraph instruments and repair tools.

All business transacted is credited to, or charged against, the La Mesilla office.

In case of trouble on the line this station is found useful. It has also been of great benefit during the year's campaign against hostile Indians. The two principal Indian trails across the Jornada del Muerto are situated, respectively, 3 miles below and 7 miles above this station. Several times during the year the crossing of hostile Indians has been reported to district headquarters within two hours thereafter, and for some time during the year the station was used as headquarters by the district commander.

The repair section extends to Round Mountain, 25 miles north, and to Leasburg, 31½ miles south.

BAYARD (FORT BAYARD), NEW MEXICO.

[*Official number*, 170.]

Latitude	32° 46′
Longitude	108° 10′

Established February 16, 1876.

Civilian operator, Charles V. Hugo, was in charge until November 1; Private H. E. Higgins, from November 1 to February 1, and civilian operator, T. A. Donahoe, from February 1 to date.

Number of messages during the year.—Sent paid, 568; received paid, 566; sent free, 1,585; received free, 1,378; total, 4,097.

Receipts.—This line, $162.51; other lines, $91.01; sundry, $4.01; total, $257.53.

The station is supplied with a complete set of telegraph instruments and repair tools.

Thre are no meteorological instruments at the station.

A daily sunset observation is forwarded by telegraph.

For purposes of repair this station is attached to Silver City.

The office is in the headquarters building. But little commercial business is transacted. Fort Bayard, being the most important military post on the line the office, is maintained for military purposes.

It has been inspected once during the year.

BELEN, NEW MEXICO.

Latitude	35° 1′
Longitude	106° 45′

Established June 1, 1876.

This is a branch office of Los Lunas, and is 10 miles south of that place.

It is under the charge of Mr. John Becker, who receives no compensation.

All business transacted is credited to, or charged against, the Los Lunas office.

In many cases this office has been found of benefit.

BERNALILLO, NEW MEXICO.

Latitude	35° 21′
Longitude	106° 31′

Established June 1, 1879; ordered closed May 2, 1880.

This office was supported until May 1, 1880, by the citizens of Bernalillo, but owing to the establishment of a Western Union telegraph office at this place, and the refusal of the citizens to contribute any longer to the support of the military office, it was closed on the above date.

CRAIG (FORT CRAIG), NEW MEXICO.

[*Official number*, 180.]

Latitude	33° 42′
Longitude	107° 8′

Re-established as a repair station November 1, 1879.

Private W. D. McChesney is in charge. All business transacted is credited to, or charged against, the Socorro office.

This station, which has been closed since June 27, 1879, was re-opened for the purpose of facilitating repairs and for the accommodation of troops operating against hostile Indians in the southern portion of the Territory. It has been of great benefit in these respects. It was inspected in May.

The repair section extends to Socorro, 32 miles north, and to Round Mountain, 24 miles south.

CUMMINGS (FORT CUMMINGS), NEW MEXICO.

[*Official number*, 214.]

Latitude	32° 18′
Longitude	107° 32′

Re-established March 1, 1879, as a repair station.

Private John Cronin, Company E, Fifteenth Infantry, is in charge.

This is a branch office of Silver City, 51 miles south, and all business transacted is credited to, or charged against, that office.

In the year's campaign against hostile Indians the station has been invaluable to the district commander and to officers commanding troops in the field. It has been the headquarters of a force of nearly one thousand troops, actively engaged in field operations, whose movements have been directed mostly by telegraph from Santa Fé via Fort Cummings.

The most important trails used by hostile Apaches, from the United States to Mexico, are within a few miles of this station, and several times the approach and passage of Indians on these trails have been promptly communicated to district headquarters, to troops in the field, and to citizens and settlers, enabling them to take prompt action whereby many lives and much property have been saved.

The repair section extends to Slocum's Ranch, 31 miles southeast, and to Hot Springs, 24 miles northwest.

EL PASO, TEXAS.

[*Official number*, 195.]

Latitude	31° 46′
Longitude	106° 32′
Elevation of barometer above mean sea-level	3,956.00 feet.
Mean annual rainfall for one year	6.63 inches.

Established November 5, 1877; observations commenced April 13, 1878.

Office, north side Santa Fé street.

Sergeant S. W. Naylor was in charge until August 1; Private W. D. McChesney, from August 1 to May 20; Private J. H. Fox from May 20 to June 20, and Private W. T. Miles, from June 20 to date. Private Joseph H. Fox is assistant.

Number of messages during the year.—Sent paid, 1,094; received paid, 900; sent free, 1,100; received free, 774; total, 3,868.

Receipts.—This line, $558.92; other lines, $601.55; sundry, $1.60; total, $1,162.07.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station was inspected in April.

This office is of much importance in connection with Indian troubles and frontier matters. It is within one mile of Fort Bliss, a four-company post now being built.

The repair section extends to Cottonwood's Ranche, 30 miles northwest, and to Old Fort Quitman, 85 miles southeast.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

LA MESILLA, NEW MEXICO.

[*Official number*, 181.]

Latitude	32° 17′
Longitude	106° 48′
Elevation of barometer above mean sea-level	4,124.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	26.070
Mean annual barometer (reduced to sea-level) for the year ending June 30, 1880	30.217
Mean annual rainfall for two years	7.68 inches.

Established July 16, 1876; observations commenced May 25, 1877.

Office, in Lemon's Building (adobé).

Private W. T. Miles was in charge until July 30; Sergeant S. W. Naylor, from July 30 to August 29, and Sergeant N. D. Lane, from August 29 to date. There is one assistant at this station.

Number of messages during the year.—Sent paid, 1,385; received paid, 1,432; sent free, 1,894; received free, 1,162; total, 5,873.

Receipts.—This line, $369.43; other lines, $211.83; sundry, $6.21; total, $587.47.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The office is commodious and conveniently situated. Signals are consolidated here from the California, New Mexico, and Texas divisions, and sent to Denison. Next to Santa Fé this is the most important station on the line. It was inspected in May.

The repair section extends to Leasburg, 22 miles north; to Mason's Ranche, 24 miles west, and to Cottonwood's, 22 miles southeast.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

LAS CRUCES, NEW MEXICO.

[*Official number*, 216.]

Latitude	32° 17′
Longitude	106° 46′

Established October 10, 1877.

The services of the operator being greatly needed elsewhere this office was closed June 20.

LOS LUNAS, NEW MEXICO.

[*Official number*, 217.]

Latitude	34° 53′
Longitude	106° 45′

Established December 20, 1876.

Civilian operator, W. M. Smith, was in charge until December 25; civilian operator, E. E. Simpson, from December 25 to June 25, and Private W. A. Merchant, from June 25 to date.

Number of messages during the year.—Sent paid, 1,640; received paid, 1,580; sent free, 618; received free, 253; total, 4,091.

Receipts.—This line, $604.46; other lines, $284.72; sundry, $6.30; total, $895.48.

The station is supplied with a complete set of telegraph instruments and repair tools.

There are no meteorological instruments at the station and no observations are taken.

A daily sunset report is forwarded by telegraph.

A branch office is in operation at Belen, 10 miles south. This is maintained without cost to the line.

During the past year the office has been supported by line receipts and contributions from citizens. The opening of a Western Union telegraph office at this point renders the establishment of a station here no longer necessary, and this one will probably be discontinued.

It was inspected in May.

SANTA FÉ, NEW MEXICO.

[*Official number*, 69.]

Latitude	35° 41′
Longitude	106° 10′
Elevation of barometer above mean sea-level	6,970.37 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for seven years	23.262
Mean annual barometer (reduced to sea-level) for eight years	29.800
Mean annual temperature for eight years	48°.7
Mean annual rainfall for eight years	14.70 inches.

Established November 20, 1871.

Office, Johnson's Building, east side of Public Plaza.

Sergeant Max Frost has remained in charge of the meteorological and clerical work of the station. Private E. C. Guthrie is assistant; Mr. William T. Adams, manager; Mr. J. L. Vreeland, clerk. Three assistants have been ordered to, and three relieved from, this station during the year.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Eight full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

Number of messages during the year.—Sent paid, 5,643; received paid, 6,312; sent free, 4,481; received free, 4,141; total, 20,577.

Receipts.—This line, $1,814.05; other lines, $7.78; sundry, $8; total, $1,829.83.

The office was inspected in May.

Extracts from the observer's semi-annual report:

> The press of Santa Fé, and in fact of the entire Territory, is very friendly to the service, and frequently very flattering and complimentary articles are published on both branches of the service—meteorological and telegraphic. Information on the climate of Santa Fé and the Territory has been furnished to a considerable extent to residents of the Territory.
>
> The reputation and general standing of the service among all classes of citizens of Santa Fé is excellent.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

SHAKSPEARE, NEW MEXICO.

Established November 20, 1879.

Private Oscar D. Stewart was in charge from November 20 until March 1; civilian operator, A. E. Lindsay, from March 1 to June 20, and civilian operator, Robert Reeder, from June 20 to date.

Number of messages during the year.—Sent paid, 1,065; received paid, 694; sent free, 437; received free, 297; total, 2, 493.

Receipts.—This line, $346.83; other lines, $385.63; total, $732.46.

The station is supplied with a complete set of telegraph instruments and repair tools.

There are no meteorological instruments at the station and no observations are taken.

A daily sunset observation is forwarded by telegraph.

It has not been inspected.

SILVER CITY, NEW MEXICO.

[*Official number*, 194.]

Latitude	32° 48′
Longitude	108° 15′
Elevation of barometer above mean sea-level	5,796.00 feet.

Established May 15, 1878; observations commenced May 17, 1878.

Office, corner Yankie and Main streets.

Private Martin Hoover was in charge until February 1, when he was relieved by Private J. G. Frankenberg. There are two additional enlisted men on duty, one as assistant, the other as repair man. One assistant has been ordered to, and one relieved from, this station during the year.

Number of messages during the year.—Sent paid, 4,332; received paid, 3,810; sent free, 2,060; received free, 964; total, 11,166.

Receipts.—This line, $1,563.03; other lines, $1,572.87; sundry, $180.00; total, $3,315.90.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The cash receipts at this office are very large and are a great aid to the line.

The station was inspected in May.

The repair section extends to Hot Springs, 31 miles southeast, and to Knight's Ranche, 30 miles southwest.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	14
Total	14

SOCORRO, NEW MEXICO.

[*Official number*, 218.]

Latitude	34° 5′
Longitude	106° 55′
Elevation of barometer above mean sea-level	4,564.83 feet.

Established January 1, 1877.

Office, in the Socorro Hotel.

Sergeant N. D. Lane was in charge until September 14, when he was relieved by Private F. M. Tilghman.

Number of messages during the year.—Sent paid, 1,381; received paid, 1,114; sent free, 2,171; received free, 1,004; total, 5,670.

Receipts.—This line, $412.70; other lines, $256.41; sundry, $3.80; total, $672.91.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station was inspected in May.

The repair section extends to Fort Craig, 32 miles south, and to Sabinal, 22 miles north.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	22
Total	22

ARIZONA DIVISION.

Table showing stations on the United States military telegraph line in Arizona and California from which reports have been received during the year ending June 30, 1880.

Name of station.	Reports commenced.	Reports discontinued.	Number of reports by telegraph, (daily).	Character of reports received by mail on form 4, (weekly).
Burkes, Ariz	(*)		0	Observations of thermometer, hygrometer, direction of wind and state of weather, clouds, and rainfall taken three times a day.
Campo, Cal	(*)		1	Complete observations taken four times a day.
Camp Thomas, Ariz	April 1, 1880		1	Do
Fort Apache, Ariz	(*)		4	Do
Fort Grant, Ariz	(*)		4	Do
Fort Verde, Ariz	(*)		1	Complete observations, except barometric, taken four times a day.
Florence, Ariz	(*)		1	Complete observations taken four times a day.
Phœnix, Ariz	(*)		1	Do
Prescott, Ariz	(*)		4	Complete observations taken eight times a day.
San Diego, Cal	(*)		4	Do
Tucson, Ariz	(*)		4	Complete observations taken four times a day.
Wickenburg, Ariz	(*)		1	Complete observations, except barometric, taken four times a day.
Yuma, Ariz	(*)		4	Complete observations taken four times a day.

* Reporting at date of last annual report, June 30, 1879.

Report of stations on the United States military telegraph line, division of Arizona and California, compiled from the annual report of Lieut. Charles A. Booth, First United States Infantry, acting signal officer in charge, and from data on file in the office of the Chief Signal Officer.

APACHE (FORT APACHE), ARIZONA TERRITORY.

[*Official number*, 192.]

Latitude	33° 47′ 18″
Longitude	109° 57′ 52″
Elevation of barometer above mean sea-level	5,004.46 (?) feet.
Mean rainfall for the year ending June 30, 1880	19.30 inches.

Established October 9, 1877; observations commenced June 28, 1878.

Private Will C. Barnes, Signal Corps, U. S. A., is in charge. Private John J. Falvey was in charge until February 19, 1880, when he was relieved by Private Barnes. There is no assistant at this station.

Number of messages during the year.—Sent paid, 270; sent collect, 78; received paid, 240; received collect, 86; sent D. H., 964; received D. H., 1,028; total, 2,666. Free business, $684.38.

Receipts.—This line, $166.06, other lines, $56.00; total, $222.06.

This station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station was inspected on January 1, 1880, by First Lieut. J. P. Story, acting signal officer.

Extracts from the observer's semi-annual reports:

On the 20th day of April the instruments were removed from the building which had been used as an office since November 21, 1878, to the present location, which is better in many respects.

On the 9th of April, Private Falvey, while waiting orders here, accompanied Captain Kramer's command, Company E, Sixth Cavalry, as a scout to intercept Victoria and his band of hostiles at Ash Creek, about 40 miles from here. He took with him a key and relay, and each night, as the trail lay near the line, cut in and placed Captain Kramer in direct telegraphic communication with headquarters. On arrival at Ash Creek he opened a station in a tent, about a quarter of a mile from their camp, and for two weeks transmitted many important messages over the wires.

The military telegraph line is of great benefit to those in the post and the scattered settlements to the north and east of us. Parties frequently come in from Saint Johns and other places over a hundred miles from here to place themselves in communication with the telegraphic stations of the world.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

APACHE PASS (FORT BOWIE), ARIZONA TERRITORY.

[*Official number*, 211.]

Latitude	32° 8′
Longitude	109° 30′

Established May 4, 1877.

Office is in a one-story adobé building.

Sergeant William Baber was in charge of this station until September 28, 1879; Private J. M. Burlew, from September 28, 1879, to June 12, 1880, and Private C. M. Jameson, from June 12 to date.

Number of messages during the year.—Sent paid, 518; sent collect, 112; received paid, 428; received collect, 133; sent D. H., 964; received D. H., 1,028; total, 3,183. Free business, $343.42.

Receipts.—This line, $203.02; other lines, $119.65; total, $322.67.

This station is supplied with a partial set of meteorological instruments, and a complete set of telegraph instruments and repair tools. The meteorological instruments have not yet been put in position as the office building is much in need of repair. When these repairs are made the instruments will be placed in position and observations commenced.

The station has been inspected twice during the year—by Lieut. C. A. Booth, officer in charge, on October 15, 1879, and by Lieut. J. P. Story, acting signal officer, on January 8, 1880.

Extracts from the observer's semi-annual report:

During the Indian troubles the line is used to great advantage. All orders for movements of troops are transmitted by telegraph. The line is also used by the citizens to their advantage and fully appreciated by them.

BURKES, ARIZONA TERRITORY.

[*Official number*, 911.]

Latitude	32° 55′
Longitude	113° 20′
Mean annual rainfall for two years	4.77 inches.

Established and observations commenced December 5, 1877.

Office is in an adobé building.

Private E. I. Falconer was in charge until July 31; Private Frank Ridgway, from July 31 to February 23, 1880; Corporal Edmund Davis, from February 23 to April 6, and Private W. J. Croley, Company I, Sixth Cavalry, from April 6 to date. There is no assistant at this station.

Number of messages during the year.—Sent paid, 153; sent collect, 78; received paid, 147; received collect, 44; sent D. H., 304; received D. H., 21; total, 747. Free business, $69.83.

Receipts.—This line, $33.45; other lines, $0.78; total, $34.23.

The station is supplied with a partial set of meteorological instruments and a complete set of telegraph instruments and repair tools.

Observations of the hygrometer, thermometer, direction of wind and state of weather, clouds and rainfall are taken tri-daily and forwarded by mail, weekly. Sunset observations were reported by telegraph until April 5.

The most important duty at this station is to keep this section of the line in repair.

The station was inspected December 3, 1879, by First Lieut. J. P. Story, acting signal officer.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

CAMPO, CALIFORNIA.

[*Official number*, 171.]

Latitude	32° 22′
Longitude	116° 8′
Elevation of barometer above mean sea-level	2,527.12 (?) feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	27.385
Mean annual rainfall for two years	14.53 inches,

Established January, 1874; observations commenced September 28, 1875.

Office, corner Grant avenue and Blaine street.

Sergeant W. U. Simons was in charge until February 2, 1880, when he was relieved by Private Thomas S. Collins, who still remains. There is no assistant at this station.

Number of messages during the year.—Sent paid, 63; sent collect, 25; received paid, 60; received collect, 21; sent D. H., 332; received D. H., 6; total, 507. Free business, $89.77.

Receipts.—This line, $26.51; other lines, $7.80; total, $34.31.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Meteorological observations are taken four times a day and forwarded to this office by mail weekly. Sunset observations are forwarded daily by telegraph.

The station was inspected August 7, 1879, by Lieut. C. A. Booth, officer in charge, and by Lieut. J. P. Story, acting signal officer, on November 26, 1879. It is located near the boundary line, and the telegraph affords quick means of applying for assistance when the place is threatened by border ruffians, which is not infrequent, and saves the government the expense of keeping a garrison for the protection of the farmers and citizens.

Extracts from the observer's semi-annual report:

> The only interest taken in the service at this point is in regard to the telegraph office and the facilities it affords for communication with the civil and military author-

ities, in case of an incursion of bandits or Indians across the line of the United States and Mexico, enabling the business men here to summon aid in case the raiding party is too large to be repulsed by the force at hand. The fact of speedy means of communication gives a feeling of security that would not prevail were the telegraphic facilties removed, and the only regret of the settlers is that there is not more commercial business done here to recompense the government for the great benefit the community derives from the line.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

CORRILLIA STATION (FORT LOWELL), ARIZONA TERRITORY.

[*Official number*, 173.]

Latitude	32° 16′
Longitude	110° 47′

Re-established September 12, 1878.

Private O. W. White was in charge until December 1, 1879; Private C. M. Jameson, from December 1 to January 12, 1880; and Private J. M. Burlew, from January 12 to date. There is no assistant at this station.

Number of messages during the year.—Sent paid, 138; sent collect, 30; received paid, 142; received collect, 40; sent D. H., 2,564; received D. H., 2,508; total, 5,422. Free business, $965.54.

Receipts.—This line, $38.79; other lines, $190.85; total, $229.64.

The station is supplied with an anemescope and rain-gauge and a complete set of telegraph instruments and repair tools.

No meteorological observations are taken.

The station was inspected by Lieut. C. A. Booth, officer in charge, October 11, 1879, and by Lieut. J. P. Story, acting signal officer, December 22, 1879.

FLORENCE, ARIZONA TERRITORY.

[*Official number*, 172.]

Latitude	33° 2′ 32″
Longitude	111° 17′ 14″
Elevation of barometer above mean sea-level	1,552.83 (?) feet.
Mean barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	28.417
Mean annual rainfall for two years	12.75 inches.

Established November 12, 1874; observations commenced November 9, 1875.

Office, Drake's Block, Main street.

Lance Corporal William E. Guild has been in charge during the year. Private T. T. Moore was on duty as assistant from July 3 to August 25, 1879; Private W. J. Dailey, from August 25 to date.

Number of messages during the year.—Sent paid, 1,593; sent collect, 470; received paid, 1,552; received collect, 323; sent D. H., 411; received D. H., 97; total, 4,446. Free business, $111.41.

Receipts.—This line, $575.60; other lines, $1,261.38; total, $1,846.98.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Complete observations are taken four times a day and forwarded by mail, weekly. Sunset observations are forwarded daily by telegraph.

The station was inspected by Lieut. C. A. Booth, officer in charge, October 3, 1879, and by Lieut. J. P. Story, acting signal officer, December 19, 1879.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

GRANT (FORT GRANT), ARIZONA TERRITORY.

[*Official number*, 182.]

Latitude	32° 25′
Longitude	109° 56′
Elevation of barometer above mean sea-level	4,737.00 (?) feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	25.215
Mean rainfall for the year ending June 30, 1880	13.30 inches.

Established November 1, 1875; observations commenced July 14, 1877.

Office, Headquarters' Building, north corner of the fort.

Private Fred. C. Kelly was in charge until August 1, 1879, when he was relieved by Private Thomas Gibson, who still remains. Private A. C. Linderkrantz is on duty as repair-man.

Number of messages during the year.—Sent paid, 508; sent collect, 116; received paid 348; received collect, 160; sent D. H., 1,516; received D. H., 968; total, 3,616. Free business, $1,164.60.

Receipts.—This line, $210.50; other lines, $111.50; total $322.00.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the entral office.

The station has been inspected twice during the year—by Lieut. C. A. Booth, officer in charge, October 17, 1879, and by Lieut. J. P. Story, acting signal officer, January 6, 1880.

Extracts from the observer's semi-annual report:

> During the past year the United States military telegraph line has been of incalculable value to the public at large, and to the military authorities in particular. During the late Indian outbreaks commanding officers have frequently established their headquarters in telegraph offices, and through the medium of the operators have transmitted orders and directed the movement of troops as well as if they had been present at any point communicated with. By means of the telegraph it has been possible to quickly concentrate the forces, to aid and protect the settlements, and to engage or pursue the hostiles. The prompt and efficient aid rendered the military authorities by the operators, in movements of troops, supplies, &c., shows the value of the line.

PUBLICATIONS.

Number of Forms 22 issued during the year June 30, 1880	24
Total	24

MARICOPA, ARIZONA TERRITORY.

[*Official number*, 206.]

Latitude	33° 11′
Longitude	112° 4′

Re-established May 1, 1879.

Lance Sergeant William Story was in charge until August 1, 1879; Mr. A. Venton, civilian, from August 1, 1879, to September 1, 1879; Private T. T. Moore, from September 1, 1879, to March 5, 1880; Private Wenzel Mandereld, from March 5 to date. Private T. T. Moore is assistant.

Number of messages during the year.—Sent paid, 5,725; sent collect, 2,735; received paid, 6,752; received collect, 1,851; sent D. H., 534; received D. H., 482; total, 18,079. Free business, $433.16.

Receipts.—This line, $2,620.32; total, $2,620.32.

There are no meteorological instruments at this station, and no observations are taken.

The station is supplied with a complete set of telegraph instruments and repair tools.

Nearly all commercial business received for other lines is transferred here.

This station was inspected by Lieut. C. A. Booth, officer in charge, September 12, 1879, and by Lieut. J. P. Story, acting signal officer, December 4, 1879.

PHŒNIX, ARIZONA TERRITORY.

[*Official number*, 175.]

Latitude	33° 18′
Longitude	112° 0′ 15″
Elevation of barometer above mean sea-level	1,068.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	28.763
Mean annual rainfall for two years	6.35 inches.

Re-established May 9, 1877.

Office, Centre, between Washington and Jefferson streets.

Sergeant S. E. Patton has continued in charge throughout the year. Private O. W. White is assistant; Private George Harmon, Company I, Sixth Cavalry, is repair-man; John Bulsz, civilian employé, is messenger; Private W. J. Dailey was on duty as assistant until August 25, 1879; Mr. E. Jungerman was on duty as civilian operator until March 31, 1880.

Number of messages during the year.—Sent paid, 2,825; sent collect, 1,042; received paid, 2,197; received collect, 1,322; sent D. H., 1,067; received D. H., 618; total, 9,071. Free business, $454.85.

Receipts.—This line, $1,304.57; other lines, $1,148.20; total, $2,452.77.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Meteorological observations are taken four times a day and forwarded by mail.

A daily sunset observation is forwarded by telegraph.

The Phœnix Daily Herald and Expositor publish reports.

The station was inspected by Lieut. C. A. Booth, officer in charge, September 13, 1879, and by Lieut. J. P. Story, acting signal officer, December 17, 1879.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

PRESCOTT, ARIZONA TERRITORY.

[*Official number*, 176.]

Latitude	34° 29′ 6″
Longitude	112° 30′ 30″
Elevation of barometer above mean sea-level	5,339.00 (?) feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	24.750
Mean annual barometer (reduced to sea-level) for the year ending June 30, 1880	30.122
Mean annual rainfall for four years	13.73 inches.

Established November 19, 1873; observations commenced November 28, 1875.

Office, Old Headquarters' building.

Sergeant John J. Nanry has been in charge during the year. Private James E. Hayes was assistant until September 8, 1879; J. S. Hunter, civilian, was employed until January 31, 1880, when he was succeeded by George P. Men Muir, who still remains. Private Voules, Company K, Sixth Cavalry, is repair-man. Miss G. A. McClintock is in charge of the branch office in the city.

Number of messages during the year.—Sent paid, 2,794; sent collect, 869; received paid, 2,757; received collect, 1,417; sent D. H., 6,718; received D. H., 4,862; total, 19,417. Free business, $3,391.52.

Receipts.—This line, $1,373.16; other lines, $4,461.53; total, $5,834.69.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Eight full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station was inspected by Lieut. C. A. Booth, officer in charge, September 19, 1879, and by Lieut. J. P. Story, acting signal officer, December 8, 1879.

SAN CARLOS AGENCY, ARIZONA TERRITORY.

Latitude	33° 9′
Longitude	110° 9′

Established December 6, 1879.

Private Robert C. Lord, Company H, Twelfth Infantry, is repair-man, and in charge. All of the business of this office during the year, both free and commercial, has been checked against, and accounted for, by Camp Thomas office.

Telephones were used between these stations until May 1, 1880, when telegraph instruments were substituted.

The station is supplied with a complete set of telegraph instruments and repair tools.

There are no meteorological instruments at the station, and no observations are taken.

This station has not been inspected.

SAN DIEGO, CALIFORNIA.

[*Official number*, 75.]

Latitude	32° 32′
Longitude	117° 8′
Elevation of barometer above mean sea-level	67.12 feet.

Mean annual barometer (corrected for temperature and instrumental error only) for two years	29.937
Mean annual barometer (reduced to sea-level) for eight years	30.012
Mean annual temperature for eight years	60°.6
Mean annual rainfall for eight years	9.97 inches.

Established November 1, 1871.

Office, Corner D and Fifth streets.

At this station are the headquarters of the officer in charge of the California and Arizona division United States military telegraph line. Lieut. C. A. Booth is in charge; Sergeant Martin L. Hearne is chief clerk to officer in charge; Sergeant W. H. Clendenon is in charge of the meteorological work; Lance Sergeant William Story is in charge of the operating room; Clarence E. Hubon is civilian messenger, and Henry T. Bradt is janitor and battery man. Private J. H. McKenna was relieved from this station March 13, 1880.

Number of messages during the year.—Sent paid, 544; sent collect, 512; received paid, 844; received collect, 224; sent D. H., 1,418; received D. H., 414; total, 3,956. Free business, $483.10.

Number of words sent and received on business connected with the government and maintenance of the line.—Sent, 50,641; received, 58,550; total, 109,191.

This station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Eight full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

A great deal of interest is manifested here in the meteorological reports, and especially in the record of rainfall, by farmers, as the amount of rain during the winter months is an index of what the crops will be the ensuing season.

The office is regularly visited by the meteorological committee of the San Diego Society of Natural History.

The station was inspected by Lieut. John McClellan, acting signal officer, October 6, 1879, and by Lieut. J. P. Story, acting signal officer, November 23, 1879.

Extracts from the observer's semi-annual reports:

> The newspapers of this place publish daily and monthly reports of the observations taken at this station, together with those received by telegraph. The operations of the service continue to attract a fair share of attention, both from residents of the city and vicinity and strangers, and the office is often visited from motives of either curiosity or a desire for information. As this port possesses very little commerce, not much can be said of the service in this connection.

PUBLICATIONS.

Number of Bulletins (manifold) issued during the year ending June 30, 1880	2,897
Number of Forms 22 issued during the year ending June 30, 1880	24
Total	2,921

THOMAS (CAMP THOMAS), ARIZONA TERRITORY.

[*Official number*, 212.]

Latitude	32° 4′ 14″
Longitude	110° 5′ 37″

Established September 22, 1877; observations commenced April 1, 1880.

Private John T. Fitzgerald has been in charge throughout the year. There is no assistant at this station.

Number of messages during the year.—Sent paid, 1,160; sent collect, 164; received paid, 770; received collect, 274; sent D. H., 1,516; received D. H., 968; total, 4,852. Free business, $855.93.

Receipts.—This line, $525.54; other lines, $138.82; total, $664.36.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Meteorological observations are taken four times a day and forwarded by mail weekly.

A daily sunset observation is forwarded by telegraph.

The station was inspected by Lieut. C. A. Booth, officer in charge, October 21, 1879, and by Lieut. J. P. Story, acting signal officer, December 25, 1879.

Extracts from the observer's semi-annual reports:

> The great convenience and utility of the telegraph line has been clearly demonstrated during the recent raid made into this section of the country by hostile Indians.
>
> The telephones on the San Carlos line worked well for two or three months, but then gradually failed, until at last they became entirely useless, and were replaced by Morse instruments.
>
> The necessary material having been furnished by the Signal Service the post commander had a suitable building for an office erected. It consists of two rooms, one 12 feet by 8 for office, and the other 12 by 12 for store-room. The building was occupied October 3, 1879.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1889	8
Total	8

TRES ALAMOS, ARIZONA TERRITORY.

[*Official number*, 213.]

Latitude	32° 9′
Longitude	110° 15′

Established June 11, 1877.

Private M. A. Cunningham has been in charge throughout the year. Private H. A. Kremp, Company M, Sixth Cavalry, is repair-man.

Number of messages during the year.—Sent paid, 218; sent collect, 84; received paid, 175; received collect, 37; sent D. H., 267; received D. H., 91; total, 872. Free business, $87.53.

Receipts.—This line, $69.32; other lines, $31.17; total, $100.49.

There are no meteorological instruments on this station, and no observations are taken.

The station is supplied with a complete set of telegraph instruments and repair tools.

The station was inspected by Lieut. C. A. Booth, officer in charge, October 13, 1879, and by Lieut. J. P. Story, acting signal officer, December 23, 1879.

TUCSON, ARIZONA TERRITORY.

[*Official number*, 178.]

Latitude	32° 14′
Longitude	110° 56′
Elevation of barometer above mean sea-level	2,355.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	27.507
Mean annual rainfall for four years	13.86 inches.

Established December 2, 1873; observations commenced October 30, 1875.

Office, Ott street, east of Cosmopolitan Hotel.

Lance Sergeant G. V. Phillips was in charge until October 7, 1879, when he was relieved by Private W. H. Agey, who still remains. Private C. M. Jameson was on duty as assistant from October 11 to December 1, 1879; Private O. W. White, from December 1, 1879, to March 13, 1880, and Private J. H. McKenna from March 13 to date. Private J. J. Keefer, Company M, Sixth Cavalry, is repair-man; J. M. Mariscal is civilian messenger.

Number of messages during the year.—Sent paid, 5,678; sent collect, 2,019; received paid, 5,712; received collect, 1,778; sent D. H., 1,040; received D. H., 728; total, 16,955. Free business, $572.96.

Receipts.—This line, $2,304.35; other lines, $7,231.91; sundry, $65.51; total, $9,601.77.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station was inspected by Lieut. C. A. Booth, officer in charge, October 8, 1879, and by Lieut. J. P. Story, acting signal officer, December 21, 1879.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

VERDE (FORT VERDE), ARIZONA TERRITORY.

[*Official number*, 179.]

Latitude	34° 23′ 42″
Longitude	111° 53′ 5″
Elevation of barometer above mean sea-level	3,105.00 (?) feet.
Mean annual rainfall for three years	10.04 inches.

Established November 9, 1874; observations commenced February 17, 1876.

Office, No. 3 Laundress Row.

Corporal Dudley Brooks has been in charge throughout the year, and has had no assistant.

Number of messages during the year.—Sent paid, 284; sent collect, 14; received paid, 143; received collect, 55; sent D. H., 1,237; received D. H., 1,087; total, 2,820. Free business, $362.18.

Receipts.—This line, $99.65; other lines, $58.50; total, $158.15.

This station is supplied with a partial set of meteorological instruments and a complete set of telegraph instruments and repair tools.

Meteorological observations are taken four times a day and forwarded to this office by mail weekly.

A daily sunset observation is forwarded by telegraph.

This station was inspected by Lieut. C. A. Booth, officer in charge, September 25, 1879, and by Lieut. J. P. Story, acting signal officer, December 14, 1879.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

WICKENBURG, ARIZONA TERRITORY.

[*Official number*, 168.]

Latitude	33° 58′
Longitude	112° 42′
Elevation of barometer above mean sea-level	1,400.00 (?) feet.
Mean annual rainfall for two years	9.36 inches.

Established January 6, 1874; observations commenced November 13, 1875.

Office, north side of Hassyampa Square.

Private I. R. Birt was in charge until August 1, 1879, when he was sent to the hospital for medical treatment. The station was in charge of a repair-man until September 8, 1879. Private James E. Hayes was in charge from September 8, 1879, to February 13, 1880, when he was relieved by Private Frank Ridgway, who remains in charge. Private Patrick Barry, Company K, Sixth Cavalry, is repairman.

Number of messages during the year.—Sent paid, 639; sent collect, 253; received paid, 737; received collect, 208; sent D. H., 1,793; received D. H., 565; total, 4,195. Free business, $116.38.

Receipts.—This line, $108.96; other lines, $112.52; total, $221.48.

This station is supplied with a partial set of meteorological instruments and a complete set of telegraph instruments and repair tools.

Meteorological observations are taken four times a day and forwarded weekly by mail.

A daily sunset observation is forwarded by telegraph.

The station was inspected by Lieut. C. A. Booth, officer in charge, September 17, 1879, and by Lieut. J. P. Story, acting signal officer, December 6, 1879.

The station was temporarily closed from August 7 to September 11, 1879.

Extracts from the observer's semi-annual report:

> The utility of the telegraph line was signally demonstrated during the military operations against the Chemjuevis Indians in May last, when this line became the principal medium of communication between the department commander at Prescott and his subordinates and agents in the field and at this point. Full instructions and lengthy detailed reports of operations were exchanged at short intervals, enabling all parties to act with promptness and intelligence, and thus avert what threatened to be a bloody Indian war.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

YUMA, ARIZONA TERRITORY.

[*Official number*, 169.]

Latitude	32° 43′ 32″
Longitude	114° 36′ 9″
Elevation of barometer above mean sea-level	138.00 (?) feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	29.762
Mean annual rainfall four years	2.69 inches.

Established November 18, 1873; observations commenced October 4, 1875.

Office, quartermasters' building, Yuma.

Private W. Mandereld was in charge until September 20, 1879; Sergeant W. H. Clendenon, from September 20 to November 1, 1879; Private Mandereld, from November 1, 1879, to April 29, 1880; Sergeant C. A. Smith, from April 29, 1880, to date. Private Charles E. Truesdell has been on duty as assistant since May 12, 1880. Private M. J. Murphy, Company A, Eighth Infanty, is repair-man.

Number of messages during the year.—Sent paid, 350; sent collect, 176; received paid, 297; received collect, 85; sent D. H., 481; received D. H., 82; total; 1,471. Free business, $612,87.

Receipts.—This line, $126.79; other lines, $24.18; total, $150.97.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

The full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station was inspected by Lieut. C. A. Booth, officer in charge, September 6, 1879, and by Lieut. J. P. Story, acting signal officer, November 30, 1879.

Extracts from the observer's semi-annual report:

> Invalids residing at Yuma during the winter manifest considerable interest in the meteorological records of this station. No reports are published by the local paper.
>
> A report of the rainfall and dry and wet bulb thermometer and humidity is furnished to the engineer of the Central Pacific Railroad Company in tabulated form.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

NORTHWESTERN DIVISION.

Table showing stations on the United States military telegraph line, northwestern division, from which reports have been received during the year ending June 30, 1880.

Name of station.	Reports commenced.	Reports discontinued.	Number of reports by telegraph, (daily).	Character of reports received by mail on Form 4, (weekly).
Bismarck, Dak	(*)	......	3	Complete observations taken eight times a day.
Deadwood, Dak	(*)	......	3	Do.
Fort Assinniboine, Mont	Dec. 15, 1879	......	3	Complete observations taken four times a day.
Fort Bennett, Dak	June 23, 1880	......	3	Do.
Fort Benton, Mont	Nov. 12, 1879	......	3	Do.
Fort Buford, Dak	(*)	......	3	Do.
Fort Custer, Mont	Aug. 12, 1879	......	3	Do.
Fort Ellis, Mont	(*)	......	1	No meteorological observations taken.
Fort Keogh, Mont	(*)	......	3	Complete observations taken four times a day.
Fort Meade, Dak	(*)	......	1	No meteorological observations taken.
Fort Missoula, Mont	Dec. 15, 1879	......	3	Complete observations taken four times a day.
Fort Stevenson, Dak	(*)	......	3	Do.
Fort Shaw, Mont	Nov. 11, 1879	......	3	Do.
Fort Yates, Dak	Dec. 1, 1879	......	3	Partial observations taken three times a day.
Helena, Mont	Nov. 15, 1879	......	3	Complete observations taken three times a day.

* Reporting at date of last annual report, June 30, 1878.

Report of stations on the United States military telegraph line, northwestern division, compiled from the annual report of First Lieut. George S. Grimes, Second United States Artillery, acting signal officer in charge, and from data on file in the office of the Chief Signal Officer:

ASSINNIBOINE, MONTANA TERRITORY.

Latitude	48° 37′
Longitude	109° 43′

Established October 6, 1879.

Mr. J. E. Wilson has remained in charge during the year. He has no assistant.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Number of messages during the year.—Sent paid, 518; sent collect, 89; received paid, 311; received collect, 141; sent free, 468; received free, 451; total, 1,978.

Receipts.—This line, $249.03; other lines, $321.87; total, $570.90. Free business, $206.55.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station has not been inspected during the year.

This station is the northern terminus of the main line, and the observer has 30 miles of wire to keep in repair.

BENNETT (FORT BENNETT), DAKOTA TERRITORY.

Latitude	44° 42′
Longitude	100° 38′

Established December 22, 1879.

Private W. P. Carr has been in charge since its establishment. He has no assistant.

Number of messages since opening station.—Sent paid, 12; sent collect, 3; received paid, 21; received collect, 5; sent free, 37; received free, 71; total, 149.

Receipts.—This line, $4.47; other lines, $20.67; total, $25.14. Free business, $11.99.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

The station has not been inspected.

The station maintains in repair 30 miles of wire.

BENTON (FORT BENTON), MONTANA TERRITORY.

Latitude	47° 51′
Longitude	110° 40′

Re-established October 11, 1879.

Private A. H. Bell is in charge. Changes: October 11, 1879, Private E. E. Ellery, Signal Corps, U. S. A., in charge; December 29, 1879, Private Ellery relieved and ordered to Deer Lodge, Mont. There is no assistant at this station.

Number of messages since opening of station.—Sent paid, 1,646; sent collect, 324; received paid, 291; received collect, 464; sent free, 1,014; received free, 481; total, 4,220.

Receipts.—This line, $901.35; other lines, $834.08; total, $1,735.43. Free business, $330.00.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station has not been inspected.

This station maintains in repair 40 miles of wire.

BISMARCK, DAKOTA TERRITORY.

[*Official number*, 104.]

Latitude	46° 48′
Longitude	100° 38′
Elevation of barometer above mean sea-level	1,704.33 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for five years	28.149
Mean annual barometer (reduced to sea-level) for five years	29.905
Mean annual temperature for five years	39°.8
Mean annual rainfall for five years	23.80 inches.

Established September 15, 1874.

Office, corner First and Meigs streets.

At this station are the headquarters of the officer in charge of this division.

Sergeant Cyrus Cramer is in charge of the station. He has two assistants. Eight assistants have been ordered to, and eight relieved from, this station during the year.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Eight full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

Number of messages during the year.—Sent paid, 2,610; sent collect, 1,226; received paid, 5,038; received collect, 1,024; sent free, 2,910; received free, 10,336; total, 23,144.

Receipts.—This line, $1,727.85; other lines, $40.16; total, $1,768.01. Free business, $1,604.02.

The station maintains in repair 35 miles of wire.

There has been no formal inspection of this station.

Extracts from the observer's semi-annual reports:

> Weekly reports and the monthly means are furnished the local weekly paper and generally published. Items are also furnished and published from time to time.
>
> A general interest is taken in the service. The reports are relied on and inquiries are frequently made of the prospects of the weather. Instruments are sometimes brought for comparison and adjustment.
>
> The river reports are also valuable to steamboat men, one of whom informed me that a single report was sometimes worth hundreds of dollars.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

BOZEMAN, MONTANA TERRITORY.

Latitude	45° 42′
Longitude	111° 3′

Established March 20, 1880.

Mr. J. J. Abernethy has remained in charge since opening of station. He has no assistant.

Number of messages during the year.—Sent paid, 417; sent collect, 173; received paid, 239; received collect, 195; sent free, 145; received free, 212; total, 1,381.

Receipts.—This line, $217.47; other lines, $239.19; total, $456.66. Free business, $58.59.

The station is supplied with a complete set of telegraph instruments and repair tools.

No meteorological observations are taken at this station.

The station has not been inspected.

BUFORD (FORT BUFORD), DAKOTA TERRITORY.

[*Official number*, 203.]

Latitude	48° 3′
Longitude	103° 58′
Elevation of barometer above mean sea-level	1,876.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	27.886
Mean annual rainfall for the year ending June 30, 1880	18.45 inches.

Established October 23, 1878; observations commenced January 13, 1879.

Office, United States Signal and Telegraph Office.

Private W. B. Stockman was in charge until May 31, when he was relieved by Private J. S. Clarke, who remains in charge.

Number of messages during the year.—Sent paid, 883; sent collect, 338; received paid, 574; received collect, 266; sent free, 1,634; received free, 804; total, 4,499.

Receipts.—This line, $375.22; other lines, $382.24; total, $757.46. Free business, $861.95.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station maintains in repair 60 miles of wire.

The station has not been inspected.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 4880	24
Total	24

BURN'S RANCHE, MONTANA TERRITORY.

Established June 30, 1880, as a sub-station of Fort Buford, Dakota Territory.

Private C. G. Raymond is in charge. This station was formerly located at Morgan and O'Brien's Ranche, from which it was moved on June 30, 1880.

The station maintains in repair 57 miles of wire.

COAL BANKS, MONTANA TERRITORY.

Latitude	48° 3′
Longitude	110° 10′

Established December 22, 1879.

Corporal J. P. McGuire, Company C, Eighteenth Infantry, was in charge from opening of station until June 17, 1880, since which time Corporal C. A. Ross, Company A, Eighteenth Infantry, has been in charge.

The station is supplied with a full set of repair tools, and maintains in repair 50 miles of wire.

The station has not been inspected.

COULSON, MONTANA TERRITORY.

Latitude	45° 49′
Longitude	108° 30′

Established January 21, 1879.

Private V. Wickersham, Company C, Eleventh Infantry, has remained in charge during the year.

The station is supplied with a set of repair tools.

No meteorological observations are taken.

The station has not been inspected.

It maintains in repair 50 miles of wire.

CUSTER (FORT CUSTER), MONTANA TERRITORY.

[*Official number*, 200.]

Latitude	45° 48′
Longitude	107° 38′
Elevation of barometer above mean sea-level	3,086.00 feet.
Rainfall for the ten months ending June 30, 1880	15.17 inches.

Established December 5, 1878; observations commenced August 12, 1879.

Office, officers' quarters, marked Quarters No. 3.

Private D. C. Ralston is in charge. Private J. Baker, Second Cavalry, is repairman.

Number of messages during the year.—Sent paid, 949; sent collect, 167; received paid, 645; received collect, 202; sent free, 2,212; received free, 1,543; total, 5,718.

Receipts.—This line, $364.16; other lines, $355.16; total, $719.32. Free business, $871.36.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station maintains in repair 60 miles of wire.

It has not been inspected.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30 1880	24
Total	24

DEADWOOD, DAKOTA TERRITORY.

[*Official number*, 185.]

Latitude	44° 22′
Longitude	103° 34′
Elevation of barometer above mean sea-level	4,630.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for one year	25.332
Mean annual rainfall for one year	28.50 inches.

Re-established November 1, 1878.

Office, room No. 1, third floor, Phœnix Block.

Sergeant J. O'Dowd was in charge until June 17, when he was relieved by Private W. B. Stockman. There is one assistant at this station.

This station maintains in repair 42 miles of wire.

The office was moved March 31 from the Davis Assay Building.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Number of messages during the year.—Sent paid, 2,177; sent collect, 637; received paid, 1,480; received collect, 666; sent free, 1,022; received free, 371; total, 6,353.

Receipts.—This line, $1,355.99; other lines, $1,392.71; total, $2,748.71. Free business, $135.95.

Eight full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station has not been inspected during the year.

Extracts from the observer's semi-annual report:

> On the morning of September 26, 1879, during the Deadwood conflagration, the building in which the Signal Office was located being considered in great danger, the instrument shelter was pulled down and the instruments therein destroyed.
>
> The large wind vane and telescopic rod were erected October 25, 1879. An instrument shelter, constructed at Fort Meade by order of the commanding officer of that post, received and erected October 28, 1879, and observations resumed.

PUBLICATIONS.

Number of Local Reports issued during the year ending June 30, 1880	347
Number of Forms 22 issued during the year ending June 30, 1880	24
Total	371

DEER LODGE, MONTANA TERRITORY.

Latitude	46° 24′
Longitude	112° 45′

Established December 8, 1879.

Private E. E. Ellery was in charge until April 14, 1880, when he was relieved by Private G. R. Tompkins, who remains in charge.

The station maintains in repair 40 miles of wire, and is supplied with a complete set of telegraph instruments and repair tools.

No meteorological observations are taken.

Number of messages since opening of station.—Sent paid, 329; sent collect, 58; received paid, 297; received collect, 55; sent free, 19; received free, 10; total, 768.

Receipts.—This line, $134.77; other lines, $145.15; total, $279.92. Free business, $3.78.

ELLIS (FORT ELLIS), MONTANA TERRITORY.

[*Official number*, 223.]

Latitude	45° 40′
Longitude	110° 0′

Established February 1, 1879.

Private F. C. Buell was in charge until November 17, when he was relieved by civilian operator, W. P. Larcey.

Number of messages during the year.—Sent paid, 893; sent collect, 280;

received paid, 727; received collect, 357; sent free, 1,367; received free, 775; total, 4,399.

Receipts.—This line, $351.45; other lines, $482.91; total, $834.36.

The station is supplied with a complete set of telegraph instruments and repair tools.

A daily sunset observation is forwarded by telegraph.

The station maintains in repair 60 miles of wire.

FERRY POINT, MONTANA TERRITORY.

Latitude	46° 51′
Longitude	105° 9′

Established January 3, 1879.

Private W. H. Ames, Company H, Fifth Infantry, has remained in charge.

The station maintains in repair 57 miles of wire, and is supplied with a full set of repair tools.

No meteorological observations are taken.

GAGE'S, MONTANA TERRITORY.

Established November 19, 1879.

Station removed to Shields River, Mont., on April 26, 1880. Private W. E. Milnor, Company C, Eleventh Infantry, was in charge.

GRINNELL'S RANCHE, DAKOTA TERRITORY.

Established September 9, 1879.

Private R. E. Kerkam, Company K, Sixth Infantry, has remained in charge since opening of station.

The station maintains in repair 72 miles of wire, and is supplied with a complete set of telegraph instruments and repair tools.

HELENA, MONTANA TERRITORY.

Latitude	46° 33′
Longitude	112° 2′

Established October 15, 1879; observations commenced April 1, 1880.

Private N. C. Smith has been in charge since establishment of station. He has no assistant. An assistant was on duty from January 10 to April 14.

Number of messages since opening station.—Sent paid, 1,725; sent collect, 517; received paid, 2,775; received collect, 272; sent free, 1,525; received free, 1,259; total, 8,073.

Receipts.—This line, $637.59; other lines, $103.85; total, $741.44. Free business, $590.12.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station maintains in repair 70 miles of wire.

HUNTER'S SPRINGS, MONTANA TERRITORY.

Latitude (approximate)	45° 50′
Longitude (approximate)	109° 35′

Established March 31, 1879.

Removed to Shields, Mont., April 26, 1880.

Private W. E. Milnor, Eleventh Infantry, was in charge until the removal of the station to Gage's, Mont., on November 19, 1879.

KEOGH (FORT KEOGH), MONTANA TERRITORY.

[*Official number*, 202.]

Latitude	46° 17′
Longitude	105° 55′
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	27.276
Mean annual rainfall for the year ending June 30, 1880	19.44 inches.

Established November 18, 1878; observations commenced January 13, 1879.

Office, in building which quartermaster occupies.

Private A. H. Bell was in charge until November 1; Private S. Wheaton, from November 1 until June 17; Sergeant J. O'Dowd from June 17 to June 21, and Sergeant D. M. Kennedy from June 21 to date. There is one assistant at this station.

Number of messages during the year.—Sent paid, 1,994; sent collect, 286; received paid, 1,446; received collect, 621; sent free, 2,498; received free, 1,584; total, 8,429.

Receipts.—This line, $846.80; other lines, $1,307.54; total, $2,154.34. Free business, $969.67.

This station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station maintains in repair 45 miles of wire.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

KNIFE RIVER, DAKOTA TERRITORY.

[*Official number*, 227.]

Latitude	48° 0′
Longitude	102° 32′

Established January 30, 1879.

Private D. I. Mercier remained in charge until removal of station to Grinnell's Ranche, Dak., on September 9, 1879.

LE BEAU'S RANCHE, DAKOTA TERRITORY.

Latitude	45° 20′
Longitude	100° 15′

Established January 21, 1880.

Private J. C. Kent, Company E, Eleventh Infantry, has been in charge since opening of station.

The station maintains in repair 62 miles of wire.

LINCOLN (FORT A. LINCOLN), DAKOTA TERRITORY.

Latitude	46° 45′
Longitude	100° 52′

Established November 1, 1879.

Mr. H. S. Davis was in charge until March 10, 1880, since which time Mr. H. W. Filbert has been in charge.

This station is supplied with a complete set of telegraph instruments and repair tools.

No meteorological observations are taken.

The station maintains in repair 35 miles of wire.

Number of messages since opening of station.—Sent paid, 171; sent collect, 110; received paid, 260; received collect, 76; sent free, 588; received free, 567; total, 1,772.

Receipts.—This line, $56.79; other lines, $110.61; total, $167.40. Free business, $256.73.

LITTLE MISSOURI, MONTANA TERRITORY.

Latitude (approximate)	45° 5′
Longitude (approximate)	104° 18′

Established April 30, 1879.

Private F. Thomas, Company E; F. Dickerty, Company M; and E. B. Fair, Company E, Seventh Cavalry, relieved August 29, 1879, by Privates J. C. Lawler, Company C; J. H. Carroll, Company E; and F. Garlick, Company G, Seventh Cavalry. Private Carroll was relieved January 27, 1880, and Corporal A. Capri, Company C, and Private E. B. Fair, Company E, Seventh Cavalry, assigned to duty same date. Corporal Capri and Private Garlick were relieved May 28, 1880, by Privates Watson and McKeen, Seventh Cavalry, who remain on duty. Private Lawler was relieved June 5, 1880, and Private Fair on June 17, 1880.

The station is supplied with a complete set of telegraph instruments and repair tools, and maintains in repair 65 miles of wire.

No meteorological observations are taken.

McKINNEY STATION (OLD FORT McKINNEY), WYOMING TERRITORY.

Private T. S. Collins at this station awaiting orders from June 30 until October 20, 1879.

The telegraph line on which this station is located has never been turned over to the officer in charge of the northwestern division.

McKINNEY (FORT McKINNEY), WYOMING TERRITORY.

Latitude	44° 23′
Longitude	106° 46′

Sergeant D. Moore was at this station awaiting orders from July 19, 1879, to June 19, 1880.

The telegraph line on which this station is located has never been turned over to the officer in charge of the northwestern division.

MEADE (FORT MEADE), DAKOTA TERRITORY.

[*Official number*, 224.]

Latitude	44° 26
Longitude	103° 32′

Established February 19, 1879.

Private A. A. Stoneburner has been in charge during the year. He has no assistant.

The station maintains in repair 24 miles of wire.

Number of messages during the year.—Sent paid, 626; sent collect, 146; received paid, 616; received collect, 135; sent free, 404; received free, 185; total, 2,112.

Receipts.—This line, $323.92; other lines, $348.62; total, $672.54. Free business, $136.46.

The station is supplied with a complete set of telegraph instruments and repair tools.

A daily sunset observation is forwarded by telegraph.

MISSOULA (FORT MISSOULA), MONTANA TERRITORY.

Latitude	46° 54′
Longitude	114° 10′

Established December 15, 1879.

Private F. C. Buell has remained in charge since opening of station. There was one assistant on duty at this station from December 15, 1879, to January 13, 1880.

It maintains in repair 45 miles of wire.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station has not been inspected.

Number of messages since opening of station.—Sent paid, 160; sent collect, 30; received paid, 114; received collect, 43; sent free, 205; received free, 170; total, 722.

Receipts.—This line, $71.22; other lines, $196.63; total, $267.85. Free business, $160.95.

MORGAN AND O'BRIEN'S RANCHE, DAKOTA TERRITORY.

Latitude (approximate)	47° 30′
Longitude (approximate)	104° 30′

Established June 30, 1879.

Private J. A. Funstan, Company D, Sixth Infantry, was in charge from opening of station to September 24, 1879; Sergeant J. A. Frank, Company I, Sixth Infantry, was in charge from September 24, 1879, to June 10, 1880, since which time Private C. G. Raymond has been in charge.

The station was removed to Burns' Ranche, Mont., June 30, 1880.

NEW CHICAGO, MONTANA TERRITORY.

Latitude	46° 45′
Longitude	113° 15′

Established January 19, 1880, as a repair station.

Corporal C. E. Fisher, Company H, Third Infantry, was in charge until March 16, 1880, when he was relieved by Mr. John H. Cole, who remains in charge.

No meteorological observations are taken.

This station is supplied with a complete set of telegraph instruments and repair tools, and maintains in repair 45 miles of wire.

Number of messages since opening of station.—Sent paid, 155; sent collect, 15; received paid, 61; received collect, 18; sent free, 7; received free, 4; total, 260.

Receipts.—This line, $53.13; other lines, $41.66; total, $94.79. Free business, $3.68.

PLUM CREEK, DAKOTA TERRITORY.

Established June 17, 1880.

Private E. B. Fair, Company E, Seventh Cavalry, has been in charge since opening of station.

The station is supplied with a complete set of telegraph instruments and repair tools, and maintains in repair 50 miles of wire.

No meteorological observations are taken.

POWDER RIVER, MONTANA TERRITORY.

Latitude (approximate)	45° 48′
Longitude (approximate)	105° 20′

Established November 1, 1878.

Private L. Hohman, Company E, Fifth Infantry, has remained in charge during the year.

The station is supplied with a complete set of telegraph instruments and repair tools, and maintains in repair 66 miles of wire.

No meteorological observations are taken.

RADERSBURG, MONTANA TERRITORY.

Latitude	46° 12′
Longitude	111° 42′

Established April 4, 1880.

Private T. Maunier, Company D, Eighteenth Infantry, has been in charge since opening of station (Crow Creek, which was opened December 27, 1879, being closed for the purpose).

The station is supplied with a complete set of telegraph instruments and repair tools, and maintains in repair 50 miles of wire.

No meteorological observations are taken.

RAPID CITY, DAKOTA TERRITORY.

Latitude	44° 0′
Longitude	103° 0′

Established January 19, 1880.

Private E. B. Fair, Company E, Seventh Cavalry, was in charge until January 28, when he was relieved by Private R. L. Rotchford, who remains in charge.

The station is supplied with a complete set of telegraph instruments and repair tools, and maintains in repair 50 miles of wire.

No meteorological observations are taken.

Number of messages since opening of station.—Sent paid, 605; sent collect, 142; received paid, 414; received collect, 125; sent free, 7; received free, 15; total, 1,308.

Receipts.—This line, $238.62; other lines, $290.20; total, $528.82. Free business, $2.68.

ROCK CREEK, MONTANA TERRITORY.

Latitude	47° 3′
Longitude	112° 2′

Established December 18, 1879.

Private R. E. Chase, Company F, Third Infantry, has been in charge since opening of station.

This station is supplied with a complete set of telegraph instruments and repair tools, and maintains in repair 50 miles of wire.

No meteorological observations are taken.

ROSEBUD, MONTANA TERRITORY.

Latitude	46° 14′
Longitude	106° 28′

Established February 3, 1879.

Private J. W. Carr, Company F, Eleventh Infantry, has remained in charge during the year.

The station is supplied with a complete set of telegraph instruments and repair tools, and maintains in repair 55 miles of wire.

No meteorological observations are taken.

SHAW (FORT SHAW), MONTANA TERRITORY.

Latitude	47° 29′
Longitude	111° 46′

Private G. R. Tompkins was in charge until January 23, when he was relieved by Private A. L. Matthews. There is no assistant at this station.

Number of messages during the year.—Sent paid, 296; sent collect, 42; received paid, 200; received collect, 91; sent free, 638; received free, 456; total, 1,723.

Receipts.—This line, $131.05; other lines, $95.84; total, $226.89. Free business, $263.91.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

SHIELD'S RIVER, MONTANA TERRITORY.

Latitude	45° 42′
Longitude	110° 31′

Established March 31, 1879.

This station was established at Hunter's Springs on March 31, 1879; moved to Gage's, Mont., November 19, 1879, and to Shield's River, its present location, April 27, 1880. Private W. E. Milnor, Company C, Eleventh Infantry, has remained in charge since opening of station.

The station is supplied with a complete set of telegraph instruments and repair tools, and maintains in repair 50 miles of wire.

No meteorological observations are taken.

SMITHVILLE, DAKOTA TERRITORY.

Established June 18, 1880.

Corporal W. H. Lavering, Company H, Seventh Cavalry, has remained in charge since opening of station, with one assistant.

The station is supplied with a complete set of telegraph instruments and repair tools, and maintains in repair 50 miles of wire.

No meteorological observations are taken.

STEVENSON (FORT STEVENSON), DAKOTA TERRITORY.

[*Official number*, 201.]

Latitude	47° 36′
Longitude	101° 23′
Elevation of barometer above mean sea-level	1,734.00 feet.
Mean annual barometer (corrected for temperature and instrumental error only) for the year ending June 30, 1880	28.085
Mean rainfall for the year ending June 30, 1880	13.01 inches.

Established September 19, 1878; commenced observations December 26, 1878.

Office, northeast corner of garrison.

Private N. C. Smith was in charge until August 9, 1879; Private D. I. Mercier, from August 9 until June 23, 1880, and Private J. H. Young, from June 23 to date. A repair-man was on duty at this station from May 14 to August 9.

This station is kept open as a repair station, and the man in charge is kept constantly at work looking after the line. When at the office the regular meteorological observations are taken.

Number of messages during the year.—Sent paid, 219; sent collect, 100; received paid, 209; received collect, 52; sent free, 1,422; received free, 662; total, 2,664.

Receipts.—This line, $82.25; other lines, $73.00; total, $155.25. Free business, $672.07.

The station is supplied with a complete set of meteorological and telegraph instruments and repair tools, and maintains in repair 75 miles of wire.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

PUBLICATIONS.

Number of Forms 22 issued during the year ending June 30, 1880	24
Total	24

STILLWATER, MONTANA TERRITORY.

Latitude	45° 36′
Longitude	109° 21′

Established February 21, 1879.

Private W. P. Carr was in charge until October 27, when he was relieved by Private J. Driscoll, Company E, Third Infantry.

The station is supplied with telegraph instruments and repair tools, and maintains in repair 52 miles of wire.

No meteorological observations are taken.

SULLY (FORT SULLY), DAKOTA TERRITORY.

Latitude	44° 39′
Longitude	100° 36′

Re-established December 1, 1879.

Private L. F. Cary, Company G, Eleventh Infantry, has been in charge during the year.

The station has not been inspected.

The station is supplied with a complete set of telegraph instruments and repair tools, and maintains in repair 30 miles of wire.

No meteorological observations are taken.

Number of messages since opening of station.—Sent paid, 55; sent collect, 7; received paid, 136; received collect, 13; sent free, 125; received free, 117; total, 453.

Receipts.—This line, $19.60; other lines, $48.22; total, $67.82. Free business, $50.25.

TERRY'S LANDING, MONTANA TERRITORY.

Latitude	46° 9′
Longitude	107° 32′

Established December 28, 1878.

Private George J. Walters, Company D, Second Cavalry, was in charge until May 28, 1880, when he was relieved by Private Virgil Verge, Company A, Fifth Infantry.

The station is supplied with a complete set of telegraph instruments and repair tools, and maintains in repair 55 miles of wire.

No meteorolgical observations are taken.

YATES (FORT YATES), DAKOTA TERRITORY.

Latitude	46° 11′
Longitude	100° 34′

Established September 5, 1879.

Private W. D. Maxwell has remained in charge since opening of station.

Since December 1, 1879, four partial meteorological observations have been taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

The station is supplied with a full set of telegraph instruments and repair tools, and maintains in repair 40 miles of wire.

Number of messages since opening of station.—Sent paid, 238; sent collect, 45; received paid, 135; received collect, 81; sent free, 679; received free, 252; total, 1,430.

Receipts.—This line, $99.19; other lines, $182.30; total, $281.49. Free business, $132.72.

WASHINGTON AND IDAHO DIVISION.

Table showing stations on the United States telegraph lines, Washington and Idaho division, from which reports have been received during the year ending June 30, 1880.

Name of station.	Reports commenced.	Reports discontinued.	Number of reports by telegraph, (daily).	Character of reports received by mail on Form 4. (weekly).
Dayton, Wash	Dec. 1, 1879	....	3	Observations of thermometer, hygrometer, direction of wind and state of weather, clouds and rainfall, taken four times a day.
Fort Lapwai, Idaho	Dec. 1, 1879	....	1	No meteorological observations taken.
Lewiston, Idaho	Nov. 23, 1879	....	3	Complete observations taken four times a day.
Pomeroy, Wash	Dec. 1, 1879	....	1	No meteorological observations taken.

Report of stations on the United States military telegraph line, Washington and Idaho division, compiled from the annual report of First Lieut. W. E. Birkhimer, Third United States Artillery, acting signal officer and officer in charge, and from data on file in the office of the Chief Signal Officer.

DAYTON, WASHINGTON TERRITORY.

[*Official number*, 234.]

Latitude	46° 23′
Longitude	117° 50′
Elevation of barometer above mean sea-level	1,700 (?) feet.

Established July 1, 1879.

Observations commenced December 1, 1879.

Office in United States military and telegraph building, Main street.

Sergeant Frank Greene has been in charge of station since its establishment.

Private Samuel Lackland, Company M, First Cavalry, was on duty as assistant operator from May 17 to June 14, 1880. There is now no assistant at this station.

Privates Whiting, Benedict, and Holland, of the Twenty-first Infantry, have been on duty at this station for short periods during the year.

Number of messages during the year.—Sent paid, 591; sent collect, 327; received paid, 984; received collect, 208; sent free, 376; received free, 344; total, 2,830.

Receipts.—This line, $308.93; other lines, $2; total, $310.93.

Four full meteorological observations, except of the barometer, are taken daily. The three regular telegraphic and sunset observations are fowarded to the central office.

Much local interest in the service is exhibited, and much good feeling toward the service at large is expressed, and many inquiries are made at this office during threatening weather.

LAPWAI (FORT LAPWAI), IDAHO.

Latitude	46° 25′
Longitude	116° 48′

Established July 1, 1879.

Private William De Lisle, Company B, Second Infantry, was in charge until July 28; Private E. H. Holland, Company D, Twenty-first Infantry, from July 28 to October 1; Private Benedict, Company C, Twenty-first Infantry, from October 1 to January 18, 1880; Private Lackland, Company M, First Cavalry, from January 18 to May 13. Private Lackland was relieved by Private Harry Clifford, Company I, Twenty-first Infantry, who remains in charge.

Number of messages during the year.—Sent paid, 85; sent collect, 28; received paid, 96; received collect, 33; sent free, 581; received free, 524; total, 1,347.

Receipts.—This line, $32.04; other lines, $94.04; total, $126.08.

The station is not yet supplied with instruments. A sunset observation is forwarded by telegraph daily.

LEWISTON, IDAHO TERRITORY.

[*Official number*, 235.]

Latitude	46° 25′
Longitude	116° 59′
Elevation of barometer above mean sea-level	619 (?) feet.

Established July 1, 1879.

Observations commenced November 23, 1879.

Office, corner Montgomery and Fourth streets.

Private Samuel Lackland, Company M, First Cavalry, was in charge until November 22. He was relieved by Private L. R. Ayres, who was superseded March 22, 1880, by Private Wesley Blake, who remains in charge.

Number of messages during the year.—Sent paid, 774; sent collect, 213; received paid, 540; received collect, 262; sent free, 405; received free, 515; total, 2,709.

Receipts.—This line, $358.19; other lines, $1,299.94; total, $1,658.13.

This station is supplied with a full set of meteorological instruments.

Four full meteorological observations are taken daily. The three regular telegraphic and sunset observations are forwarded to the central office.

POMEROY, WASHINGTON TERRITORY.

Latitude	46° 30′
Longitude	117° 35′

Established July 1, 1879.

Observations commenced December 1, 1879.

Private W. G. Whiting, Company G, Twenty-first Infantry, was in charge of this station to July 8; Private L. R. Ayres, to October 1; Private Whiting from October 1 to 22; Private Ayres from October 22 to November 22; Private Lackland, Company M, First Cavalry, from November 22 to January 18, 1880; Private C. S. Benedict, Company C, Twenty-first Infantry, from January 18 to date.

Number of messages during the year.—Sent paid, 330; sent collect, 40; received paid, 181; received collect, 72; sent free, 76; received free, 56; total, 755.

Receipts.—This line, $134.75; other lines, $162.87; total, $297.62.

This station is not supplied with meteorological instruments. A sunset observation is forwarded by telegraph daily.

Table showing the location of the sunset stations, Signal Service, U. S. A., with the names of the observers and the dates of their establishment.

Station.	Observer.	Date established.
Austin, Nev	L. A. Weller	July 1, 1877.
Central City, Nebr	George Bockes	July 1, 1877.
Deep Creek, Utah	E. R. Ferguson	July 1, 1877.
Elmira, N. Y	A. J. Carpenter	July 1, 1877.
Emporia, Kans	L. T. Heritage	Apr. 5, 1879.
Eugene City, Oreg	J. Kemble Peters	July 1, 1877.
Fillmore City, Utah	Andrew Henry, P. M	July 1, 1877.
Fort Fetterman, Wyo	Andrew Foote	July 1, 1877.
Hamilton, Nev	H. Carpenter, P. M	July 1, 1877.
Hat Creek, Wyo	John H. Bowman	July 1, 1877.
Kit Carson, Colo	D. A. Ray	July 1, 1877.
Lytton, British Columbia	W. H. Wright	July 1, 1877.
Monterey, Cal	Felipe Gomez, P. M	July 1, 1877.
New Westminster, British Columbia	Adolphus Peele	July 1, 1877.
Pembroke, Ontario	W. A. Moffat	Apr. 5, 1879.
Santa Barbara, Cal	G. P. Tebbetts	July 1, 1877.
Sault de Ste. Marie, Mich	Charles Ripley, assistant P. M	July 1, 1877.
Sidney, Nebr	A. E. Annis	July 1, 1877.
Saint George, Utah	John Pymm	July 1, 1877.
*Edson, Wyo	M. R. McDonald	July 1, 1877.
Trinidad, Colo	O. B. Park	July 1, 1877.
Victoria, Vancouver's Island, British Columbia	John Smith	July 1, 1877.
Wadena, Minn	C. J. Stuart	July 1, 1877.
Waterville, Kans	Mrs. Clara B. Phillips	July 1, 1877.
Yreka, Cal	C. H. Pyle	July 1, 1877.

*Name of town changed from Saint Mary's, May 1.

Observations of the character of the sunset are taken each day at sunset, telegraphed to the nearest regular Signal Service station, and embodied in the next telegraphic report from that station to this office.

Sunset observations are also made daily, and forwarded weekly, by mail from the following stations in New Jersey: New Brunswick, Belvidere, Flemington, Elizabeth, Freehold.

The following tables show the location of the cautionary and cautionary off-shore signal display stations under the direction of the office of the Chief Signal Officer, the date on which each was established, the names of the displaymen, the number of cautionary and cautionary off-shore signals displayed, the number reported justified and the number reported not justified, from July 1, 1879, to June 30, 1880, except in cases where they were established subsequent to July 1, 1879:

SECTION No. 1, ON OR NEAR LAKE MICHIGAN.

Stations.	Date of establishment.	Name of displayman.	Cautionary signals.			
			Number ordered * displayed.	Number reported justified.	Number reported not justified.	Number not reported upon.
Green Bay Wis	Sept. 16, 1877	David Soper	41	28	13	0
Horn's Pier, Wis	Mar. 15, 1878	W. H. Horn	50	32	13	5
*Kenosha, Wis	Sept. 16, 1877	H. R. Simmons				
Kewaunee, Wis	Sept. 16, 1877	A. D. Laughlin, P. M	47	29	16	2
Manitowoc, Wis	Sept. 16, 1877	W. W. De Lano	43	30	13	0
Menomonee, Mich	Sept. 16, 1877	N. Gram	46	32	14	0
Racine, Wis	Sept. 16, 1877	G. W. Scanlon	48	27	21	0
Sheboygan, Wis	Sept. 16, 1877	J. L. Mallery	45	26	19	0
Sturgeon Bay, Wis	Sept. 16, 1877	J. B. Scott	45	31	14	0

*Reports incomplete.

Section No. 1 is under the charge of the sergeant at Milwaukee, Wis., through whom all signal orders are sent.

SECTION No. 3, ON OR NEAR LAKE MICHIGAN.

Frankfort, Mich	July 20, 1878	C. S. Collier	47	35	12	0
Ludington, Mich	Jan. 20, 1878	H. F. Alexander	64	47	17	0
Muskegon, Mich	Feb. 15, 1879	Lafayette Freeman	45	19	19	7
Northport, Mich	July 20, 1878	Wm. Gill, P. M.	47	36	11	0
Pentwater, Mich	July 20, 1878	M. A. Rice	43	34	9	0
South Haven, Mich	Aug. 10, 1878	J. S. Donahue	46	19	27	0
Saint Joseph, Mich	Aug, 10, 1878	J. H. King	51	29	20	2
Traverse City, Mich	July 20, 1878	S. C. Fuller, P. M	45	26	19	0
Charlevoix, Mich	Aug. 1, 1879	W. A. Smith	38	33	5	0

Section No. 3 is under the charge of the sergeant at Detroit, Mich., through whom all signal orders are sent.

During the suspension of navigation signals are ordered for Ludington direct from the office of the Chief Signal Officer.

SECTION No. 4, ON OR NEAR LAKE HURON.

Bay City, Mich	Aug. 1, 1878	James Roberts	49	33	16	0
East Tawas, Mich	Aug. 1, 1878	E. C. French	45	33	12	0
Forester, Mich	Aug. 1, 1878	F. T. Smith	41	21	20	0
Port Austin, Mich	Aug. 1, 1878	Philip Winsor	42	33	8	1
Rogers City, Mich	Aug. 1, 1878	Henry Clothier	40	33	7	0
Monroe, Mich	Aug. 1, 1878	J. J. Hubbell	45	36	9	0
Sand Beach, Mich	Sept. 20, 1879	R. W. Irwin	37	26	11	0

Section No. 4 is under the charge of the sergeant at Detroit, Mich., through whom all signal orders are sent.

SECTION No. 5, ON LAKE ERIE.

Ashtabula, Ohio	Aug. 1, 1878	W. O. Nettleton	47	38	9	0
Dunkirk, N. Y	Aug. 1, 1878	S. T. Blakeney	48	26	22	0
Fairport, Ohio	Aug. 28, 1878	A. P. Sanford	50	39	11	0

Section No. 5 is under the charge of the sergeant at Cleveland, Ohio, through whom all signal orders are sent.

SECTION No. 7, ON THE NEW ENGLAND COAST.

Station.	Date of establishment.	Name of displayman.	Cautionary signals.				Cautionary off-shore signals.				
			Number ordered displayed.	Number reported justified.	Number reported not justified.	Number not reported upon.	Number ordered displayed.	Number reported fully justified.	Number reported justified as to direction.	Number reported justified as to velocity.	Number reported not justified.
Booth Bay, Me	Aug. 20, 1878	John O'Brien	46	28	19	0	22	14	6	....	2
Deer Isle, Me	Apr. 1, 1879	F. H. Gross	44	24	20	0	23	17	5	....	1
Portsmouth, N. H	Aug. 20, 1878	G. H. Nutter	44	15	29	0	22	10	12	....	0
Rockland, Me	June 1, 1879	W. J. Rideout	44	25	19	0	21	13	5	1	2

Section No. 7 is under the charge of the sergeant at Portland, Me., through whom all signal orders are sent.

SECTION No. 8, ON THE NEW ENGLAND COAST.

Station.	Date of establishment.	Name of displayman.	Cautionary signals.			Cautionary off-shore signals.					
			Number ordered displayed.	Number reported justified.	Number reported not justified.	Number ordered displayed.	Number reported fully justified.	Number reported justified as to direction.	Number reported justified as to velocity.	Number reported not justified.	Number not reported upon.
Chatham, Mass	Aug. 15, 1878	C. S. Nickerson	56	35	21	30	20	8	1	1	0
Fall River, Mass	Oct. 18, 1878	W. G. Bennett	17	6	11	16	5	5	2	4	0
Gloucester, Mass	Sept. 25, 1878	Edward McQuinn	50	35	15	30	17	13	0	0	0
Highland Light, Mass	Aug. 15, 1878	Isaac M. Small	50	38	12	29	21	6	2	0	0
Hyannis, Mass	Aug. 15, 1878	E. F. Lothrop	53	41	12	29	22	2	2	3	0
Marblehead, Mass	Aug. 15, 1878	Frank Dodge	52	20	32	33	16	16	0	0	1
New Bedford, Mass	Aug. 15, 1878	G. A. Gifford	51	20	31	27	13	10	4	0	0
Newburyport, Mass	Aug. 15, 1878	Capt. J. W. Sargent	52	21	31	28	13	3	0	12	0
Provincetown, Mass	Sept. 1, 1879	A. M. Kemp	46	36	10	24	18	4	0	2	0

Section No. 8 is under the charge of the sergeant at Boston, Mass., through whom all signal orders are sent.
The display of signals was suspended at Fall River, Mass., from May 12, 1879, to February 17, 1880.

List of display stations not in sections, but which receive their orders from a designated station or direct from the office of the Chief Signal Officer.

Station.	Date of establishment.	Name of displayman.	Designated station from which orders are received.	Cautionary signals.				Cautionary off-shore signals.				
				Number ordered displayed.	Number reported justified.	Number reported not justified.	Number not reported upon.	Number ordered displayed.	Number reported fully justified.	Number reported justified as to direction.	Number reported justified as to velocity.	Number reported not justified.
Cape Vincent, N. Y	Aug. 1, 1878	C. C. Brown	Oswego, N. Y	35	23	12	0					
Charlotte, N. Y	Aug. 1, 1878	A. J. Mulligan	Rochester, N. Y	37	22	13	2					
City Island, N. Y	Feb. 1, 1879	H. B. Roberts	New York, N. Y	51	40	11	0	30	29	1	0	0
Houghton, Mich	Aug. 1, 1879	J. R. Dee	Office Chief Signal Officer	36	17	19	0					
Lewes, Del	Feb. 25, 1878	C. M. Marshall	do	50	39	11	0	32	29	3	0	0
Mackinac City, Mich	Oct. 4, 1878	J. F. Stimpson	do	38	29	9	0					
Pensacola, Fla	Nov. 10, 1878	James Brown, jr	Mobile, Ala	4	4	0	0					
Port Eads, La	Oct. 10, 1878	F. C. Welschans	Office Chief Signal Officer, through the sergeant at New Orleans, La.	16	10	6	0	9	5	1	0	3
Stonington, Conn	Oct. 10, 1878	S. O. Pendleton	New London, Conn	43	16	27	0	28	14	10	2	2
Tybee Island, Ga	Feb. 15, 1879	H. J. Valleau	Savannah, Ga	10	5	5	0					

The station at Lewes was transferred to Delaware Breakwater January 27, 1880.
Pensacola became a station of the first class October 27, 1879.

The following is the record of the display stations for the year ending June 30, 1880:

ASHTABULA HARBOR, OHIO.

Established August 1, 1878.

Displayman, Mr. W. O. Nettleton.

Signals are displayed from a staff placed against the southwest corner of Mr. Nettleton's store, which stands about sixty-five feet above, and about two hundred yards from, the lake. The view of the signals from the lake is unobstructed, except from the west, where it is cut off by a high bluff. Vessels coming from that direction can see the signals when within three miles of the harbor entrance, giving them ample time to run in if they should desire to do so.

The Western Union Telegraph office is in Mr. Nettleton's store.

The station has not been inspected during the year.

BAY CITY, MICHIGAN.

Established August 1, 1878.

Displayman, Mr. James Roberts.

Signals are displayed from a staff placed on the roof of a three-story building near the bridge. The situation is a good one, as the signals can be seen from all parts of the river nearly up to Saginaw and the anchorage ground in the bay.

BOOTH BAY, MAINE.

Established August 20, 1878.

Displayman, Mr. John O'Brien.

Signals are displayed from a staff on a hill about a quarter of a mile southeast of the telegraph office. The top of the staff is about two hundred and twenty-five feet above low water. The signal is visible from all parts of the harbor, and from some distance out at sea.

The station has not been inspected during the year.

CAPE VINCENT, NEW YORK.

Established August 1, 1878.

Displayman, Mr. C. C. Brown.

Signals are displayed from a staff about twenty-five feet from the telegraph office, on the R. W. and O. wharf, and are visible to all vessels passing into and out of Lake Ontario; those using the American channel passing within three-quarters of a mile of the wharf.

The station has not been inspected during the year.

CHARLEVOIX, MICHIGAN.

Established August 1, 1879.

Displayman, Mr. W. A. Smith.

The station has not been inspected since its establishment.

CHARLOTTE, NEW YORK.

Established August 1, 1878.

Displayman, Mr. A. J. Mulligan.

Signals are displayed from a staff thirty-five feet high, on the roof of a two-story building used as a custom-house and post-office. The building is forty-five feet high, making the height of the signal above ground eighty feet. The signal may be seen from all parts of the harbor, and at the lake shore, which is half a mile distant. When the station was first established Mr. G. W. Allen was employed as displayman, but was soon after succeeded by Mr. A. J. Mulligan.

The station has not been inspected during the year.

CHATHAM, MASSACHUSETTS.

Established August 15, 1878.

Displayman, Mr. C. S. Nickerson.

Signals are displayed from a staff sixty feet in height, situated on a hill about seventy-five yards from the post-office and telegraph office. The view of the signal is unobstructed from all directions for several miles. Vessels bound between New York and Boston usually pass within sight of the signal.

The station has not been inspected during the year.

CITY ISLAND, NEW YORK.

Established February 1, 1879.

Displayman, Mr. H. B. Roberts.

The station has not been inspected during the year.

DEER ISLAND, MAINE.

Established April 1, 1879.

Displayman, Mr. F. H. Gross.

Signals are displayed from a staff about one hundred feet high, which stands near the head of the harbor, and but a few yards from the beach.

The harbor is a long, narrow strip of water, surrounded by high hills. The signal can only be seen for a few minutes by passing vessels.

The station has not been inspected during the year.

DUNKIRK, NEW YORK.

Established August 1, 1878.

Displayman, Mr. S. T. Blakeney.

Signals are displayed from a staff on the roof of the opera house, which is one block from the lake and about two blocks from the steamboat landing.

The building is one of the most prominent in the town, and the signal can be seen for several miles from the lake in all directions.

The station has not been inspected during the year.

EAST TAWAS, MICHIGAN.

Established August 1, 1878.

The display of signals at this point is under the charge of Miss Estella C. French.

Signals are displayed from a staff about eighty feet high, near the end of the wharf, and are visible from all parts of Tawas Bay, and for some distance out on Saginaw Bay.

The station has not been inspected during the year.

FAIRPORT, OHIO.

Established August 28, 1878.

Displayman, Mr. A. P. Sanford.

Signals are displayed from a staff on the west end of the roof of a warehouse near the entrance to the harbor, and about one hundred yards from the lake. Signals can be seen from all directions on the lake, and several miles out.

The station has not been inspected during the year.

FALL RIVER, MASSACHUSETTS.

Established October 18, 1878; discontinued May 12, 1879; re-established February 17, 1880.

Displayman, Mr. W. G. Bennett.

Signals are displayed from a staff on the tower of a five-story building. The top of the staff is about two hundred and fifty feet above tidewater. The signal is visible for at least ten miles in the direction of Newport, farther from the westward, and by vessels bound out from Providence. Mr. Bennett is a prominent druggist, whose store is in the building from which signals are displayed.

The station has not been inspected during the year.

FORESTER, MICHIGAN.

Established August 1, 1878.

Displayman, Mr. F. T. Smith.

Signals are displayed from a staff on the roof of a large flouring mill near the end of the wharf, and one hundred and fifty yards from the telegraph office. The top of the staff is about ninety feet above the water, and, as the shore here runs nearly north and south, the signal is very prominent.

The station has not been inspected during the year.

FRANKFORT, MICHIGAN.

Established July 20, 1878.

Displayman, Mr. C. S. Collier.

Signals are displayed from a staff which stands a few yards from and in front of the telegraph office on Main street. The signal may be seen from all parts of the harbor, and from the lake in all directions except the northwest, where the view is obstructed by a high bluff.

The station has not been inspected during the year.

GLOUCESTER, MASSACHUSETTS.

Established September 25, 1878.

Displayman, Mr. Edward McQuinn.

Signals are displayed from a staff on the roof of the custom-house, and are visible for several miles seaward. Mr. McQuinn reports that the display of signals at this place has been of great service to the fishermen, and that since the establishment of the station they have been guided to a great extent by them.

The station has not been inspected during the year.

GREEN BAY, WISCONSIN.

Established September 16, 1877.

Displayman, Mr. David Soper.

Signals are displayed from a staff on the roof of the elevator of the Chicago and Northwestern Railroad in Fort Howard, across the river from Green Bay. The signals are visible for miles in every direction. Mr. Soper reports that the signals are growing in favor with vessel-men, very few captains being willing to go out when the signal is up.

The station was inspected July 11, and found in excellent condition.

HIGHLAND LIGHT, MASSACHUSETTS.

Established August 15, 1878.

Displayman, Mr. Isaac M. Small.

Signals are displayed from a staff a few feet from the north end of the telegraph office, which is fifty yards from the edge of the cliff and three hundred yards from the light-house. Signals can be seen from a great distance in all directions, except the south; they are also plainly visible from all parts of the harbor at Provincetown. It is estimated that fifty thousand vessels pass this station each year, and as there is a good harbor, easy of access, at Provincetown, the display of signals must be of great benefit to shipping.

The station has not been inspected during the year.

HORN'S PIER, WISCONSIN.

Established March 15, 1878.

Displayman, Mr. W. H. Horn.

Signals are displayed from a staff which stands near the corner of Mr. Horn's store, about one hundred yards from the lake. The signals are visible from the lake in all directions, and for some distance out.

The station was inspected July 10, and found in excellent condition.

HOUGHTON, MICHIGAN.

Established August 1, 1879.

Displayman, Mr. J. R. Dee.

Cautionary signals are sent direct from this office.

The station has not been inspected since its establishment.

HYANNIS, MASSACHUSETTS.

Established August 15, 1878.

Displayman, Mr. Isaac M. Small.

Signals are displayed from a staff near the light-house, about one and a half miles southwest of the telegraph office and in the center of the town.

The station has not been inspected during the year.

KENOSHA, WISCONSIN.

Established September 16, 1877.

Displayman, Mr. R. H. Simmons.

Signals are displayed from a staff on the building of the Northwestern Telegraph Company.

The station was inspected July 5, and found in good condition.

KEWAUNEE, WISCONSIN.

Established September 16, 1877.

Displayman, Mr. A. D. Laughlin, P. M.

Signals are displayed from a staff which stands in front of the post-office, and about two blocks from the wharf. Signals are visible from all parts of the wharves and the lake.

The station was inspected July 9, and found in excellent condition.

LEWES, DELAWARE.

Established February 25, 1878.

Displayman, Mr. C. M. Marshall.

On April 1 this station was discontinued and property transferred to Delaware Breakwater, where a station of the Signal Service had been established.

LUDINGTON, MICHIGAN.

Established January 20, 1878.

Displayman, Mr. H. F. Alexander.

Signals are displayed from a staff that stands near the corner of Mr. Alexander's store; they are visible from all parts of the harbor, and from the lake in all directions for several miles out.

The station has not been inspected during the year.

MACKINAC CITY, MICHIGAN.

Established October 4, 1878.

Displayman, Mr. J. F. Simpson.

The flags are displayed from a staff which consists of a large pine tree, from which the branches have been cut, and a pine staff about twenty feet long fastened to the top. The top of the staff is about ninety feet above the ground, thus bringing the flag above the surrounding trees, and making it visible from all parts of the straits. The lantern, when signals are displayed at night, is placed on a platform on the top of Mr. Simpson's barn, which stands a short distance from the staff. The elevation of the lantern is sufficient to make the light visible to all passing vessels.

The station has not been inspected during the year.

MANITOWOC, WISCONSIN.

Established September 16, 1877.

Displayman, Mr. W. W. De Lano.

Signals are displayed from a staff on the roof of a building, at the end nearest the river, of the Eighth-street bridge. Signals can be seen from all parts of the harbor, and from the lake for a long distance out.

The station was inspected July 9, and found in good condition.

MARBLEHEAD, MASSACHUSETTS.

Established August 15, 1878.

Displayman, Mr. Frank Dodge.

Signals are displayed from a staff that stands a few yards north of Abbot Hall, which is on a hill overlooking the town. As the top of the staff is one hundred and twenty-seven feet above the ground, the signal can be seen for several miles from all directions. The fishing grounds are within sight of the signal, and Mr. Dodge states that a display of the "off-shore" signal is invariably followed by a return of the fishing fleet to port.

The station has not been inspected during the year.

MENOMONEE, MICHIGAN.

Established September 16, 1877.

Displayman, Mr. N. Gram.

Signals are displayed from a staff on the top of the engine-house, which stands a few yards from the beach, and may be seen from all points of the harbor.

The station was inspected July 12, and found in good condition.

MONROE, MICHIGAN.

Established August 1, 1878.

Displayman, Mr. J. J. Hubbell.

Signals are displayed from a staff on the roof of a four-story house in the central part of the town; the building is about a mile from the lake. The signal is visible for several miles out on the lake, and must be seen by all vessels passing, except those that keep close to the north shore.

The station has not been inspected during the year.

MUSKEGON, MICHIGAN.

Established February 15, 1879.

Displayman, Mr. Lafayette Freeman.

Signals are displayed from a staff on the roof of the Mason building, one of the most prominent in the town. Signals can be seen from all parts of the harbor, and from Lake Michigan for some distance.

The station has not been inspected during the year.

NEW BEDFORD, MASSACHUSETTS.

Established August 15, 1878.

Displayman, Mr. G. A. Gifford.

Signals are displayed from a staff on the end of the building in which Mr. Gifford's office is situated, and is on the dock near the foot of School street. The view of the signal is unobstruced from all parts of the harbor, and for several miles seaward. The display of signals at this station has been reported as being of great interest to the shipping, and they have been generally heeded by vessel masters. The city papers publish all signal orders.

The station has not been inspected during the year.

NEWBURYPORT, MASSACHUSETTS.

Established August 15, 1878.

Displayman, Capt. John W. Sargent.

Signals are displayed from a staff on the top of the custom-house. It stands on the dock, and there is nothing to obstruct the view of the signals from the harbor or from the sea beyond. It is reported that the fishermen closely watch the signals, and as they can be plainly seen from their fishing ground, they generally run in when one is hoisted.

The station has not been inspected during the year.

NORTHPORT, MICHIGAN.

Established July 20, 1878.

Displayman, Mr. W. Gill, P. M.

Signals are displayed from a staff in the rear of Mr. Gill's store. The telegraph office is but a short distance away. The view of the signal is unobstructed from all parts of the harbor, and may be distinctly seen with a glass from the opposite side of the bay.

The station has not been inspected during the year.

PENSACOLA, FLORIDA.

Established November 10, 1878.

Displayman, Mr. James Brown, jr.

Discontinued as a display station October 1, 1879, a station of the Signal Service having been established at this point on the above date.

PENTWATER, MICHIGAN.

Established July 20, 1878.

Displayman, Mr. M. A. Rice.

Signals are displayed from a staff immediately in front of the telegraph office, about one hundred yards from the harbor, and can be seen from all parts thereof. A high bluff extends along the lake shore, in front of the town, and cuts off all view of the signals from passing vessels, except during the time they are going by the entrance to the harbor. Mr. Rice reports that the display signals at this station are growing more and more popular.

The station has not been inspected during the year.

PORT AUSTIN, MICHIGAN.

Established August 1, 1878.

Displayman, Mr. Philip Winsor.

Signals are displayed from a staff which stands a few yards from the store of Messrs. Carrington & Winsor. Signals may be easily seen by vessels bound in and out of the bay.

The station has not been inspected during the year.

PORT EADS, LOUISIANA.

Established October 10, 1878.

Displayman, Mr. F. C. Welschhans.

Signals are displayed from a tower one hundred and ten feet above ground. This station is one hundred and five miles below New Orleans, on the east bank of the South Pass of the Mississippi River, two miles from the bar, and three miles from the head of the pass.

This station has not been inspected during the year.

PORTSMOUTH, NEW HAMPSHIRE.

Established August 20, 1878.

Displayman, Mr. G. H. Nutter.

Signals are displayed from a staff on the building next to the corner of Daniel and Market streets. The view of the signal is unobstructed from the harbor and its entrance, and at times may be seen from the Isle of Shoals.

The station has not been inspected during the year.

PROVINCETOWN, MASSACHUSETTS.

Established September 1, 1879.

Displayman, Mr. A. M. Kemp.

The station has not been inspected since its establishment.

RACINE, WISCONSIN.

Established September 16, 1877.

Displayman, Mr. G. W. Scanlon.

The signal is displayed from a staff on the roof of the warehouse of the Goodrich Steamboat Company, which is on the dock at the harbor entrance. The signal is visible from all parts of the harbor, and for a long distance out on the lake.

The station was inspected July 7, and found in good condition.

ROCKLAND, MAINE.

Established June 1, 1879.

Displayman, Mr. W. H. Waltham.

The station has not been inspected since its establishment.

ROGERS CITY, MICHIGAN.

Established August 1, 1878.

Displayman, Mr. Henry Clothier.

Signals are displayed from a staff a few yards south of the telegraph office, which is about seventy-five yards from the wharf. The usual course of passing vessels is within five miles of this station. Owing to the background of pine trees, signals are not easily distinguished by the naked eye, but can be easily seen with a glass from the vessels. The telegraph line along the eastern shore of Michigan, for a great part of the way, passes through pine timber, and is frequently broken by falling trees.

The station has not been inspected during the year.

SAINT JOSEPH, MICHIGAN.

Established August 10, 1878.

Displayman, Mr. J. H. King.

Signals are displayed from a staff situated on the roof of the Lake House, which stands on a high bluff near the lake. The view of the signal is unobstructed from all directions.

The station has not been inspected during the year.

SAND BEACH, MICHIGAN.

Established September 20, 1879.

Displayman, Mr. R. W. Irwin.

This station has not been inspected since its establishment.

SHEBOYGAN, WISCONSIN.

Established September 16, 1877.

Displayman, Mr. J. L. Mallery.

The staff stands near the post-office, and is the property of the Signal Service.

The station was inspected July 8, and found in good condition.

SOUTH HAVEN, MICHIGAN.

Established August 10, 1878.

Displayman, Captain J. S. Donahue.

Signals are displayed from a staff upon a high bluff in the rear of the light-house, immediately at the entrance to the harbor, and are visible for miles on the lake.

The station has not been inspected during the year.

STONINGTON, CONNECTICUT.

Established August 10, 1878.

Displayman, Mr. S. O. Pendleton.

Signals are displayed from a staff in the northwest corner of the yard of the light-house, and can be seen for several miles from every direction. Mr. Pendleton has had a telegraph line put up between the light-house and the telegraph office, over half a mile distant. He states that coasters pay a great deal of attention to the signals, seldom leaving port, and often coming in, when one is displayed.

The station has not been inspected during the year.

STURGEON BAY, WISCONSIN.

Established September 16, 1877.

Displayman, Mr. T. A. Pieplow.

Signals are displayed from a staff near Leonhardt Music Hall, and about a block east of the telegraph office, which is two blocks from the wharf. The signals are visible from the harbor of refuge, at the Lake Michigan end of the canal, and also from Green Bay.

The station was inspected July 10, and found in good condition.

TRAVERSE CITY, MICHIGAN.

Established July 20, 1878.

Displayman, Mr. S. C. Fuller.

Signals are displayed from a staff on the roof of the post-office building, and can be seen from all parts of the bay. The telegraph office is in the same building.

The station has not been inspected during the year.

TYBEE ISLAND, GEORGIA.

Established February 15, 1879.

Displayman, Mr. H. J. Valleau.

The station has not been inspected during the year.

Table showing the location of the special river stations, east of the Rocky Mountains, reporting to the Chief Signal Officer, the names of the observers, the date at which each began reporting originally, and the highest and lowest water at each during the year ending June 30, 1880.

	Stations.	Rivers.	Name of observer.	Commenced reporting.	Highest water.		Date of highest water.	Lowest water.		Date of lowest water.
					Feet.	Inches.		Feet.	Inches.	
1	Freeport, Pa	Alleghany	M. H. Alter	Apr. 17, 1873	17	6	January 1, 1880	—0	*0	October 16, 17, 19, 20, 23, and 24, 1879.
2	Hermann, Mo	Missouri	Edward Kehr	Apr. 24, 1873	15	1	July 2, 1879	—0	*10	December 22, 1879.
3	Jefferson City, Mo	do	Louis C. Lohman	May 12, 1873	14	4	July 1 and 2, 1879	0	4	December 22 to 25, 1879.
4	Oil City, Pa	Alleghany	W. R. Stevenson, C. E	Apr. 20, 1873	7	2	November 16, 1879	—0	*6	October 6 and 7, and 16 to 18, 1879.
5	Brownsville, Pa	Monongahela	J. Allen Hubbs	June 6, 1873	23	0	February 14, 1880	2	7	October 18, 19, 24, and 25, 1879.
6	Evansville, Ind	Ohio	J. P. Elliott	Apr. 21, 1873	42	1	February 21, 1880	0	5	October 28 and 29, 1879.
7	Confluence, Pa	Youghiogheny	M. Tannehill	Apr. 23, 1873	9	7	June 15, 1880	—0	*8	October 8 to 10, 1879.
8	New Geneva, Pa	Monongahela	H. T. Davenport	Apr. 24, 1873	26	3	February 14, 1880	0	9	November 1 to 9, 1879.
9	Lexington, Mo	Missouri	Z. S. Mitchell	Apr. 28, 1873	16	3	July 1, 1879	0	1	January 10 to 12, and 22, and February 7, 1880.
10	Kansas City, Mo	do	W. A. M. Vaughan	Apr. 21, 1873	18	9	July 7, 1879	2	7	March 19, 1880.
11	Brunswick, Mo	do	G. D. Kennedy	May 1, 1873	12	3	July 1, 1879	—4	*0	March 20, 21 and 22, 1880.
12	Plattsmouth, Nebr	do	A. L. Child, M. D	Apr. 20, 1873	11	11	July 5, 1879	—1	*3	March 15, 1880.
13	Marietta, Ohio	Ohio	C. J. Best	Apr. 19, 1873	31	6	February 16, 1880	1	8	October 25 and 28, 1879; October 31 to November 1, 1879.
14	Saint Joseph, Mo	Missouri	Robert Gunn	May 8, 1873	15	0	July 1, 1879	—0	*2	December 20 and 27, 1879.
15	Warsaw, Ill	Mississippi	D. H. Cox	May 7, 1873	19	9	June 28, 1880	0	10	December 21 and 22, 1879.
16	Paducah, Ky	Ohio	John Bachmann	May 1, 1873	44	0	May 22 and 23, 1880	0	8	October 16, 1879.
17	Boonville, Mo	Missouri	Charles W. Hazell	Apr. 28, 1873	17	0	July 1, 1879	—2	*5	December 20, 1879.
18	Le Claire, Iowa	Mississippi	C. P. Disney	June 2, 1873	14	6	June 25, 1880	0	8	December 15, 1879, and February 3, 1880.
19	Helena, Ark	do	J. B. Miles	Feb. 25, 1874	43	8	March 30, 1880	4	11	November 14, 1879.
20	Decatur, Ala	Tennessee	Miss A. G. Hoxter	Oct. 1, 1875	21	8	March 19 to 22, 1880	0	1	October 3 to 10, 1879.
21	Johnsonville, Tenn	do	W. H. Johnson	Oct. 1, 1875	37	8	March 23 and 24, 1880	†0	0	September 27 to October 1, 1879.
22	Muscatine, Iowa	Mississippi	William Molis	Jan. 1, 1878	17	6	July 26 and 27, 1879	1	11	September 20 to October 12, 1879.
23	Fort Smith, Ark	Arkansas	George H. Williams	Apr. 13, 1879	5	11	April 5, 1880	—5	*7	October 7 to 15, 1879.

* Below bench-mark.

† At bench-mark.

Table showing the location of the special river stations on the Pacific Slope reporting to the Chief Signal Officer, the names of the observers, the date at which each began reporting originally, the highest and lowest water at each, and the period in which observations were taken, during the year ending June 30, 1880.

	Station.	Rivers.	Name of observer.	Commenced reporting.	Period in which observations were taken.	Highest water.		Date of highest water.	Lowest water.		Date of lowest water.
						Feet.	Inches.		Feet.	Inches.	
1	Albany, Oreg	Willamette ...	A. Monteith	Nov. 24, 1878	June 29, 1879, to May 1, 1880.	23	6	Dec. 7, 1879	0	2	September 25 to 27, 1879.
2	Colusa, Cal	Sacramento ...	P. L. Washburn...	Jan. 10, 1879	November 2, 1879, to April 24, 1880.	25	4	Dec. 21, 1879	0	5	November 3, 4, 5 and 6, 1879.
3	Eugene City, Oreg ..	Willamette ...	J. Kemble Peters.	Dec. 1, 1878	November 15 to December 15, 1879, and February 15 to March 15, 1880.	17	0	Dec. 5, 1879	1	9	November 28, 29 and 30, 1879.
4	Folsom City, Cal....	American.....	C. L. Ecklon	Dec. 15, 1878	December 15, 1879, to March 15, 1880.	10	9	Dec. 20, 1879	5	9	January 6 and 7, 1880.
5	Marysville, Cal	Yuba	E. J. Lockwood ...	Dec. 15, 1878	November 2, 1879, to March 20, 1880.	4	4	Dec. 20, 1879	—0	*1	February 2, 3, 4 and 5, 1880.
6	Oroville, Cal	Feather.......	R. W. Smith	Dec. 15, 1878	November 2, 1879, to April 24, 1880.	6	5	Dec. 27, 1879	1	3	November 2, 3, 4, 5 and 6, 1879.

* Water below bench-mark.

Observations are taken at these stations during the rainy season, and when the water approaches the danger-line reports of the depth of the same are telegraphed daily to certain designated stations on the lower waters of the rivers on which they are located, and continued until danger to property along the banks is passed. Mail reports are also forwarded weekly to this office.

WEST INDIAN STATIONS.

BRIDGETOWN, BARBADOES.

[*Official number*, 8.]

Latitude	13° 4′ 12″
Longitude	59° 37′ 0″
Elevation of barometer above mean sea-level	22.0 feet.

Observer, Mr. Edwin Racker.

The office is in the second story of the observer's residence.

Two observations were taken daily from August to October, at hours synchronous with those at which the a. m. and p. m. observations are taken at Washington, and forwarded to this office by telegraph.

The station was inspected in April, and the observer found to be well informed in regard to his duties. The barometers were cleaned, and such instructions as were necessary in regard to the care of instruments, rendition of reports, &c., were given.

HAVANA, CUBA.

[*Official number*, 100.]

Latitude	23° 9′ 24″
Longitude	82° 22′ 0″
Elevation of barometer above mean sea-level	21.6 feet.

Observer, Mr. Charles H. Hasselbrink.

The office is in the second story of the observer's residence.

Three observations have been taken daily at hours synchronous with those at which the a. m., p. m., and midnight observations are taken at Washington. Two of these observations, the a. m. and p. m., have been telegraphed to this office. The three observations have been forwarded by mail weekly. Through the courtesy of Mr. H. C. Hall, consul-general, all reports from this station are forwarded in the consular mail.

The station was inspected in March, and found in good condition. The observer was found to understand his duties, and to be very attentive to them. The barometers were cleaned, and such suggestions and instructions in regard to care of instruments, rendition of reports, &c., as were necessary were given.

KINGSTON, JAMAICA.

[*Official number*, 4.]

Latitude	17° 58′ 0″
Longitude	76° 47′ 30″
Elevation of barometer above mean sea-level	30.2 feet.

Mr. James Gall is nominally in charge of this station, and responsible for the property and for the proper performance of the duties. Mr. Alfred Stewart, in the employ of Mr. Gall, is the meteorological observer. The office is in the Myrtle Bank building.

Two observations have been taken daily during the year at hours synchronous with those at which the a. m. and p. m. observations are taken at Washington, and forwarded to this office by telegraph. Weekly reports are also forwarded by mail.

The station was inspected in May, and found in an unsatisfactory condition. The observer did not understand the proper method of per-forming many of his duties. The instruments were cleaned, and in some instances given a better exposure. The observer was instructed thoroughly as to the manner in which his duties were performed.

On June 1 a station was established at Park Lodge by Mr. Maxwell Hall, who had visited this office and obtained the necessary instructions in regard to conducting the work.

The a. m. and p. m. observations are telegraphed to this office daily. These are taken at hours synchronous with 7 a. m. and 3 p. m., Washington mean time. The additional observations are also taken and forwarded to this office by mail. The 11 p. m. (Washington mean time) observation will be telegraphed to this office when the necessary arrangements can be made with the telegraph company.

This is the first of a number of stations that it is proposed to establish in the West Indies under the direction of Mr. Maxwell Hall.

NAVASSA ISLAND.

[*No official number.*]

Latitude	18° 25′
Longitude	75° 3′
Elevation of barometer above mean sea level	77.3 feet.

Observer, Mr. F. M. Everett.

Two observations have been taken daily during the year, at hours synchronous with those at which the a. m. and p. m. observations are taken at Washington, and forwarded to this office weekly by mail.

The station has not been inspected.

POINT-A-PITRE, GUADELOUPE.

[*Official number*, 9.]

Latitude	16° 3′
Longitude	61° 30′
Elevation of barometer above mean sea-level	20.0 feet.

Observer, Mr. L. V. Bigard.

Two observations were taken daily during the months of September and October at hours synchronous with those at which the a. m. and p. m. observations were taken at Washington, and forwarded to this office by telegraph.

The station has not been inspected.

SAINT THOMAS, S. T.

[*Official number*, 102.]

Latitude	18° 20′ 24″
Longitude	64° 55′ 45″
Elevation of barometer above mean sea-level	12.5 feet.

Observer, Mr. G. O. Gyllich.

The office is in the residence of the observer.

Two observations were taken daily during August, September, and October at hours synchronous with those at which the a. m. and p. m. observations were taken at Washington, and reported to this office by telegraph. Mail reports were also received for the above months.

The station was inspected in April, and found in an unsatisfactory condition. The instruments were poorly exposed, the reports improperly transmitted, and no records kept at the station. Miss Gyllich, daughter of the observer, was found to be familiar with the duties, and was placed in charge of the meteorological work of the station.

SANTIAGO DE CUBA, CUBA.

[*Official number*, 3.]

Latitude	19° 55′
Longitude	75° 50′
Elevation of barometer above mean sea-level	7.05 feet.

Mr. T. W. Beattie is in charge of the station. Mr. Robert Mason attends to the meteorological duties.

The office is in the warehouse of Brooks & Co.

Two observations were taken daily during the months of August, September, and October at hours synchronous with those at which the a. m. and p. m. observations were taken at Washington, and reported to this office by telegraph. Mail reports were also forwarded weekly.

The station was inspected in April, and found in a satisfactory condition. The observer was familiar with, and attentive to, his duties.

BRITISH-AMERICAN STATIONS.

SAINT JOHN'S, NEWFOUNDLAND.

[*Official number*, 10.]

Latitude	44° 17′
Longitude	66° 3′
Elevation of barometer above mean sea-level	150.0 feet.

The Hon. John Delaney continues to report by mail (weekly) to this office. Three daily observations are taken by him, two of which, the a. m. and p. m., are taken at hours synchronous with those at which the Washington observations are taken.

SAINT ANDREWS, NEW BRUNSWICK.

[*Official number*, 193.]

Latitude	45° 4′ 3″
Longitude	67° 3′ 0″
Elevation of barometer above mean sea-level	45.0 feet.

Observer, Dr. Gove.

Three observations are taken daily, at hours simultaneous with the telegraphic series of the United States, and forwarded to this office by mail weekly.

STAYNER, ONTARIO.

[*Official number*, 128.]

Latitude	44° 25′
Longitude	80° 15′
Elevation of barometer above mean sea-level	714.0 feet.

Two observations were taken daily, except Sunday, simultaneous with the a. m. and p. m. telegraphic series of the United States, from July 1 to August 2, 1879, since which time no reports have been received.

YORK FACTORY, HUDSON'S BAY TERRITORY.

[*Official number*, 11.]

Latitude	57° 2′
Longitude	92° 26′
Elevation of barometer above mean sea-level	45.00 feet.

Observers, J. Fortescue and W. Wood.

Four observations have been taken daily, one at 7 a. m., 2 p. m., and 9 p. m., local time, respectively, and one synchronous with 7.35 a. m., Washington mean time, and forwarded to this office, by mail, on weekly forms.

EDMONTON, NORTHWEST TERRITORY.

Latitude	53° 31′
Longitude	113° 38′

Three observations were taken daily, at hours simultaneous with the United States telegraphic series, and reported tri-daily by telegraph from December 29, 1879, to April 25, 1880, after which date they were discontinued.

PRINCE ARTHUR'S LANDING, ONTARIO.

Latitude	48° 27′
Longitude	89° 12′

Three observations were taken daily, at hours simultaneous with the United States telegraphic series, and reported tri-daily by telegraph from November 13, 1879, to April 30, 1880, on which date reports were discontinued.

BATTLEFORD, NORTHWEST TERRITORY.

Latitude	52° 41′
Longitude	108° 30′

Three observations were taken daily, at hours simultaneous with the United States telegraphic series, and reported tri-daily by telegraph from November 24, 1879, to April 25, 1880, on which date reports were discontinued.

HUMBOLDT, NORTHWEST TERRITORY.

Latitude	52° 11′
Longitude	105° 12′

Three observations were taken daily, at hours simultaneous with the United States telegraphic series, and reported tri-daily by telegraph from November 14, 1879, to April 25, 1880, on which date reports were discontinued.

DOMINION OF CANADA.

Telegraphic reports have been regularly received during the year from the stations named below, after concentration at the central office of the Dominion meteorological system in Toronto:

CHATHAM, NEW BRUNSWICK.

[*Official number*, 2.]

Latitude	47° 1′
Longitude	65° 30′
Elevation of barometer above mean sea-level	56.0 feet.

Three observations have been taken daily, at hours simultaneous with the United States telegraphic series, and regularly forwarded to this office, tri-daily by telegraph and weekly by mail.

FATHER POINT, QUEBEC.

[*Official number*, 5.]

Latitude	48° 31′ 25″
Longitude	68° 27′ 40″
Elevation of barometer above mean sea-level	20.0 feet.

Three observations have been taken daily, at hours simultaneous with the United States telegraphic series, and regularly forwarded to this office, tri-daily by telegraph and weekly by mail.

FORT GARRY, MANITOBA.

[*Official number*, 88.]

Latitude	49° 52′
Longitude	97° 0′
Elevation of barometer above mean sea-level	754.0 feet.

Three observations have been taken daily, at hours simultaneous with the United States telegraphic series, and regularly forwarded to this office, tri-daily by telegraph and weekly by mail.

HALIFAX, NOVA SCOTIA.

[*Official number*, 89.]

Latitude	44° 39′ 20″
Longitude	63° 39′ 40″
Elevation of barometer above mean sea-level	122 feet.

Three observations have been taken daily, at hours simultaneous with the United States telegraphic series, and regularly forwarded to this office, tri-daily by telegraph and weekly by mail.

KINGSTON, ONTARIO.

[*Official number*, 80.]

Latitude	44° 12′
Longitude	75° 41′
Elevation of barometer above mean sea-level	335.0 feet.

Three observations have been taken daily, at hours simultaneous with the United States telegraphic series, and regularly forwarded to this office, tri-daily by telegraph and weekly by mail.

MONTREAL, QUEBEC.

[*Official number*, 56.]

Latitude	45° 31′ 0″
Longitude	73° 33′ 14″
Elevation of barometer above mean sea-level	182 feet.

Three observations have been taken daily, at hours simultaneous with the United States telegraphic series, and regularly forwarded to this office, tri-daily by telegraph and weekly by mail.

PARRY SOUND, ONTARIO

[*Official number*, 108.]

Latitude	45° 22′ 0″
Longitude	80° 12′ 45″
Elevation of barometer above mean sea-level	635.0 feet.

Three observations have been taken daily, at hours simultaneous with the United States telegraphic series, and regularly forwarded to this office, tri-daily by telegraph and weekly by mail.

QUEBEC, QUEBEC.

[*Official number*, 57.]

Latitude	46° 48′
Longitude	71° 12′
Elevation of barometer above mean sea-level	293 feet.

Three observations have been taken daily, at hours simultaneous with the United States telegraphic series, and regularly forwarded to this office, tri-daily by telegraph and weekly by mail.

ROCKLIFFE, ONTARIO.

[*Official number*, 7.]

Latitude	46° 10′
Longitude	77° 45′
Elevation of barometer above mean sea-level	418.0 feet.

Three observations have been taken daily, at hours simultaneous with the United States telegraphic series, and regularly forwarded to this office, tri-daily by telegraph and weekly by mail.

SAUGEEN, ONTARIO.

[*Official number*, 8.]

Latitude	44° 40′
Longitude	81° 10′
Elevation of barometer above mean sea-level	656.3 feet.

Three observations have been taken daily, at hours simultaneous with the United States telegraphic series, and regularly forwarded to this office, tri-daily by telegraph and weekly by mail.

SYDNEY, CAPE BRETON.

[*Official number*, 6.]

Latitude	46° 12′
Longitude	60° 12′
Elevation of barometer above mean sea-level	27 feet.

Three observations have been taken daily, at hours simultaneous with the United States telegraphic series, and regularly forwarded to this office, tri-daily by telegraph and weekly by mail.

TORONTO, ONTARIO.

[*Official number*, 58.]

Latitude	49° 39′ 4″
Longitude	79° 23′ 15″
Elevation of barometer above mean sea-level	350 feet.

Three observations have been taken daily, at hours simultaneous with the United States telegraphic series, and regularly forwarded to this office, tri-daily by telegraph and weekly by mail.

CHARLOTTETOWN, P. E. ISLAND.

[*Official number*, 127.]

Latitude	46° 14′
Longitude	63° 10′
Elevation of barometer above mean sea-level	38 feet.

Three observations are taken daily, at hours simultaneous with the telegraphic series of the United States, and sent to this office by mail weekly.

PORT DOVER, ONTARIO.

[*Official number*, 79.]

Latitude	42° 47′
Longitude	80° 13′
Elevation of barometer above mean sea-level	635. 0 feet.

Three observations are taken daily, at hours simultaneous with the telegraphic series of the United States, and sent to this office by mail weekly.

PORT STANLEY, ONTARIO.

[*Official number*, 78.]

Latitude	42° 40′ 0″
Longitude	81° 13′ 30″
Elevation of barometer above mean sea-level	592 feet.

Three observations have been taken daily, at hours simultaneous with the telegraphic series of the United States, and sent to this office by mail weekly.

PUBLICATIONS.

(*For year ending June* 30, 1880.)

Farmers' Bulletins	1,774,921
Manifold Bulletins	299,968
Maps	111,511
Local Reports	64,747
Forms 15 (Synopsis and Indications)	65,297
Forms 22 (Monthly means)	8,530
Forms 26 (River Bulletins)	34,058
Weekly Chronicles	7,500
Monthly Weather Reviews	22,800
International Bulletins	160,250
Total	2,549,582

GENERAL SUMMARY.

UNITED STATES STATIONS.

Statement showing number of stations, Signal Service, U. S. A., in operation June 30, 1880.

Number of regular stations taking seven observations daily, and making full reports three times a day by telegraph	10
Number of United States military telegraph stations taking three observations daily, and making full reports three times a day by telegraph	26
Number of regular stations taking seven observations daily, and making full reports once a day by telegraph	1
Number of regular stations taking six observations daily, and reporting twice a day by telegraph	1
Number of regular stations taking six observations daily, and making sunset reports by telegraph	1
Number of regular stations taking seven observations daily, and reporting by mail weekly	10
Number of United States military telegraph stations taking three observations daily, and reporting by mail weekly, and sunset reports by telegraph	19
Number of United States military telegraph stations taking sunset observations only, reporting monthly by mail, and by telegraph daily when the observer is not absent from the station on repair duty	11
Number of United States military telegraph stations at which no observations are taken	44
Number of printing stations taking sunset observations daily, and reporting monthly by mail	3
Number of regular stations taking three observations daily, and reporting by mail as opportunity offers	1
Number of supply stations	1
Number of display and repair stations	1
Number of flying-stations on sea-coast taking sunset observations daily, and reporting monthly by mail	3
Number of flying-stations on sea-coast sending in partial reports once a day by telegraph	1
Number of United States military telegraph stations taking four observations daily, and reporting three times a day by telegraph	2
Number of United States military telegraph stations taking four observations daily, sending sunset reports by telegraph and weekly reports by mail	1
Number of display stations	50
Number of sunset stations	28
Number of special river stations	29
Total	343

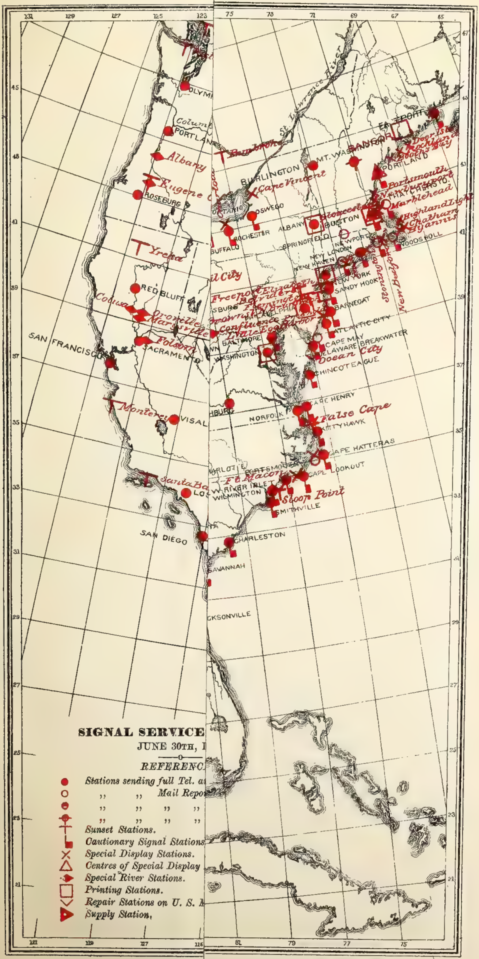
Number of regular stations discontinued during the year	1

WEST INDIAN STATIONS.

Number of stations reporting daily by telegraph and weekly by mail during the year	1
Number of stations reporting weekly by mail during the year	1
Number of stations reporting weekly by mail and telegraph during a portion of the year	3
Total	5

CANADIAN AND BRITISH-AMERICAN STATIONS.

Number of stations making full reports by mail and telegraph during the year	13
Number of stations making full reports by mail only	4
Number of stations making reports by telegraph during a portion of the year	3
Total	20


SIGNAL SERVICE
JUNE 30TH, 1
REFERENC
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Sunset Stations.
Cautionary Signal Stations
Special Display Stations.
Centres of Special Display
Special River Stations.
Printing Stations.
Repair Stations on U. S.
Supply Station,
OLYMI
PORTLAN
Albany
Eugene
ROSEBURG
Yreka
RED BLUFF
Colusa
Oroville
Marysville
SAN FRANCISCO
Folsom
SACRAMENTO
Monterey
VISAL
Santa Ba
LO
SAN DIEGO
St. Lawrence River
BURLINGTON
Cape Vincent
MT. WASHINGTON
BANGOR
EASTPORT
PORTLAND
Portsmouth
Newburyport
Marblehead
Gloucester
BOSTON
Highland Light
Chatham
Hyannis
WOODS HOLL
NEWPORT
New Bedford
Stonington
NEW LONDON
NEW HAVEN
SPRINGFIELD
ALBANY
OSWEGO
ROCHESTER
BUFFALO
NEW YORK
SANDY HOOK
BARNEGAT
ATLANTIC CITY
CAPE MAY
DELAWARE BREAKWATER
Ocean City
CHINCOTEAGUE
BALTIMORE
WASHINGTON
CAPE HENRY
NORFOLK
False Cape
KITTY HAWK
CAPE HATTERAS
CAPE LOOKOUT
PORTSMOUTH
Ft. Macon
RIVER INLET
WILMINGTON
Sloop Point
SMITHVILLE
CHARLESTON
SAVANNAH
CKSONVILLE
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GENERAL SUMMARY.

UNITED STATES STATIONS.

Statement showing number of stations, Signal Service, U. S. A., in operation June 30, 1880.

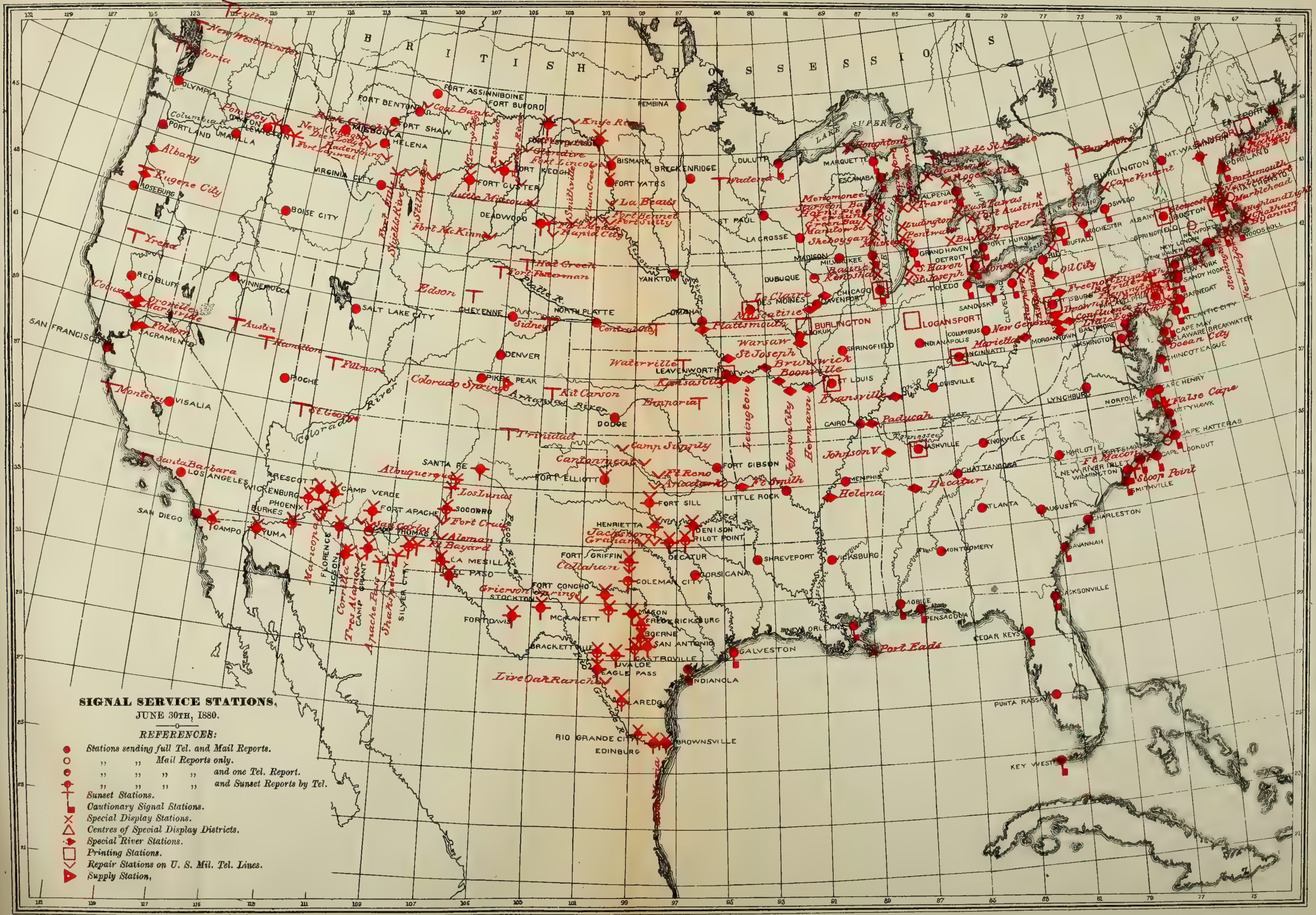
Number of regular stations taking seven observations daily, and making full reports three times a day by telegraph	10
Number of United States military telegraph stations taking three observations daily, and making full reports three times a day by telegraph	26
Number of regular stations taking seven observations daily, and making full reports once a day by telegraph	1
Number of regular stations taking six observations daily, and reporting twice a day by telegraph	1
Number of regular stations taking six observations daily, and making sunset reports by telegraph	1
Number of regular stations taking seven observations daily, and reporting by mail weekly	10
Number of United States military telegraph stations taking three observations daily, and reporting by mail weekly, and sunset reports by telegraph	19
Number of United States military telegraph stations taking sunset observations only, reporting monthly by mail, and by telegraph daily when the observer is not absent from the station on repair duty	11
Number of United States military telegraph stations at which no observations are taken	44
Number of printing stations taking sunset observations daily, and reporting monthly by mail	3
Number of regular stations taking three observations daily, and reporting by mail as opportunity offers	1
Number of supply stations	1
Number of display and repair stations	1
Number of flying-stations on sea-coast taking sunset observations daily, and reporting monthly by mail	3
Number of flying-stations on sea-coast sending in partial reports once a day by telegraph	1
Number of United States military telegraph stations taking four observations daily, and reporting three times a day by telegraph	2
Number of United States military telegraph stations taking four observations daily, sending sunset reports by telegraph and weekly reports by mail	1
Number of display stations	50
Number of sunset stations	28
Number of special river stations	29
Total	343
Number of regular stations discontinued during the year	1

WEST INDIAN STATIONS.

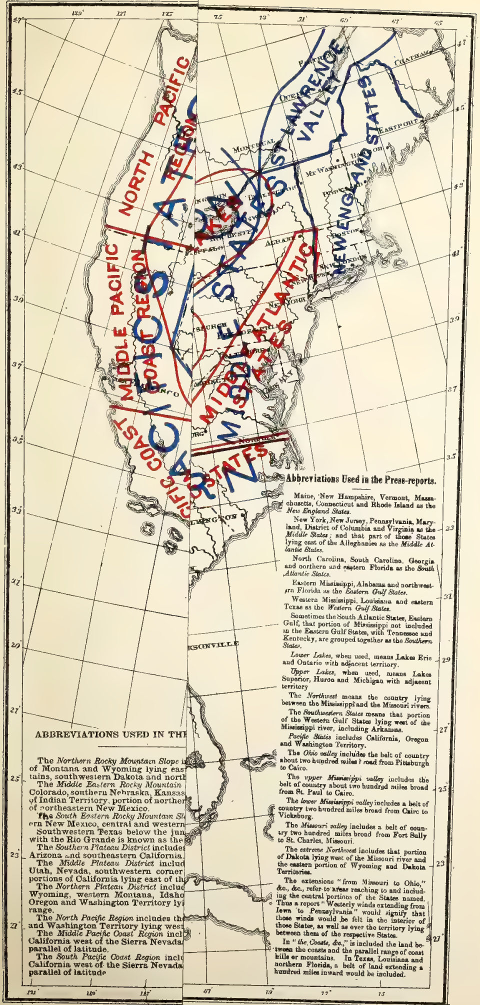
Number of stations reporting daily by telegraph and weekly by mail during the year	1
Number of stations reporting weekly by mail during the year	1
Number of stations reporting weekly by mail and telegraph during a portion of the year	3
Total	5

CANADIAN AND BRITISH-AMERICAN STATIONS.

Number of stations making full reports by mail and telegraph during the year	13
Number of stations making full reports by mail only	4
Number of stations making reports by telegraph during a portion of the year	3
Total	20



SIGNAL SERVICE STATIONS,
JUNE 30TH, 1880.



Abbreviations Used in the Press-reports.

Maine, New Hampshire, Vermont, Massachusetts, Connecticut and Rhode Island as the *New England States.*

New York, New Jersey, Pennsylvania, Maryland, District of Columbia and Virginia as the *Middle States*; and that part of those States lying east of the Alleghanies as the *Middle Atlantic States.*

North Carolina, South Carolina, Georgia and northern and eastern Florida as the *South Atlantic States.*

Eastern Mississippi, Alabama and northwestern Florida as the *Eastern Gulf States.*

Western Mississippi, Louisiana and eastern Texas as the *Western Gulf States.*

Sometimes the South Atlantic States, Eastern Gulf, that portion of Mississippi not included in the Eastern Gulf States, with Tennessee and Kentucky, are grouped together as the *Southern States.*

Lower Lakes, when used, means Lakes Erie and Ontario with adjacent territory.

Upper Lakes, when used, means Lakes Superior, Huron and Michigan with adjacent territory

The *Northwest* means the country lying between the Mississippi and the Missouri rivers.

The *Southwestern States* means that portion of the Western Gulf States lying west of the Mississippi river, including Arkansas.

Pacific States includes California, Oregon and Washington Territory.

The *Ohio valley* includes the belt of country about two hundred miles broad from Pittsburgh to Cairo.

The *upper Mississippi valley* includes the belt of country about two hundred miles broad from St. Paul to Cairo.

The *lower Mississippi valley* includes a belt of country two hundred miles broad from Cairo to Vicksburg.

The *Missouri valley* includes a belt of country two hundred miles broad from Fort Sully to St. Charles, Missouri.

The *extreme Northwest* includes that portion of Dakota lying west of the Missouri river and the eastern portion of Wyoming and Dakota Territories.

The extensions "from Missouri to Ohio," &c., &c., refer to areas reaching to and including the central portions of the States named. Thus a report "Westerly winds extending from Iowa to Pennsylvania" would signify that those winds would be felt in the interior of those States, as well as over the territory lying between them of the respective States.

In "*the Coasts, &c.,*" is included the land between the coasts and the parallel range of coast hills or mountains. In Texas, Louisiana and northern Florida, a belt of land extending a hundred miles inward would be included.

ABBREVIATIONS USED IN THE

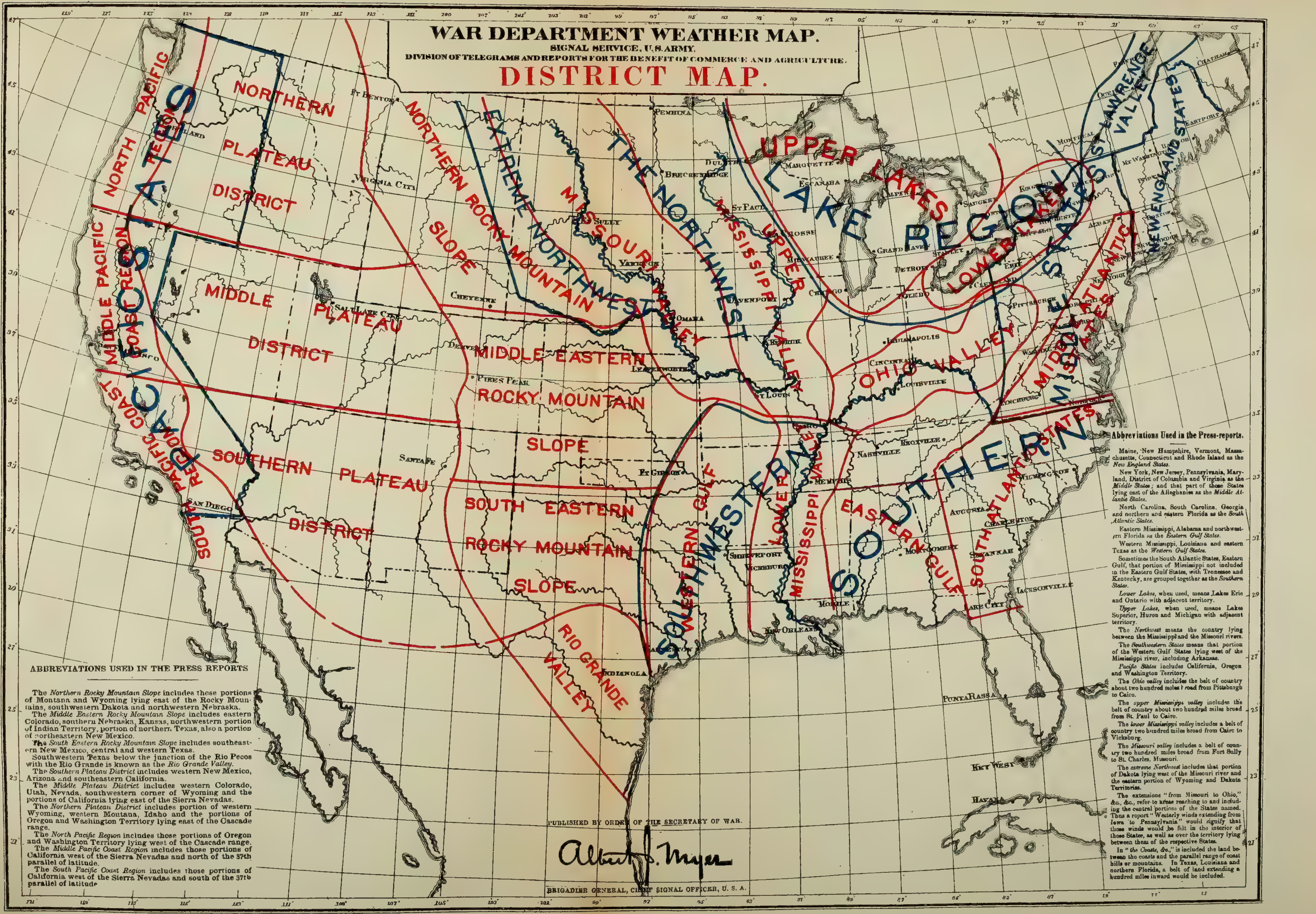
The *Northern Rocky Mountain Slope* i
of Montana and Wyoming lying eas
tains, southwestern Dakota and north
The *Middle Eastern Rocky Mountain*
Colorado, southern Nebraska, Kansas
of Indian Territory, portion of norther
of northeastern New Mexico.
The *South Eastern Rocky Mountain Sl*
ern New Mexico, central and western
Southwestern Texas below the jun
with the Rio Grande is known as the
The *Southern Plateau District* includes
Arizona and southeastern California.
The *Middle Plateau District* includ
Utah, Nevada, southwestern corner
portions of California lying east of th
The *Northern Plateau District* incluc
Wyoming, western Montana, Idaho
Oregon and Washington Territory lyi
range.
The *North Pacific Region* includes th
and Washington Territory lying west
The *Middle Pacific Coast Region* incl
California west of the Sierra Nevada
parallel of latitude.
The *South Pacific Coast Region* inclu
California west of the Sierra Nevada
parallel of latitude

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

DISTRICT MAP.



ABBREVIATIONS USED IN THE PRESS REPORTS

The *Northern Rocky Mountain Slope* includes those portions of Montana and Wyoming lying east of the Rocky Mountains, southwestern Dakota and northwestern Nebraska.

The *Middle Eastern Rocky Mountain Slope* includes eastern Colorado, southern Nebraska, Kansas, northwestern portion of Indian Territory, portion of northern Texas, also a portion of northeastern New Mexico.

The *South Eastern Rocky Mountain Slope* includes southeastern New Mexico, central and western Texas.

Southwestern Texas below the junction of the Rio Pecos with the Rio Grande is known as the *Rio Grande Valley*.

The *Southern Plateau District* includes western New Mexico, Arizona and southeastern California.

The *Middle Plateau District* includes western Colorado, Utah, Nevada, southwestern corner of Wyoming and the portions of California lying east of the Sierra Nevadas.

The *Northern Plateau District* includes portion of western Wyoming, western Montana, Idaho and the portions of Oregon and Washington Territory lying east of the Cascade range.

The *North Pacific Region* includes those portions of Oregon and Washington Territory lying west of the Cascade range.

The *Middle Pacific Coast Region* includes those portions of California west of the Sierra Nevadas and north of the 37th parallel of latitude.

The *South Pacific Coast Region* includes those portions of California west of the Sierra Nevadas and south of the 37th parallel of latitude

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIGADIER GENERAL, CHIEF SIGNAL OFFICER, U. S. A.

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The *lower Mississippi valley* includes a belt of country two hundred miles broad from Cairo to Vicksburg.

The *Missouri valley* includes a belt of country two hundred miles broad from Fort Sully to St. Charles, Missouri.

The *extreme Northwest* includes that portion of Dakota lying west of the Missouri river and the eastern portion of Wyoming and Dakota Territories.

The extensions "from Missouri to Ohio," &c., &c., refer to areas reaching to and including the central portions of the States named. Thus a report "Westerly winds extending from Iowa to Pennsylvania" would signify that those winds would be felt in the interior of those States, as well as over the territory lying between them of the respective States.

In "*the Coasts, &c.,*" is included the land between the coasts and the parallel range of coast hills or mountains. In Texas, Louisiana and northern Florida, a belt of land extending a hundred miles inward would be included.

It is found necessary to repeat in the annual reports of each succeeding year large portions of the annual reports of preceding years. The number of copies of the printed annual reports allowed to this office for distribution is small. The mode in which its duties are rendered is not yet fully understood by the public at large, and repetition is necessary that the readers may comprehend to some extent the office modes of operation.

A portion of the meteorological statistics for the year ending June 30, 1880, as had from the regular reporting stations and collated, are given in detail in papers 9 to 19.

One hundred and eighty-five stations, including those upon the telegraph lines in the interior in charge of the Signal Corps, were inspected during the year ending June 30, 1880. Paper 20 shows the name of each station inspected, with date of inspection, and name of inspecting officer. A number of officers are kept continually on duty as inspectors, and arriving at the stations without previous notice given, critically examine and report upon all facts in relation to them.

The instructions under which inspectors act and the character of the reports made by them are exhibited in paper 21 herewith.

The average cost of maintaining each full station of observation during the year ending June 30, 1880, exclusive of the cost of telegraphing reports and the pay and maintenance of the enlisted men on duty at each, has been $382.28, a decrease since the preceding year of $17.62 per station. In the cost of each station, as here given, is included the rent of and cost of maintaining a suitable office or room at each place for the public use, with facilities for the necessary exposure of instruments, and for the display of cautionary signals, when such signals are required.

The duties of the enlisted men at each station were fully described in the last annual report, as follows:

At stations forwarding telegraphic reports they are required to take, put in cipher, and furnish, to be telegraphed tri-daily on each day, at different fixed times, the results of observations made at those times, and embracing, in each case, the readings of the barometer, the thermometer, the wind velocity and direction, the rain-gauge, the relative humidity, the character and movement of upper and lower clouds, and the condition of the weather. These observations are taken at such hours, at the different stations, as to provide the three simultaneous observations taken daily at three fixed moments of physical time throughout the whole extent of the territory of the United States.

On November 18, 1879, the times of taking the morning telegraphic observations were changed to a time thirty-five minutes earlier, viz, from 7 hrs. 35 min. a. m. to 7 hrs. a. m., Washington mean time. On the same date the times of taking the afternoon telegraphic observations were changed so as to be taken one hour and thirty-five minutes earlier, viz, from 4 hrs. 35 min. p. m. to 3 hrs. p. m., Washington mean time.

These changes were made in order that the intervals between the observations should be uniform, viz, eight hours, it having been impracticable to change the time of taking the 11 hr. p. m., Washington mean time, observations.

Observations have, however, been and will continue to be taken at 7 h. 35 m. a. m., Washington mean time, at all the Signal Service stations until the change of time is made by foreign observers, which will occur on January 1, 1881. It being desirable that the observations taken abroad should be simultaneous with those taken in the United States, so that a daily chart of the Northern Hemisphere might be prepared, foreign observers were communicated with looking to that end. Mexico, through Señor Mariano Barcena, Director of the Central Meteorological Observatory, in the City of Mexico, replied favorably, and began taking observations a 7 h. a. m., Washington mean time, on July 1, 1880. He was requested to continue observations at a few stations at 7 h. 35. a. m., Washington time, until all foreign observers had changed to 7 h. a. m., Washington time.

It was suggested to the other countries that the change in time should go into effect on September 1, 1880, but, at the request of Russia, the date was postponed to January 1, 1881.

The following countries and separate observers have replied that they will make the change desired by the Chief Signal Officer, viz: Algeria, General Maritz; Canada, Mr. Charles Carpmael; Denmark, Capt. N. Hoffmeyer; Greece, Dr. J. F. Julius Schmidt; Mexico, Prof. Mariano Barcena; Portugal, Mr. J. C. de Brito Capello; Turkey, Prof. A. Coumbary; Barcelona, Spain, Mr. Antonio Rave; Beirut, Syria, Prof. C. V. A. van Dyck; Bogota, United States of Colombia, Mr. Thomas Herran; Burgos, Spain, Mr. Domingo Martin; San José, Costa Rica, Mr. F. Maison; Cape of Good Hope, Prof. D. Gill; Fort-de-France, Martinique, L'Abbé Marchési; Murcia, Spain, Mr. Olayo Diaz; Naples, Italy, Prof. Faustino Brioschi; Rivas, Nicaragua, Mr. E. Flint; St. John's, Porto Rico, W. I., Mr. Enrique Gadea; San Fernando, Spain, Capt. C. Pujazon; Santiago, Spain, Mr. R. G. Villanueva; Zurich, Switzerland, Prof. R. Wolf.

The following steamship companies have signified their intention of making the desired change, viz: Allan Line, Messrs. A. Schumacher & Co.; American Steamship Company, Messrs. Peter Wright & Sons; North German Lloyd, of Bremen, Messrs. A. Schumacher & Co.; Red Star Line, Messrs. Peter Wright & Sons. The following steamship companies made the desired change in January, 1880: California and Mexican Steamship Company, Mr. J. Birmingham; Occidental and Oriental Steamship Company, Mr. D. D. Stubbs; Oregon Railway and Navigation Company, Mr. K. van Oterendorp; Pacific Coast Steamship Company, Messrs. Goodall, Perkins & Co.; Pacific Mail Steamship Company, Messrs. Williams, Dimond & Co.

The following countries have expressed a willingness to comply with the request, provided other countries will do the same, viz: France, Prof. F. Mascart; Great Britain, Mr. Robert H. Scott; and Russia, Prof. H. Wild, who replies that he will endeavor to comply with the request of the Chief Signal Officer, and has already made preparation to issue notices to the different observers to take the simultaneous observations at 7 h. a. m., Washington mean time, from January 1, 1881.

The following have not been heard from: Austria, Prof. Dr. Julius Hann; Belgium, Mr. J. C. Houzeau; Germany, Prof. George Neumayer; India, Mr. H. F. Blanford; Italy, Prof. Pietro Tacchini; Japan, Mr. I. Arai; Netherlands, Prof. Buys Ballot; Norway, Prof. H. Mohn; Madrid, Spain, Mr. Antonio Aguilar; Stockholm, Sweden, Prof. R. Rubenson; Upsala, Sweden, Prof. H. H. Hildebrandsson; Nautical Meteorological Bureau, Stockholm, Sweden, Mr. F. Malmberg; Scotland, Mr. Alexander Buchan; Geneva, Switzerland, Prof. E. Plantamour; Montsouris Observatory, Paris, France, Prof. M. H. Marié-Davy; Zi-Ka-Wei, China, Rev. Marc Dechevrens, S. J.; Havana, Cuba, Rev. Benito Vines, S. J.; Manila, Philippine Islands, Mr. F. Faura, S. J.; Navassa, W. I., Mr. F. M. Everett; Paramaribo, Dutch Guiana, S. A., Mr. C. J. Hering; York Factory, B. A., Messrs. J. Fortescue and W. Wood; White Star

Line, Mr. R. J. Cortis; steamship Algeria (Cunard Line), Capt. W. Watson; steamship Samaria (Cunard Line), Capt. H. C. Miles; steamship Scythia (Cunard Line), Capt. W. H. O. Hains; ship Iron Cross, Capt. W. Randall; bark Nordenskiöld, Capt. Philip Landelin; brigantine George, Capt. W. H. Champlin; schooner Addie Fuller, Capt. J. Jörgensen; schooner Annie R. Lewis, Capt. L. L. Lewis; schooner Abby K. Bentley, Mr. A. R. Mehaffey; schooner Delia Hodgkins, Mr. S. S. Miner; barkentine Carrie Heckle, Capt. B. F. Woodbury.

In addition to the three telegraphic reports, three other observations to be taken at the local times, 7 a. m., 2 p. m., and 9 p. m., at the different stations are made and recorded at each station. A seventh and especial observation is taken and recorded at 11 hrs. a. m., Washington mean time, each day. If at this observation such instrumental changes are noted as to cause anxiety, the fact is to be telegraphed to the central office at Washington.

An eighth observation is required to be taken at the exact hour of sunset at each station. This observation, embracing the appearance of the western sky, the direction of the wind, the amount of cloudiness, the readings of the barometer, thermometer, and hygrometer, and amount of rainfall since last preceding report, is reported with the midnight report.

At the stations at which cautionary signals are displayed an observer must be constantly on duty to receive the order and to show the signal, which may be ordered at any moment. At stations from which river reports are furnished, an observation and record of the depth and temperature of the water is made and reported at a fixed hour on each day. In cases of threatening storms or dangerous freshets, any station may be called upon to make hourly reports. In cases of violent storms, reports are sometimes required to be made hourly during its continuance.

The data thus gathered on the files at each station are to be consolidated; first, weekly, on forms which, with copies of the telegraphic cipher reports, are to be sent weekly to the central office; then monthly, in the form of a careful digest, also to be forwarded. The thorough duty of the work of the month is then to be condensed in the form of a monthly chart. None of these observations or records ought to be dispensed with; nor can they, with meteorological instruments as they now exist, be taken and recorded more economically. At stations where the population warrants it the duties of the enlisted men are increased by the receipt and record of data from other stations, to be exhibited upon written bulletins or furnished to the press for public use. In the great cities there are the further duties of the display, at the rooms of the boards of trade, chambers of commerce, and other similar places, of symbol maps on which the meteoric conditions are shown by symbols, changeable daily.

There are to be prepared and posted also by the enlisted men, at these stations, bulletins of the storm-warning orders as received from the central office, on which appear very frequently, in addition to the order, brief notes as to the force of the anticipated storm, the direction in which it may be moving, the names of places menaced, though storm-signals may not yet have been ordered at them, and other items of information, all of which require to be carefully copied and posted with quick dispatch.

In cases of disasters occurring on the lakes or sea-coasts, full information concerning which is often in possession of the service, or in the instance of any matter of public interest coming within the scope of the duties of the service, the station force is required to exhibit bulletins containing in detail full reports.

The local offices of the Signal Service are always places of resort for inquiry on the part of those desiring to be informed what changes of weather have been particularly noticed, or are likely to affect the various industries in which the populations are engaged.

In the cities upon the sea-coast of the United States, or at the lake ports, the offices of the service are open for the comparison of instruments to obtain special instrumental readings, to make examinations of data, or to furnish whatever information may be practicable to captains of vessels or others concerned in shipping interests. At stations upon telegraphic lines in charge of or constructed by the service in pursuance and furtherance of its duties, the ordinary duties of telegraphing and the maintenance of the lines devolve upon the force there stationed, in addition to the duties of observation.

The cautionary signal flag is always, when flown officially, an invitation to mariners or others interested to visit the offices for information. The courtesies and duties of the office are not limited to the people of the United States alone, but are tendered freely to the people of any nation who may be within our borders.

The distribution of Farmers' Bulletins for the use of agricultural populations has been frequently and is elsewhere described.

The forms exhibiting, condensed, the labor thus required of the Signal Service men stationed at separate stations, and the instructions under which the separate observations and reports are made, are herewith described. (Paper 22.)

In times of especial emergencies or danger of any kind threatening the separate States or the United States, the different stations make, by order and in cipher by telegraph, regular reports upon any subject under the attention of superior authorities.

The enlisted men in charge of stations are responsible for the care, cleanliness, and good working of the instruments; the clearness of the records; the correctness and punctuality of the reports; display of signals or bulletins, and, in fine, for the conduct and good condition of the station itself. It has been considered necessary to make this description thus minute that it might be understood what duties are required of the non-commissioned officers and privates of the Signal Corps in addition to the military duties heretofore referred to, and that it may be comprehended that the force must consist of men of more than ordinary acquirements to be competent for such duties.

The sum of the pay and allowances of these soldiers comprehends every compensation which is permitted the soldier, to house, feed, and clothe himself, to meet in full every expense of his maintenance wherever in the wide extent of the territories of the United States the vicissitudes of the service may call him. It must be borne in mind that as a soldier he can have no home, and that he must purchase anew, with every change of station, the little comforts which homes gather around them. The regular tour of duty permits service on each station for two years only. These soldiers are liable to all a soldier's duties. On the occurrence of serious disturbances, the armed detachments of the corps are, with its officers, in readiness, wherever they may be, for service at a moment's warning. In the service upon the frontier they are exposed in their duties of the construction, repair, and maintenance of telegraph lines, or whenever they may accompany expeditions, to the dangers of the field.

In times of dangerous pestilence these soldiers are by their duties more exposed than other forces of the Army. Other forces may be moved, for sanitary reasons, to places of comparative safety. The exigencies of the service and the need that regular series of data should be had, by observations, on which to base precautions against existing epidemics for the time, and for the study of them thereafter, have required that the enlisted men of the service should remain faithfully at their posts during some of the worst visitations of disease which have devastated the country. As a rule they have done so without a murmur.

It has been considered that as the United States have, as above rehearsed in the case of the body of men constituting the Signal Corps, the military services of a force trained and competent to act as armed soldiers when there is need, there is in effect secured by the duties other than armed duties on which these men are employed, the benefits of all the special services rendered by the corps at stations of meteorological observations and report, at cautionary-signal stations, at stations on telegraphic lines, at sea-coast stations and elsewhere, with little compensation to the men, or cost beyond that of any other merely military force, equal in number, to the public.

The work of a constant watchfulness for the whole territory of the United States, and a plan of observation and report extending by its different branches around the northern hemisphere, is had through the service in the Signal Corps of one hundred and fifty sergeants, thirty corporals, and three hundred and twenty privates.

It is needless with such facts in view, and after nineteen years of continuous service, to reiterate the advantages secured to the Signal Service by its military organization. Service under military organizations is that form of a permanent civil service of disciplined citizens in which the duties are compulsory for the term of the service, and a proper discharge of them can be enforced by punishment. The experience of centuries has proven that whenever tasks covering in their reach the extent of nations, and involving in their execution interests of life and property, are to be undertaken, men have sought, as if by instinct, for faithful co-operation and prompt action through the regular control and sure reward or punishment which attend the military system. The soldiers of the United States are simply its citizens, held under what ought to be wise rules and regulations to duties which they have voluntarily accepted.

The duties of an army in time of peace have been defined as properly limited in their exercise to those of a police for the nation. It is considered that those rendered by the Signal Service have demonstrated that the men carried upon its rolls have been able to perform these duties and others requiring a higher standard of attainment, and rendering a better equivalent for the necessary cost. They have not failed to be ready to act armed upon any intimation that there was need of such readiness.

The duties of the force stationed at the office of the Chief Signal Officer, at the War Department, are many and onerous. In rendering these duties it ought to be borne in mind that they are continued day and night without cessation for holidays or days of rest. There is no single day of the year in which the work is suspended. It must of necessity and for this reason be performed by details of men who relieve each other at fixed times. The total force employed at this office numbers one hundred and ten enlisted men.

In estimating the numbers required to be present for duty, it is difficult to make a comparison between an establishment thus conducted and others in which the work is limited to certain hours of daylight only. This office is the center to which the daily and nightly, weekly and monthly contributions of all other offices or stations of the Signal Service scattered throughout the United States tend to be daily condensed, and finally elaborated and made of practical value. There are here concentrated, also, the reports from the six hundred and twenty-one places at which voluntary reports of daily observations are now made on this continent, and from the three hundred and twelve locations in foreign countries from which reports of daily simultaneous observations are had. From the great mass of data thus collected, and which enhances each year in value, are continuously elaborated the results which appear in the different issues of the office, whether in the form of forecasts telegraphed to the press throughout the country, of charts or bulletins distributed hence, of generalizations announced as apparent, of cautionary-signal orders, or the weekly and monthly publications. No single report of any observation received at the office fails to receive attention or study.

It is at this office that are had the management and supervision of telegraphic lines, erected and now worked by the United States, upon the Indian frontier and in the States and Territories of the interior. The wires of the coast lines have here their terminal connection, and here concentrates the labor of the different coast stations. Upon this office devolves, and with each year to an increasing extent, the duty of transmission of many and important messages from superior authorities to and from distant posts and parts of the United States, for the safe delivery and proper guarding of which, by cipher, if need be, this office is responsible. The rooms of the telegraphic department are never closed or left without an operator. The brief narration possible in a report of this character can convey but little idea of the various and incessant labors incident to such an establishment.

The regular exchange of telegraphic reports now had for a number of years by comity of exchange with the chief meteorological office of the Dominion of Canada has been maintained. Meteorological reports of observations taken simultaneously, and furnished according to the form of this office, have been received tri-daily from thirteen stations within the Dominion, and warnings have been regularly transmitted to the meteorological office of the Dominion at Toronto, as affording material on which to base the display of signals to be exhibited at ports of the Dominion at times of threatening danger. The telegraphic reports of observations received from twenty-six Signal Service stations of the United States have been furnished tri-daily to the agent of the Dominion office at Buffalo, N. Y. The relations thus maintained between the two services continue to be of service to both.

While this office has been prepared to co-operate in this manner with any foreign office, and to the limit of its power, in the furnishing of material for study, by the use of its consolidated reports or by especial warnings, it is not authorized by law to co-operate with any institution or party for the publication or display of any forecasts, indications, or cautionary signals not emanating from this bureau, or so controlled by it as not to conflict nor confuse those issued by this service for the Territories of the United States, the lakes, rivers, or coasts in or bordering upon them.

In view of the increased appropriation made available by the action of Congress at the last session, the series of telegraphic reports from stations in the West Indies, extending from Cuba, by Jamaica, to Barbadoes and the Windward Islands, have been partially resumed, two reports of observation being had on each day from each station during what is known as the hurricane season. Constantly recurring difficulties attend the collection of reports from these stations. The defective working of the telegraphic cables has frequently impaired the value of reports had from them by delay. It is difficult to secure the services of skilled observers or to obtain instrumental readings which at all accord with those at the regular stations. The crude reports are, however, at times useful.

Last year, in November, for the first time special frost indications were ordered to be forecasted and telegraphed from this office to New Orleans for the benefit of the sugar interests of Louisiana. Hereafter special attention will be given to the early forecasting of anticipated frosts for the sugar regions from the 1st of October to the 1st of February of each year. The warnings will be given as early as they can be with reasonable safety; if possible, three days in advance. This information will be furnished to interested parties and to the press of New Orleans, and sent by telegraph from that city to any point desired.

This office contemplates the early taking of steps to largely increase the usefulness of this service to the great cotton interests of the South, and to that end correspondence will soon be had with the representatives of the cotton exchanges to take into consideration the advisability of establishing a large number of auxiliary stations in the cotton belt to take rainfall and temperature observations, and also to select the most advantageous sites for such stations, which must be in telegraphic communication with the cities of the South, so that all cotton exchanges may receive daily information by telegraph of the meteorological conditions affecting the cotton crop from April 1 to October 1 of each year.

The network of the Signal Service stations extends now on this continent to both the Atlantic and Pacific coasts, and over the intervening territory of the United States. The work of the stations has been rendered utilizable for the daily provision of meteoric changes to occur over this whole geographical extent, including the great interior plateau. While the stations are in some districts far too widely separated the gaps are closing each year with steady progress. The service now has its stations located in continuous lines along the northern frontier of the United States from Maine to west of Lake Superior; along the Atlantic coast; along the southern or Gulf coast; along the southwestern boundary, separating the United States from Mexico, to the Pacific Ocean; thence northerly along the Pacific coast to British North America, and at selected points throughout the whole interior within these boundary lines. A continuous telegraphic line to follow, with near proximity, the line by which the United States, bound on British North America, from the Pacific Ocean to Lake Superior, mentioned in former reports as something to be hoped for and needed to properly complete the northern line of the circuit of stations, may be considered as now completed by the lines this summer erected in the Northwest under appropriations by Congress. This line forms the second transcontinental line carried by the labor of the Signal Corps across the continent. As other and new telegraphic lines extend within the boundary lines above referred to, they will make possible the establishment of other and much needed interior stations. The experience of years has reduced the matter of opening, equipping, and rapidly utilizing a station to a system.

The meteorological work of the United States keeps pace everywhere with the telegraphic construction. In the hands, and under the management, of a single corps, the two duties are necessarily coextensive.

The following list exhibits the stations, as classified and located in States and Territories, on June 30, 1880:

Alabama.—Mobile*, Montgomery*, Decatur**. *Alaska.*—Atka*, Attu*, Fort Saint Michaels*, Saint Paul Island*, Unalashka*. *Arizona.*—Burkes*, Camp Thomas*, Florence*, Fort Apache*, Fort Grant*, Fort Verde*, Phœnix*, Prescott*, Tucson*, Wickenburg*, Yuma*, Corrilla§, Maricopa§, San Carlos Agency§, Apache Pass||. *Arkansas.*—Little Rock*, Fort Smith**, Helena**. *British Columbia.*—Lytton†, New Westminster†, Victoria†. *California.*—Campo*, Los Angeles*, Red Bluff*, Sacramento*, San Diego*, San Francisco*, Visalia*, Colusa**, Folsom City**, Marysville**, Oroville**, Monterey†, Santa Barbara†, Yreka†. *Colorado.*—Colorado Springs††, Denver*, Pike's Peak*, Kit Carson†, Trinidad†. *Connecticut.*—New Haven*, New London*, Stonington‡, New Haven Light‡. *Dakota.*—Bismarck*, Deadwood*, Fort Buford*, Fort Yates*, Fort Stevenson*, Pembina*, Yankton*, Fort Meade||, Fort Bennett§, Fort Lincoln§, Grinnels'§, Knife River§, Plumb Creek§, Rapid City§, Smithville§. *Delaware.*—Delaware Breakwater*. *District of Columbia.*—Washington*. *Florida.*—Cedar Keys*, Jacksonville*, Key West*, Pensacola*, Punta Rassa*. *Georgia.*—Atlanta*, Augusta*, Savannah*. *Idaho.*—Boisé City*, Lewiston*, Fort Lapwai||. *Illinois.*—Cairo*, Chicago*, Springfield*, Warsaw**. *Indiana.*—Indianapolis*, Logansport¶, Evansville**. *Indian Territory.*—Fort Sill*, Fort Gibson*, Anadarko§, Cantonment§, Fort Reno§, Supply§. *Iowa.*—Davenport*, Des Moines*, Dubuque*, Keokuk*, Le Claire**, Muscatine**, Burlington¶. *Kansas.*—Dodge City*, Leavenworth*, Emporia†, Waterville†. *Kentucky.*—Louisville*, Paducah**. *Louisiana.*—New Orleans*, Shreveport*, Port Eads‡. *Maine.*—Eastport*, Portland*, Booth Bay‡, Deer Isle‡, Rockland‡. *Maryland.*—Baltimore*, Ocean City§. *Massachusetts.*—Boston*, Springfield*, Thatcher's Island*, Wood's Holl*, Chatham‡, Gloucester‡, Highland Light‡, Hyannis‡, Marblehead‡, New Bedford‡, Newburyport‡. *Michigan.*—Alpena*, Detroit*, Escanaba*, Grand Haven*, Marquette*, Port Huron*, Bay City‡, East Tawas‡, Forester‡, Frankfort‡, Houghton‡, Ludington‡, Mackinac City‡, Menomonee‡, Monroe‡, Muskegon‡, Northport‡, Pentwater‡, Port Austin‡, Roger's City‡, St. Joseph‡, South Haven‡, Traverse City‡, Sault de St. Marie†. *Minnesota.*—Breckenridge*, Duluth*, Saint Paul*, Wadena†. *Mississippi.*—Vicksburg*. *Missouri.*—Saint Louis*, Boonville**, Bismarck**, Hermann**, Jefferson City**, Kansas City**, Lexington**, St. Joseph**. *Montana Territory.*—Fort Assinniboine*, Fort Benton*, Fort Custer*, Fort Keogh*, Fort Shaw*, Helena*, Virginia City*, Radersburg§, Rosebud§, Rock Creek§, Shield's River§, Stillwater‡, Terry's Landing§, Fort Ellis||, Bozeman§, Burn's Ranche§, Coal Banks§, Deer Lodge§, Ferry Point§, Fort Sully§, Green's Ranche§, Hunter's Springs§, La Beans§, Little Missouri§, New Chicago§, Powder River§. *Nebraska.*—North Platte*, Omaha*, Central City†, Sydney†, Plattsmouth**. *Nevada.*—Pioche*, Winnemucca*, Austin†, Hamilton†. *New Hampshire.*—Mount Washington*, Portsmouth‡. *New Jersey.*—Atlantic City*, Barnegat*, Cape May*, Sandy Hook*, Little Egg Harbor||, Belvidere†, Elizabeth†, Flemington†, Freehold†, New Brunswick†. *New York.*—Albany*, Buffalo*, New York City*, Oswego*, Rochester*, Cape Vincent‡, Charlotte‡, City Island‡, Dunkirk‡. *New Mexico.*—La Mesilla*, Santa Fé*,

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*Stations of the first class. †Sunset stations. ‡Display stations. §Repair stations. ||Repair stations from which sunset reports are sent by telegraph. ¶Printing stations. **Special river stations. ††Supply station. ‡‡Sunset and special river station

Silver City*, Socorro*, Albuquerque‖, Los Lunas‖, Fort Bayard‖, Shakspeare‖, Aleman§, Fort Craig§, Tres Alamos§. *North Carolina.*—Cape Hatteras*, Cape Lookout*, Charlotte*, Kittyhawk*, New River Inlet*, Portsmouth*, Smithville*, Wilmington*, Fort Macon‡, Flying Station No. 5‖, Sloop Point‖. *Ohio.*—Cincinnati*, Cleveland*, Columbus*, Sandusky*, Toledo*, Ashtabula Harbor‡, Fairport‡, Marietta**. *Ontario, Canada.*—Pembroke†. *Oregon.*—Portland*, Roseburg*, Umatilla*, Eugene City‡‡, Albany**. *Pennsylvania.*—Erie*, Philadelphia*, Pittsburgh*, Brownsville**, Confluence**, Freeport**, New Geneva**, Oil City**. *Rhode Island.*—Newport*. *South Carolina.*—Charleston*. *Tennessee.*—Chattanooga*, Knoxville*, Memphis*, Nashville*, Johnsonville**. *Texas.*—Bœrne*, Brackettville*, Brownsville*, Castroville*, Coleman City*, Concho*, Corsicana*, Decatur*, Denison*, Eagle Pass*, Edinburgh*, El Paso*, Fort Davis*, Fort Elliott*, Fort Griffin*, Fort McKavett*, Fredericksburgh*, Galveston*, Henrietta*, Indianola*, Laredo*, Mason*, Pilot Point*, Rio Grande City*, San Antonio*, Stockton*, Uvalde*, Callahan§, Graham§, Grierson Springs§, Jacksboro§, Live Oak Ranche§, Santa Maria‖. *Utah.*—Salt Lake City*, Fillmore City†, Saint George†. *Vermont.*—Burlington*. *Virginia.*—Cape Henry*, Chincoteague*, Lynchburgh*, Norfolk*. *Washington Territory.*—Dayton*, Olympia*, Pomeroy‖. *West Virginia.*—Morgantown*. *Wisconsin.*—La Crosse*, Madison*, Milwaukee*, Green Bay‡, Horn's Pier‡, Kenosha‡, Kewaunee‡, Manitowoc‡, Racine‡, Sheboygan‡, Sturgeon Bay‡. *Wyoming Territory.*—Cheyenne*, Fort Fetterman†, Hat Creek†, Edson†, Fort McKinney§.

Map 1 exhibits the location of stations and the extent of territory brought by them under constant observation for the purposes of study.

The territory of the United States is not yet covered with stations as it ought to be, and valuable opportunities for study, which must be made good hereafter, and at an increased expense, are lost. The field of labor has increased greatly each year, as it has been learned how labor may be turned to the best benefit of different classes of citizens. The amount estimated as necessary to be appropriated for this service for the ensuing year, the sum of four hundred thousand dollars, can be wisely expended. The whole working force of the corps, five hundred men, will be constantly employed, and, in instances, overworked. The services of civilians, in addition, will be needed as in preceding years.

The reports of observations had in ceaseless succession from the stations already established, while daily and primarily employed in the studies needed for the daily issuing of forecasts and the display of cautionary signals, form also the basis for future work, to be of equal value with that made possible by the first use of them, and constitute a record, to increase in worth hereafter with every year for which it is continued.

The data already secured are worth to the country and to the world, even if the service had up to this time rendered no other return, all it has cost to obtain it.

From the moment at which it is made, each of the reports becomes to some extent complementary to all other reports had elsewhere. It is not possible to break this connection, nor in the present state of meteorological science ought any good report to be dispensed with.

It will be found, with the lapse of years, such observations have settled, by facts, questions hitherto treated by the theory only.

It is upon the data now accumulating upon the files of this office and there daily compared, compiled, and treated with an accuracy each year increased by experience, and becoming more rigid as the office is warned, sometimes by notable inaccuracies elsewhere occurring, that the future studies of the climatology and meteorology of this continent will be based. It seems not impossible that upon the results of systems of observations here first established will be founded such studies for the northern hemisphere. It is not to the discredit of the United States that a work set on foot by them should render such ends possible.

One of the difficulties in determining probable meteoric conditions on the eastern seaboard has been that this office could not obtain weather observations from points beyond the extreme limit of the coast; and that commerce may be further benefited, propositions will be made to have the vessels engaged in the coasting trade of the United States, furnish this office with transcripts of their logs; to enable vessels to furnish these with the least trouble and expense blank forms will be issued for that purpose from the Signal Office.

The permanence, regularity, and accuracy of reports to be had from the West Indies ought to be secured. No system providing warnings for the Gulf or Atlantic coasts can be considered as complete or reliable without the means of continued reports of observation, to be made from these stations. It seems to be established that the great cyclones originating within the tropics rarely, if ever, reach any coast of the United States without such indications of their existence and of their line of movement as well-managed stations among these islands would detect and announce. The possibility of protection will be increased and extended to more northern coasts whenever telegraphic communication can be had with the Bermuda Islands.

The attention of the office has continued to be directed, as in preceding years, to the solution of the difficult question as to the best mode by which to compare, for the purposes of the necessary daily studies, the observations of atmospheric changes taking place upon the Pacific coast, near the sea-level, and upon the great elevated plateau of the interior, with the reports of observations had at the same time on the eastern slope of the Rocky Mountains, and extended to the Gulf and Atlantic coasts at the sea-level. Progress is made in this direction. It is found not difficult to extend several of the office charts from the Pacific to the Atlantic coasts at the time of each tri-daily report, with the lines of the charting in so far accurate as to afford valuable suggestions as to the changes approaching.

The spread of civilization over the great interior plateau west of the Mississippi each year renders more extended observations practicable in that region.

The field of study has been pushed in that direction as rapidly as the means at the disposal of the office have permitted. The barometrical readings made in this section still lose part of their value by the difficulty of reduction to the hypothetical readings at sea-level. There seems, however, reason to hope that the unreduced readings can be utilized for purposes to which the reduced only have been hitherto applied. It is, perhaps, by multiplying stations and continuing the comparison of observations had at them, the correct solutions of all problems will be most rapidly attained.

The studies made this year in the matter of the hypothetical reductions to sea-level give reason to hope that processes have suggested themselves by which the hypothetical barometric readings referred to may be arrived at with sufficient accuracy for any practical purposes of meteorological charting.

The increased knowledge had enables improvements to be made each year; in the modes of digesting the masses of observations received upon the records, and suggests each year better methods of study to attain the accuracy of prediction which is constantly sought.

It is in consideration to equip the station upon the summit of Pike's Peak, at an elevation of 14,150 feet, with instruments for the study of solar observations, and in particular of those to be made at sunset, to trace, if possible, what connection there may be between conditions then observed and meteorological changes which follow. Instruments for this purpose are now in preparation. In this work the office has had, and still has, the zealous co-operation of its distinguished co-laborer, J. Norman Lockyer, F. R. S. These series of observations will become more valuable with each year. It is to be hoped facts leading to important improvements in meteorological study will be established.

The long-felt need of carefully studying the changes occurring upon the interior plateau led to the establishment, prior to the date of the last annual report, of a series of observations had at what are known as "sunset" stations.

Reports have been received regularly during the year ending June 30, 1880, from "sunset" stations established at the following-named points: Austin, Nev.; Santa Barbara, Cal.; Kit Carson, Colo.; Central City, Nebr.; Eugene City, Oreg.; Fort Fetterman, Wyo.; Fillmore City, Utah; Saint. George, Utah; Hamilton, Nev.; Hat Creek, Wyo.; Lytton, British Columbia; Sault Ste. Marie, Mich.; Edson,* Wyo.; Monterey, Cal.; Sidney, Nebr.; Trinidad, Colo.; Victoria, Vancouver's Island; Wadena, Minn.; Waterville, Kans.; New Westminster, British Columbia; Yreka, Cal.; Emporia, Kans.; Pembroke, Canada. Each station is in charge of a civilian observer, under the immediate direction of this office, who is required to note, and report by telegraph each day, the character of the western sky and sunset; the state of the weather; direction of the wind; appearance of the sky; amount of rainfall, if any; observed readings of barometer and wet and dry bulb thermometers. Observations are also taken daily and reported weekly by mail from "sunset" stations at Belvidere, N. J.; Elizabeth, N. J.; Flemington, N. J.; Freehold, N. J.; and New Brunswick, N. J.

Some of the observations, as stated in the last annual report, are roughly spectroscopic, the sunset report being based, in part, on such different appearances of the sun and of the effects produced by its rays, as are caused by their passage through differently-conditioned atmospheric media. It is one of the advantages that the necessary observations are so little complicated in their character that they may be taken at and reported from any point reached by the telegraphic wires. It seems probable that a simple form of spectroscope may be utilized for observations of this sort. Experiments have been continued during the year, by which it is hoped that a form of that instrument suitable for the use of enlisted men may be arrived at. The reports are found of value in often-recurring instances in which they furnish some indication of the atmospheric changes in progress at points from which it has been impossible to obtain the full report of observation.

It has been established that a certain accuracy of forecasting the local weather changes to occur, at the respective stations, within a period of twenty-four hours has been acquired by the sergeants of the Signal Corps charged with the making of the sunset reports. These sergeants have the use of meteorological instruments and access to a portion of the data which pass their own stations on their way from other stations to this office. This accuracy has reached, as computed from the records on file, a maximum percentage of eighty-nine and two-tenths for the regions west of the Mississippi Valley, where the weather conditions are notably constant, and eighty-two and six-tenths for the region east of the western bounds of that valley.

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*Formerly Saint Mary's. Name of town changed May 1, 1880.

There can be no reason that any intelligent farmer, supplied with the necessary simple instruments, habituated to similar observations, and furnished with data, either in figures or condensed by charts, should fail to attain an equal accuracy.

Since the date of the last annual report the instrument known as the Weather Case, or Farmer's Weather Indicator, has been thoroughly tested by prolonged trial. Reference is made, later in this report, to this instrument, which has been prepared with a view to its use by farmers generally.

The usefulness for meteorological purposes of the sea-coast stations of the Signal Service, in connection with the life-saving service, and located at the life-saving service stations, has continued to be demonstrated.

As explained in earlier reports, the observations taken at these stations have the advantage of being taken on the sea-coast itself, near the sea-level, and from positions which permit the conditions of the sea-swell to be reported. The stations have the further advantage of being directly connected with this office by the telegraphic lines under its control. Reports of any character can so be had at any hour they may be called for, or signals may be displayed to warn of danger.

The facilities afforded by these lines admit of conversations even being had, as they frequently are, in reference to meteorological changes or other matters, as, for instance, of the precautions to be taken against coming storms by those engaged in the salvage of wrecked ships, or other action in cases of shipwreck. The reports of observations had upon the sea-coast itself, or upon the ocean beach, differ frequently and markedly from those had from stations farther in the interior, and suggest the approach of weather conditions which, without such indications, might either have escaped attention, or could not have been observed in time.

The generalizations had from the reports received from these stations become each year of increasing value for the prediction of the weather conditions to be expected near our coasts. The reports themselves, published in the daily journals, and so known to those interested, either at the several ports or in the interior, give reliable information as to the circumstances under which coasting voyages may be taken or are being made. The benefits to follow a sea-coast service, with its stations properly prepared and equipped, are such as cause it to be hoped that all the exposed and frequented coasts of the United States may early have the advantage of such protection.

It is considered to have been demonstrated that by the services of single sea-coast stations there has been saved, at different times, property amounting in value to more than the cost of manning and maintaining all the stations from the dates at which they were first put in operation. Improving modes of communication promise as possible such close connection between the stations that it seems practicable to so arrange that there need be no points upon our coasts but to which aid can be immediately summoned, and none but from which summons for aid can go, if need be, to naval stations, posts, and cities.

The use at the sea-coast stations of telegraphic gongs connected by wire, after the manner of those used for fire-alarms, and intended to be operated from any point upon the coast at which telegraphic communication exists, or may be temporarily established for the purpose of calling the attention of any stations, has been continued. Gongs to be operated in this way are located in the offices at Norfolk, Cape May, Thatcher's Island, Kittyhawk, and the central office in this city.

The stations on the telegraphic lines, constructed in pursuance of acts of Congress on the Indian and Mexican frontiers and in the Northwest for the better protection of frontier populations, together with those for the purpose of connecting military posts and stations, serve better each year the ends for which, in part, the lines were first recommended—that of extending the fields of meteorological study over regions so sparsely settled as to be almost beyond the limits of civilization.

They have made possible the daily receipt of meteorological data from regions in which the collection of such data had been before considered impracticable. They have furnished for the office a daily knowledge of the atmospheric conditions existing along the whole course of the wires. The value of these reports, completing as they now do both the southern and the northern lines of the whole system of reports established for the territory of the United States, is very great. The lines make practicable also the receipt at the regular telegraphic stations of reports from regions in the interior of the country near them which, both at the North and at the South, have been but recently explored, and from which every reported observation is of value. The completion of lines similarly constructed and managed for similar purposes in proximity to, and following the general direction of, our northwestern frontier, from the station at Bismarck to the stations in Idaho and on the Pacific, foreshadows the best results for the interests of this especial service, and for the protection and development of that portion of our territory.

The events of the past year have illustrated what might be the uses of such lines in Indian wars. They make safer the settlement of the country. They make possible the establishment of stations valuable for meteorological reports.

Telegraphic reports from the eastern Mexican coast (the western coast of the Mexican Gulf) are still to be desired for the proper protection of the shipping in the gulf and of the gulf coasts of the United States. Cyclones moving over the West Indies, and thence pursuing a course over the Gulf of Mexico, would doubtless often manifest themselves on or near the coast of Mexico in time to permit warnings to be thence given to our own. The regularity of the telegraphic communication now had over the government lines upon the Mexican frontier and in the State of Texas has established the fact that reports collected in Mexico along or near the Mexican coasts, and transmitted over wires working with fair success, could be concentrated at this office with sufficient rapidity.

The organization by the Mexican Government, under Señor Mariano Barcena, of a system of meteorological reports from stations extended over a great portion of the Mexican territory, and carefully conducted, renders the results of that work more valuable for this purpose than in any preceding year. It is to be hoped that arrangements may be early made by which these reports can be received by telegraph. The notices for the display of cautionary signals issued from this office could reach Mexican ports as well as our own.

It is to be hoped that the sums appropriated for the service and the co-operation of the Mexican Government will permit reports to be had from these coasts within the coming year.

The international meteorological work, based upon plans suggested by this office, and carrying into practical effect a proposition adopted at a congress of persons charged with meteorological duties, assembled at Vienna in 1873, "that it is desirable, with a view to their exchange, that at least one uniform observation, of such character as to be suited for the preparation of synoptic charts, be taken and recorded daily and simultaneously at as many stations as practicable throughout the world," has continued to give satisfactory results. This work has now completed the fifth year of its progress.

With the approval of the Secretary of War, and with the courteous co-operation of scientists and chiefs of meteorological services representing the different countries, a record of observations taken daily, simultaneously with the observations taken throughout the United States and the adjacent islands, has been exchanged semi-monthly. These reports are to cover Algiers, Australasia, Austria, Bahamas, Barbadoes, Bavaria, Belgium, Cape Colony, China, Costa Rica, Denmark, Dutch Guiana, Faröe, France, Germany, Gibraltar, Great Britain, Grand Canary, Greece, Greenland, Hebrides, Hungary, Iceland, India, Ireland, Italy, Japan, Malta, Mexico, Morocco, Mauritius, Natal, the Netherlands, Norway, Portugal, Russia, Scotland, Shetland, Sierra Leone, Spain, Sweden, Switzerland, Syria, Tasmania, Tunis, Turkey, Dominion of Canada and the Provinces, United States of Colombia, South America, the United States, the Azores, Madeira, Philippine Islands, and West Indies.

The daily issue of the printed bulletin exhibiting the international simultaneous reports commenced at this office on July 1, 1875, has been maintained during the year. A copy of this bulletin is furnished, without charge, to each co-operating observer. The results to be had from the reports thus collated are considered to be of especial importance. The bulletin combines, for the first time of which there is record, the labors of the nations in a work of this kind for their mutual benefit. There is still needed the assistance to be had from the naval forces of the different powers (that of the United States, of Portugal, and of France) to extend the plan of report upon the seas to bring more fully within the scope of study observations practically extending around the northern hemisphere.

A copy of the International Bulletin herewith (Paper 24) exhibits the character of the international reports and that of the information had from each station. The chart accompanying this bulletin shows, as nearly as practicable, the location of the station and foreshadows the studies which the reports had from them will make practicable.

The average number of daily simultaneous observations now made in foreign countries is three hundred and one. The total number of stations on land and on vessels at sea from which reports are entered in the bulletin regularly is five hundred and thirteen. The co-operation of the different nations secured by this plan of exchange has rendered the additional cost to the United States of this grand system of reports it makes possible but little more than that of the cost of the preparation, paper and binding of the International Bulletin and the accompanying charts, a cost which would have to be met in great part for the proper presentation of the records themselves, even if this bulletin were not distributed.

The issue of the daily International Weather Map, commenced July 1, 1878, has been continued during the year. Each daily chart is based upon the data appearing upon the International Bulletin of similar date. The charting extends around the world and embraces for its area the whole northern hemisphere.

The daily issue of a chart of this kind, thus daily issued for the first time by the United States, was without a precedent in history. It exhibited the co-operation, for a single purpose, of the civilized powers of the world north of the equator.

The studies which such charts make possible, the improvements which will come to the charts as the work progresses and the area of the chart is better filled with reports of observations carefully elaborated, are appreciated by scientific men. The questions as to the translation of storms from continent to continent, and of the times and directions they may take in such movements; the movement of areas of high and low barometer; the conditions of temperature, pressure, and wind-direction existing around the earth at a fixed instant of time; the distribution and amount of rainfall, and other studies, many and valuable, only suggested by this enumeration, may be by such studies settled. It seems not impossible that in the future questions of climatology, and perhaps others bearing upon the prediction of weather changes far in advance of the time at which these changes may happen, or queries as to the character of coming seasons even, may be answered by the researches these charts will make practicable.

The very great aid the material furnished in this elaborate form gives to the search for generalizations, or for data in the support of theories, has been before referred to. In frequent cases, little more than collation is necessary.

As a means of better combining the work and the interests of the several nations, of certainly securing that co-operation at sea which will enable the lines of the charting to be drawn as fully and as well over oceans as over continents, and which will give the world ultimately a knowledge as practical of the movement of areas of disturbance in the midst of the seas as is now had of such movement on some continents, the undertaking is of much importance.

It is an advantage of the charting draughted from simultaneous reports that studies by normals, not possible in any other way, may be had. The normal pressure, temperature, &c., arrived at from observations taken at any one place, and the same and a fixed instant of time every day, become established as to that place and time with accuracy. Many causes of error are eliminated.

The intercomparison of these normals with the normals taken at other places simultaneously with the first and under the similar conditions that the normals to be found for those places are to be from observations taken at those places at a fixed time and on every day, gives results reliable and differing from those to be had by the use of normal readings arrived at in any other manner. Normals for the year, for the season, and for the month may be determined by such procedure. The comparison of such normals will show in the case of abnormal changes in any district or section whether and how these changes are compensated by compensating variations elsewhere. There are interesting studies as to what sequences there may be to follow such atmospheric variations occurring over any region or country—either in that region or country or elsewhere—and how and where the compensating variations occur, and with what concomitants or sequences of meteoric changes.

There is the hope to gain in this way, or by studies such study will suggest, information to affect the commercial and agricultural interests of the world.

By observations spoken of as simultaneous observations, there is meant, in the parlance of this office, observations actually taken simultaneously in reference to physical time. The readings for observations of this character, made at different stations, no matter how widely separated, are attempted to be so made that they will be in effect made together; that is, that the different observers at the different stations will each be at his separate instruments, reading them for the observation at the same moment that each and all of the other observers are at their separate instruments for the purpose of making the same observations.

In the case, for instance, of an observation or series of observations to be made at Tokio, San Francisco, New York, London, St. Petersburg, and Calcutta, the observers at each of the stations named—and the list might be prolonged indefinitely—are so instructed that at each station, and at the moment fixed for the observation, an observer would be found at the instruments taking the proper readings. So rigidly is this plan followed throughout the United States, that not only are the instruments required to be read at the different stations at that moment of physical time which has been fixed for all, but the instruments are required to be read in a certain and fixed order or sequence.

The observations are thus made, in fact, simultaneously, precisely as if—in a supposable case—the different sets of instruments, instead of being scattered over the surface of the earth, had been gathered in a single room, and the observers then directed to read the different sets together, and at once, at a fixed moment of time. Observations of this character have no resemblance to those made at similar hours named, by local or clock time, at different stations. Observations taken at similar hours of the local or clock time, at different stations, are, in effect, taken at very different hours of physical time, the differences increasing with the number of degrees of longitude intervening between the different stations. Thus, observations taken at Washington and San Francisco at the similar hours, 7 a. m., 2 p. m., and 9 p. m., of local time at the two cities, would in fact be taken at Washington three hours and two minutes before the same observations would be taken at San Francisco. Observations of this character might very properly be styled synchronous, for they are so as to local time; they are not in any way simultaneous. The distinction ought to be very carefully made. Much confusion has entered meteorological writings because this distinction has not been rigidly observed. In some of the earliest works having reference to practical meteorology, there is mention of chartings based upon observations taken "simultaneously" at different stations, at 3 p. m., or other hours fixed by local time. The use of the words "simultaneous" and "synchronous" as synonyms is not yet abandoned.

Before the introduction of the electric telegraph it was difficult to conceive of observations to be taken simultaneously, and to be concentrated with sufficient rapidity for use for any practical purpose. On the very limited fields it was then possible to consider, for study, observations taken at the same hour of local time presented themselves in appearance as taken simultaneously. It seems to have fallen to this office to first establish, for purposes of forecast, systems of observation based upon the fact that the observations were to be actually taken simultaneously, and to have first so arranged telegraphic circuits connecting the different stations that the observations taken simultaneously should move simultaneously by wire to a given center—the central office. It is by simultaneous observations only that a true synopsis of the atmosphere over any extent of the earth's surface can be given; the atmosphere being so photographed, as it were, before any changes in its condition can have been caused by motion. It is a peculiarity of such charting that it is unlimited as to its extent, and improves for any purposes of meteorological study the greater the extent given to it.

The comparison of charts covering the same surfaces and based upon simultaneous observations is easy, and when, for close study, the charts are made to follow each other in regular sequence, the observations being taken at times so fixed as to divide the daily twenty-four hours into equal periods of time, they offer advantages which it is not possible to arrive at by any other process. It is charts of this description which render a world-wide study possible, and with which will be attained in the future results, up to this time, only but faintly foreshadowed.

The work of this office is based almost wholly on observations of this description. The office series of simultaneous observations has run continuously from November, 1870. It is through observations of this character the concurrence of the nations has been invited for the preparation of the charts hoped to be extended until they cover the world.

Since the date of the last annual report additional international charts have been added to the series of charts. These charts are, like those before referred to, charts of the whole northern hemisphere, and are so made as to exhibit with close approximate correctness the geographical relations of the earth and water surfaces in that hemisphere to each other. They display, condensed by months, the means of barometric pressure, of wind direction and force, the means of temperature, and the average course of movement of areas of low barometer for each month. These charts are based almost wholly upon the international exchange of reports taken simultaneously.

The wide circulation given these charts in the Monthly Review, to which they form now an accompaniment, offers this world-work to many readers. It completes for the present the series of charts, to form which the labors of the international service were at first undertaken, and opens easily to study a field of research very nearly coextensive with the northern hemisphere. A series of charts for the special study of storm-tracks are prepared as an established office series. On such charts are traced ocean-storm tracks, these tracks being charted primarily over this continent by the regular reports at this office and at sea and on other continents, by such meteorological reports as may be had from the sea and the distant continents, together with such other information as may be collected at this office up to the dates at which the several charts issue. The construction is continuous from month to month, a storm-track commencing in one month appearing on and being continued on the charts issued for the next succeeding month, the portion of the track continued in this latter month being located by such supplementary information as may have been collected up to the date of the last issue. Thus for each succeeding month.

Examples of these charts are found accompanying the issues of the Monthly Review, in their sequence.

In this connection the office has to acknowledge, as in preceding years, the cordial and valuable co-operation of the meteorological services of the different countries represented as follows:

Algeria, Morocco and Tunis, by General Maritz, Commandant Supérieur du Génie en Algérie; Austro-Hungary, by Prof. Dr. Julius Hann, director of the Imperial and Royal Central Meteorological Institute at Vienna; Belgium, by J. C. Houzeau, director of the Royal Observatory at Brussels; Great Britain, by the Meteorological Council, through Robert H. Scott, esq., F. R. S., secretary, London, and by Alexander Buchan, M. A., F. R. S. E., secretary of the Scottish Meteorological Society, Edinburgh, and the respective observers; Costa Rica, by Señor Federico Maison, director of the Central Office of Statistics and Meteorology; Denmark, by Capt. N. Hoffmeyer, director of the Royal Danish

Meteorological Institute at Copenhagen; France, by Prof. E. Mascart, director of the Central Meteorological Bureau of France, and the respective observers; Germany, by Prof. Dr. G. Neumayer, director of the German Marine Observatory, Hamburg; Greece, by Prof. Dr. J. F. Julius Schmidt, director of the Royal Observatory at Athens; India, by H. F. Blandford, Meteorological Reporter to the Government of India; Italy, by His Excellency the Minister of Public Instruction, and the respective observers, through Prof. P. Tachini; Japan, by I. Arai, director of the Imperial Meteorological Observatory at Tokei; Mexico, by His Excellency the Secretary of Public Works, through Señor Mariano Barcena, director of the Central Meteorological Observatory in the city of Mexico, and the respective observers; Netherlands, by Prof. Buys Ballot, director of the Royal Meteorological Institute of the Netherlands at Utrecht; Norway, by Prof. H. Mohn, director of the Royal Norwegian Meteorological Institute at Christiania; Portugal and Portuguese Naval Series, by J. C. de Brito Capello, director of the Meteorological Observatory of the Infante Dom Luiz at Lisbon, and the respective observers; Russia, by Prof. H. Wild, director of the Imperial Central Physical Observatory of Russia at St. Petersburg; Spain, by Antonio Aguilar, director of the Royal Observatory at Madrid, and the respective observers; Sweden, by Prof. R. Rubenson, director of the Royal Swedish Meteorological Institute at Stockholm, by F. Malmberg, director of the Nautical Meteorological Bureau, and by Dr. H. H. Hildebrandsson, director of the Meteorological Division of the Upsala Observatory; Switzerland, by Prof. R. Wolf, director of the Observatory at Zurich, and by Prof. E. Plantamour, director of the Observatory at Geneva; Turkey, by A. Coumbary, Effendi, director of the Central Observatory at Constantinople, and by Prof. C. V. A. Van Dyck, superintendent of the Lee Observatory at Beirut; Canada, by Prof. G. T. Kingston and C. Carpmael, superintendent of the Meteorological Office of the Dominion of Canada, and director of the Magnetic Observatory at Toronto, and the respective observers; United States Navy, by His Excellency the Secretary of the Navy, through Commodore W. D. Whiting, U. S. N., Chief of the Bureau of Navigation; and by individual observers at other points.

A number of observations taken on vessels at sea to complement the simultaneous reports of this service, and at the request of this office, have been received on the form provided for this purpose. The vessels furnishing these reports belong to the navies and commercial marines of different nations. The utility of the reports is evident in the study of storms approaching our coasts or which endanger vessels sailing from our ports.

The co-operation of the Navy of the United States in the taking of observations simultaneously and in accordance with the system adopted at this office wherever naval vessels of the United States may be, as established by the general order of the Secretary of the Navy, dated December 25, 1876, has largely increased the data of this class. This co-operation has been skillfully rendered by the Navy Department and the United States Navy, through the commanders and officers of vessels and the Chief of the Bureau of Navigation.

The people of the United States are thus the first nation whose Army and Navy co-operate, as all armies and navies should, under official orders, in the taking of simultaneous observations wherever the forces may be. This co-operation has now existed for nearly four years.

In view of the accomplished establishment of the system of simultaneous reports to be recorded and made at sea by the vessels of the naval and commercial marines of the United States and of other nations, and to provide for the extension of the system, carefully tested barometers of the best make have been prepared and kept located, as standards, at the ports of New York and San Francisco. These instruments have now been in use for reference; that at New York since 1877, that at San Francisco since December 1, 1878.

These barometers are publicly located and displayed to afford means for comparison of the ships' barometers of the shipping of all nations. The instruments, while carefully guarded, are easily accessible. Public notice is given of the location of them, and a sergeant of the Signal Corps attends daily to give information and to take charge of any ship's barometer which may be brought for comparison. (Paper 25.)

The standard barometer for the use of shipping in the Atlantic Ocean is located at the Maritime Exchange, in New York City; the standard barometer for the use of shipping in the Pacific Ocean is located at the Merchants' Exchange, in the city of San Francisco. During the year just past the uses of these instruments have become more and more appreciated, and frequent applications are made by the commanding officers of foreign vessels, as well as by the shipping of the United States, for the comparison with the standard of the barometers carried by their vessels. The sergeant in charge of the duty of comparison at New York states that not unfrequently barometers are brought to him for rectification which have neither been compared nor adjusted since the time at which they had been placed upon the vessels by which they were carried, and that errors of half an inch in the reading are frequently found. The barometers are carefully put in good condition before they are returned to their owners. No charge is made under any circumstances for any part of the important work thus undertaken by the service.

The officers of the Signal Service located at the different cities and ports of the United States, and upon the sea-coast, offer every facility and aid in their power to the vessels of any nation.

With the plans for charting now adopted at this office, and with the reports now received here, it appears that the meteoric changes occurring over a great portion of the continents north of the equator can be charted with an accuracy sufficient to permit careful and valuable study. This charting, to be of the best attainable value, must be supplemented from the records of observations had on the seas. A ship at sea becomes one of the best of stations for a simultaneous system. The value of the record is enhanced by the change of the ship's location during each period of interval occurring between the separate simultaneous observations. Thus, a vessel making three simultaneous observations daily, on any given route, answers, for the meteorological study extending over that route, the purpose of three separate stations. There is no sea-going vessel but which carries human life, and each ought to carry, by compulsion, if need be, meteorological instruments. The smallest craft, in caring for its own safety, may use them enough to add to the value of the most extensive record. There is no nation without interest in the work proposed to be based upon exchanged simultaneous reports, and none has hitherto hesitated, when the subject has been properly presented, to aid in a duty which, so easily done as to require very little effort on the part of any person, has for its object a good to mankind. The work cannot, from its nature, be for the selfish good of any section.

A number of the great steamship companies, foreign and domestic, operating the principal commercial sea routes, give their powerful influence and aid.

The office has the co-operation of the Pacific Mail Steamship Company, through its agents, Williams, Dimond & Co.; the White Star Line, through its agents, Ismay, Imrie & Co., Liverpool, and R. J. Curtis, New York; the Occidental and Oriental Steamship Company, through its president, George H. Bradbury; the North German Lloyd, through its agents, A. Schumacher & Co.; the American Steamship Company, through its president, H. D. Welsh; the Red Star Line, through its president, James A. Wright; and the Allan Line, through its agents, A. Schumacher & Co.

The United States bear, in the cases of all maritime observers, co-operating in this system, all expenses for forms, postage, &c., when so desired, and frequently, when necessary, loan the required instruments.

The number of observations made daily on separate vessels at sea is one hundred and twenty-two. (Paper 26.)

Research has already gone far enough to indicate the paths by which, if it cannot be directly predicted, it can at least be studied, to learn what sequences to follow conditions reported on or near the eastern coast of Asia, or on the Pacific, will be found on our western coasts.

Similar studies will have reference to our own southern and eastern coasts, and to the western coasts of the European continent. The time cannot be far distant when vessels leaving any Atlantic port may be informed whether any notable disturbance exists at sea and when it is likely to threaten the voyage.

The establishment of permanent ocean stations in lines traversing the ocean over or near the telegraphic cables, and in telegraphic communication with either continent, is not considered impracticable and has been referred to in preceding reports.

In a preceding annual report this matter has been especially illustrated in the instance of the cable-laying steamship Faraday, while engaged in laying an electric cable between France and the United States, and holding on to the cable, found herself in the course of a cyclone which passed directly over the vessel without causing her to lose her hold of the cable, and which was at once reported by telegraph through the cable from the vessel to the European continent, the report stating wind changes and velocity, and the barometric changes occurring as the different quadrants of the cyclone passed over the vessel. The practical demonstration seems complete.

There is reason to hope that a progress has been made which will eliminate from the study of practical international meteorology some of the difficulties hitherto encountered.

There are grounds to hope also that the atmospheric conditions and changes of condition can be charted with sufficient accuracy over any extent of the earth's surface. If the hope has fruition, meteorological barriers will, as against study, cease to exist.

A second meteorological congress was held at Rome, Italy, in April, 1879. At this assembly the practical use of observations taken simultaneously, upon which use the system of this office has rested for studies and for charts for a number of years, was encouraged.

The collection of material for maps, to cover large portions of the earth's surface—interesting, by the gratuitous distribution of copies of the work of the office, to all who should, by forwarding data or material, become regular co-laborers in the office work, as has been long the usage in this country—was commended for general adoption. The daily and wide distribution of the International Bulletin and international charts is for this purpose.

The publications of the office, the Weather Review, were mentioned as models of work to be desired in Europe.

It was urged upon the United States to furnish full systems of reports from the stations on Pike's Peak and Mount Washington.

These evidences of appreciation are grateful. They go far to assure the friendly co-operation of the nations to perfect a world-wide meteorology.

The total number of daily reports, of all kinds, now received and filed at the office of the Chief Signal Officer, is as follows: Number of daily service telegraphic reports, 247; number of international daily simultaneous reports, 513; number of reports from voluntary observers, 348; number of reports received from the Medical Corps of the Army, 98; number of reports received from United States Naval Observers, 36; making a total of 1,242 reports received regularly for discussion.

Paper 28 exhibits a list of the military posts from which meteorological reports have been regularly received at this office during the year.

A list of the voluntary observers who have furnished monthly meteorological reports to this office during the year ending June 30, 1880, is exhibited in Paper 29.

As described in previous annual reports, the daily official deductions or forecasts issuing from the office of the Chief Signal Officer and constituting the tri-daily Synopses and Indications (as they are styled), and the especial deductions, in pursuance of which the orders for the display of cautionary signals at stations are given when necessary, are based upon the regular reports of the service stations of observation, transmitted tri-daily to this office by telegraph, after passing over a system of telegraphic circuits so arranged as to at once concentrate the reports at this office, and to distribute in doing so certain numbers of them at designated cities and stations. Especial reports are demanded from any station, or number of stations, whenever additional information is required as to impending disturbances. The synopses are those of the meteoric conditions existing over and near the United States for each period of twenty-four hours terminating at the hour for each general report. The indications are announcements of the changes, considered from the study of the charts, in connection with such rules and generalizations as the experience of this office and the study of meteorologists seems to have determined to be indicated as to happen within the twenty-four hours then next ensuing. The study for each issue requires the drafting and examination of eight charts, these charts exhibiting chartographically the data furnished by the simultaneous reports of the stations heretofore referred to, and located in the United States, on the Atlantic and Pacific coasts, on the coasts of the Gulf of Mexico and of the Lakes, in the western interior, and in the Dominion of Canada, Nova Scotia, Newfoundland, New Brunswick, and the West India Islands. The plans in use in this office for charting differ from any other. They are based upon the study of observations actually taken simultaneously. These charts are as follows: (Map 2.) (*a.*) A chart of barometric pressure reduced to the temperature of freezing and sea-level; of temperatures and of winds, together with the wind-directions and the velocities at the different stations; the amount, but not the nature, of the cloud formations at the different stations; the character of the precipitation, if any, occurring at the time of the reports; and the amount of precipitation, if any, since the time of the last preceding report. This chart exhibits barometric pressures and the temperatures noted at stations in their relations to districts of territory and to each other, by a system of isobaric and isothermal lines inscribed. The isobars are charted for inches and tenths of inches of barometric pressure; the isothermals for temperatures represented by the multiples of

10°. The wind-directions are shown by arrows at the different stations (Map 3.) (*b.*) A chart of the relative humidities appearing to exist over territorial districts, with the temperatures at the different stations in relation to districts and to each other. The chart of humidities enables studies to be made in reference to territorial sections, the difficulties attending the study of observations of this character being obviated to a very considerable extent by the intercorrection of stations among themselves and by the great extent of the regions over which the readings are made simultaneously. In fields so great purely local conditions in part disappear, or affect very slightly the general result. This chart contains also the character and amount of the lower clouds, and the character, amount, and direction of motion of the upper clouds, when these are visible. On this chart are traced lines of equal relative humidity, and isothermals are also drawn, as described in chart *a.* (Map 4.) (*c.*) A chart of the cloud conditions prevailing over the United States, in which the character of the different varieties of clouds and their amount, as viewed from each station, are represented graphically by appropriate symbols. On this chart also appears the weather as reported at each station at the time of each report by symbols; the stations at which rain has fallen since the preceding report, as well as the direction of movement of the upper and lower clouds, and on it each morning there are entered the minimum temperatures noted during the preceding night at the separate stations after the telegraphic observation simultaneous with 11 p. m., Washington mean time, and lines of minimum temperature are traced to exhibit these temperatures in relation to districts of territory.

The cloud areas appearing on this map are surrounded by an outline charted to enable the extent and probable movement of these areas to be considered. There also appears on the copy of this chart, made at the hour of the midnight report, the appearance of the sunset at each station, as reported by the observer at that station, and as considered by him to indicate, when taken in connection with the appearance of the western sky at sunset, the character of the weather to be anticipated at that station for the twenty-four hours next ensuing. (Map 5.) (*d.*) A chart of variation from normal pressures and of changes in these variations for each eight hours. There have been computed during past years, at this office, the means of the observed pressures recorded at each station, at each of the hours at which observations are made at that station, for the regular simultaneous telegraphic reports for each monthly period. The series of observations used in computing these means has been for as many years as was possible at each station. These mean pressures are the mean pressures computed from the actual readings had at each station, at the habitual hour of observation, for each of the tri-daily full telegraphic reports required to be made from that station, and obtained, as explained above, by reducing the readings then made to a uniform temperature—freezing—and correcting for instrumental error (variation from the standard) only. Mean pressures so obtained are styled in this office "normal pressures" for the station, for its local hour of the report, and for the month. On this chart is entered at each station, with the symbol + or −, the value by which the actual reading reported from that station at the hour of any report is above or below the "normal pressure" for that station for the hour of that telegraphic report and for that month. These deviations from such normal pressures may be styled "departures" from the normal pressure; the comparison of these departures for each period of eight hours shows what changes have taken place in the atmospheric pressure at the different stations, in each period of eight hours, after eliminating the horary variations of pressure. On the chart are traced lines of "no variation" in normal pressures, being the lines along which the pressures are at the time practically normal; also lines of "departure" from the normal pressure for each one-tenth of an inch of mercury, by which the actual readings as reported are found to be above or below the computed normal. The departures from the normal pressure in any one chart is compared with the departure for the corresponding station in the chart immediately preceding, and the change noted with its appropriate sign + or –, and lines traced to show graphically each one-tenth inch of change in pressure for each period of eight hours. This method of noting barometric pressures enables those taken and reported simultaneously from any number of different stations to be considered for purposes of study in relation to each other without reference in each case to the local questions of altitude, horary variations of pressure, or other disturbing causes at the places at which they may be taken. This chart exhibits also the wind direction as given at the hour of the daily report. (Map 6.) (*e.*) A chart of actual barometric variations. This chart exhibits the observed readings of the barometor at different stations, corrected for instrumental error (variations from the standard at Washington) and for temperature, the mercury reduced to the temperaure of freezing, but not reduced to the hypothetical readings at sea-level. In this office observed readings so treated are known as the "actual readings." On this chart are traced lines of "no variation," showing the lines along which no change in the actual readings has occurred for the periods of eight and twenty-four hours, respectively, preceding the hours of report, and also lines showing the lines of rises or falls of the actual pressure of the barometer for each one-tenth of an inch, and for the same respective periods. This chart is valuable as exibiting the nature and extent of actual barometric pressures, and the changes of such pressures, taking place at the different stations, and over the different territorial districts. (Map 7.) (*f.*) A chart of dew-point variations. On this chart there are entered the changes of the dew-point at the several stations for the periods of eight and twenty-four hours preceding the hours of report; there are traced also lines along which there has been "no variation" in dew-point during such periods, respectively, and lines showing the rises and falls for each five degrees in the dew-point for the same periods. (Map 8.) (*g.*) A chart of dew-points, vapor tensions, and actual humidity. On this chart are entered the values of the dew-point at the different stations, and lines of equal dew-point are traced for each ten degrees difference of the dew-point readings. At the extremities of these lines are noted the value of vapor tensions and actual humidity, corresponding to the given dew-point lines. The examination of the charts *f* and *g* enables the hygrometric conditions of the air and the changes in such conditions which have occurred within the periods of eight and twenty-four hours, respectively, to be considered in so far as these are indicated by the wet and dry bulb psychrometers at the different stations.

There has been prepared in the map room of the office, and to be used in connection with the studies to be had from the maps above enumerated, a colored contoured map. This map exhibits, by colored surfaces of different colors—each colored surface being bounded by contour lines—the elevations of the different terrestrial surfaces on which the stations of the Signal Service are situated, and the map exhibits as a whole the relations as to elevation of all the surfaces within the United States, Mexico, and the Dominion of Canada, over which the work of the office extends. The direction of movement of atmospheric areas may, by the study of this map, be judged of to some extent by considering the contours of the earth's surfaces over which such areas are found charted, and towards which they are thought likely to move. The linear charting has been based upon data had from Gannett's linear contour map of 1877, and from Guyot's Wall Atlas of 1863. A chart embodying additional data is now in preparation.

Several series of computations have been made in the computing-room of the office to enable additional charts each to exhibit in the lines of its charting the condensed data in their relation to each other. The regular series of computations has been continued.

The number of separate graphic chartings made and examined in the study-room, for the purpose of the daily studies of the office, during the year ending June 30, 1880, has been eight thousand seven hundred and eighty-four. The charts prepared for the issues of the Monthly Review, and exhibiting each the data received for the month and discussed for the month, have been seven in number for each month, a total of eighty-four for the year. The increase in number has been due to the addition of international charts.

The data thus accumulated on the files of this office have afforded scope for generalization differing from and perhaps more extensive in number than any before had by any one nation.

The number of reports received daily and unceasingly have necessitated a constant labor to keep up, in the discussion of them, and in the record of the results of that discussion, to the dates at which the reports are recorded, in order to prevent an accumulation which, by its mass, might lessen their usefulness. The published daily study-charts of the office and the Monthly Review, with its charts of generalizations, are examples of this work—the study-charts exhibiting a study of the data telegraphically received on each day; the charts of the Monthly Review combining the results had from these data and those received from other sources for each month during the year. It has been thus in the power of the office to lay before scientists and the public, at the close of each day, if necessary, and at the close of each month and each year, a summary for the periods then terminating. The labor of referring to the individual records in figures, which, after a time, becomes almost impracticable, is thus rendered unnecessary on the part of those who receive these papers. The charts of the average direction and velocity of movement of areas of low barometer, charts of the average barometric pressures at the hours of tri-daily report, charts of wind direction found most frequent at the different stations before rain-fall, charts of rain-frequencies for the different months, are examples of other studies of generalization. Studies of this character, and incidental to those which have in view the preannouncement of storms or other meteoric changes, furnish results valuable for practical uses.

Information of this character has been so freely and so widely furnished that it is not always considered that by no other nation is information of a similar character furnished to nearly a similar extent, and that two years ago it had not been contemplated in the United States as possible to furnish it to all.

It is by studies of this kind, and in this great field of research, that the hoped-for rules, each of which is to add its aid in the effort to attain precision of forecast and foreknowledge of climatology for the United States, are to be elaborated. It is by such rules and such knowledge, slowly but each year improving, the widest benefits of the service are to be sought. These will follow the practical use, by the people themselves, of the information gained through the work of the service, either in their attempts to have foreknowledge of coming changes from the study of their own instruments, or by supplementing that study by reference to the daily-published bulletins and reports of this office. There is hardly a class of the people, or an industry they practice, but to which good may, in this way, and from such studies, result. Enough has already been done to prove that it is possible.

The policy pursued by the office of diffusing as widely as possible, and in condensed form, the information in its possession, and that of extending the scope of its observations, enables it to benefit, in studies like these, by the labors of students everywhere. The results returned to the office, in the able suggestions made by distinguished scholars who have received its publications, and based upon deductions had from the charts and data so furnished, aid in forming the rules on which its duties rest. The list of correspondents to whom the publications of the office are furnished contains the names of many of the leading scholars and scientific men in different parts of the world. The instances are not infrequent in which the most interesting papers upon the subject of meteorology, read before the most distinguished and learned societies in the United States, have rested for their value almost wholly upon the studies of the data of observations and the charts prepared at and furnished from this office.

The search for generalizations or the support of theories becomes comparatively easy when the material is furnished in elaborate form, requiring little more than collation for either.

The Synopses and Indications have been furnished for the press at the regular hours, 1 o'clock a. m., 10.30 a. m., and 7.30 p. m., daily, and under the same rules as in preceding years. There has been no failure in the delivery of any report during the year. The total number of statements thus issued for publication has been one thousand and ninety-eight. These have been telegraphed at the moment of their issue to the principal cities, and have appeared in some form in almost every journal in the United States. A careful analysis of these statements of the office, made for the year terminating June 30, 1880, and a comparison with the meteoric conditions afterwards occurring within the twenty-four hours next ensuing, and within the district to which each forecast has had reference, has given a percentage of verification as follows:

Reference is had to the district map.

Percentage of verifications for each month of the year ending June 30, 1880.

	1879.						1880.					
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May.	June.
New England	83.9	85.9	87.7	85.8	93.1	89.4	85.8	88.3	85.5	81.6	77.4	86.6
Middle States	89.1	86.6	90.3	89.5	91.5	84.7	85.8	92.2	86.6	84.7	82.6	87.1
South Atlantic States	82.3	81.9	88.8	87.3	90.6	85.1	84.4	86.7	87.0	83.5	90.4	92.5
Eastern Gulf States	80.8	85.0	89.2	87.9	92.3	85.9	80.7	88.8	84.4	83.9	87.7	91.9
Western Gulf States	82.5	84.7	88.9	85.2	88.7	85.6	80.7	87.9	79.4	81.8	86.2	92.6
Lower Lakes	87.7	85.8	88.3	88.2	91.2	87.8	84.3	90.2	87.3	84.5	80.6	89.9
Upper Lakes	86.3	82.6	90.8	89.5	92.4	84.4	87.8	88.2	87.1	79.9	81.5	86.0
Tennessee and Ohio Valley	82.4	84.5	89.9	88.2	92.4	83.9	84.9	87.2	83.7	84.9	83.0	90.4
Upper Mississippi Valley	87.6	81.0	89.8	84.0	87.2	86.2	84.9	84.0	85.6	80.9	80.7	85.2
Lower Missouri Valley	85.0	80.3	87.5	85.0	97.5	83.9	84.7	85.3	87.2	76.8	77.3	83.4
Total percentage of verifications	85.1	84.0	89.3	86.3	90.8	85.7	84.4	88.0	85.4	82.2	82.7	88.6
Percentage of verifications for the year (changes of barometric pressures, temperatures, wind-direction, and character of weather expected) comprised												86.04
Percentage of verifications for the year (forecasts of the character of the weather only)												90.3

The percentages of accuracy first above given are for statements comprising the predictions of the changes of barometric pressures, temperatures, wind-directions, as well as the character of weather to be expected in the districts to which they have reference. Such predictions are more difficult to make correctly than those relating to the future conditions of the weather alone, for in such forecasts it must be preannounced for twenty-four hours for each district outlined upon the map, whether in that particular district the barometric pressures will increase or diminish; whether the temperatures will rise or fall; what in each district will be the wind-directions, and other statements far more difficult to make accurately than the general forecasts that the skies will be clear or cloudy, and with and without rain. The percentage of accuracy of forecasts limited to the preannouucement of the character of the weather to be expected in the districts, exclusive of the other conditions above referred to, has been 90.3.

Percentage of verifications for the Pacific coast region for the months given.

	1879.						1880.					
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May.	June.
Northern Pacific region	91.7	85.8	89.3	65.7	95.0	87.5	84.7	92.6	77.5	86.1	84.2	77.0
Central Pacific region	100.0	95.7	100.0	95.2	98.3	86.6	90.3	93.1	87.5	83.9	85.5	100.0
Southern Pacific region	100.0	100.0	100.0	100.0	97.5	88.3	96.0	92.9	88.3	83.9	87.5	100.0
Total percentage of verifications	97.2	93.8	96.4	86.9	96.9	87.5	90.3	92.9	84.4	84.6	85.7	92.3
The indications for the Pacific coast are for the "weather" only, and for the period made, the general percentage is												90.74

There was need of much deliberation and practice before it was deemed wise to attempt the work of forecasts for the great extent of coasts bordering upon the Pacific Ocean. Tradition had held it to be impossible to accurately announce approaching changes for any coast fronting westward with sea surfaces only beyond it. The stations upon the coast under consideration are yet few, the telegraphic communication difficult, the contours of the earth's surface broken by abrupt and great changes of elevation, the stations lying back from the coast so difficult to reach as to be almost useless. It has been found, however, that the facilities for study now provided in the study-room of the office enable changes approaching from the seaward to be considered by their effects on land, and studies to be made as to what sequences at sea and upon the coast must follow conditions exhibited upon the charts as existing in the interior. The results of such studies are exhibited by the statement of verifications submitted above. This work is not without its reference to future work upon the oceans. Map 9 exhibits the districts into which this region has been divided for purposes of this study.

The attempt has been continued to utilize the statements of indications issued in bulletin form by adding, when possible, precise information as to the location of areas of disturbance or storm-centers, their expected direction of movement, and such other facts as might be stated fully on the bulletins to be displayed at boards of trade rooms and other prominent points in cities, and be of utility both as amplifying the reports of indications furnished for the press, and also as capable of being issued from the central office at any hour it might be considered necessary so to issue them. The press reports are habitually furnished at fixed hours only. At these hours important and sometimes great atmospheric changes may seem to be only slightly indicated, when such changes afterward develop rapidly. It is sometimes not possible to preannounce them in any other than the bulletin form. The popular faith in the announcements of the office, now in the tenth year of their issue, has not diminished. So far as can be judged from reports, notably more attention has been paid to the announcements among the farming population. There seems each year more confidence and a greater willingness to be guided by the statements of forecasts in the conduct of agricultural operations. The increase in the proportional amount of the wheat product this year has been commented upon by the local press in some portions of the country as to some extent due to the accuracy of the weather reports furnished the farmers daily.

This confidence of the people, as a whole, has not been sensibly lessened at any time by the errors and omissions which sometimes direct attention to the fact that in the present condition of science, and with a system of observation still too limited, premonitions having for their scope a territory so great as that of the whole United States, and embracing the coasts of two oceans, cannot always be correct for every part of a district.

The reports of forecasts are necessarily limited also to a certain number and few telegraphic words, the report for a district comprising several States being condensed into four or five lines, every word of which must be paid for.

It is not possible always to describe within this limit of description weather changes clearly indicated as to occur, but notice of which must be omitted for want of space. It would not be difficult to write for each State, and with benefit to the readers, a synopsis with the forecasts stated in numbers of words equal to the whole number now allowed for those relating to all the States of the Union.

The Indications are not always correctly understood by those who read them; the error of mistaking the announcement made for one district, as set forth on the District Map, as applying to a district differently located is frequent. Every effort is made to render the division of the country into districts for purposes of description properly understood.

The popular knowledge of the duties of the office, and its reasonable success in discharging them, is in no way better evidenced than by the criticisms to which it is subjected if errors occur in the work. It is not many years since the work itself was, at home and abroad, deemed impracticable. In more recent criticisms the work has been commented upon adversely and severely, because even occasional errors happen. It has seemed to be considered that it ought never to fail. There has been no work other than that of this office to cause such success to be popularly expected. Criticisms of this kind are, by the general accuracy they imply, a source of satisfaction.

The instruction of officers of the Signal Service to fit them for the various duties of the office has been continued. The especial duties in which the officers on duty are severally engaged, each in his sphere, and each of which duties contributes its share to the success of the whole, are such as necessarily prepare them for the course of especial study and practice, and fit them to take charge, in turn, of the separate divisions and sections into which the office work is divided. A roster for duty becomes in this way possible, and provides at once for the permanent continuance of the work to be prosecuted both by day and at night, by providing for the relief of men wearied in the discharge of such parts of the duty as impose severe physical as well as mental strain by others fresh from duties less burdensome. It insures also the instant filling of vacancies in the cases of sickness or absence of any officer.

The studies to which reference has been hitherto made and the data condensed for generalization improve each year the material had in the office for study.

In the incessant work of the map-room, and in making the computations constantly called for in the course of office duty, important assistance is rendered by the competent and well-taught non-commissioned officers and soldiers on duty in the several divisions. In the matter of arriving at generalizations it would be impossible often to handle the masses of data which must be considered without the faithful service of these men. While absolute accuracy cannot be expected in work so extensive as that required from this office, and the results of which are demanded for instant publication, there is attained an accuracy sufficient for every practical purpose, and one which each year increases in rigor.

The data which appear in the publications of this office are checked figure by figure five times before the printing. These are, wherever it is practicable, accompanied by a chart, useful in itself, and by the charting the best check upon all the data which have served as its bases. Additional checks are adopted whenever experience has demonstrated a closer accuracy can be had.

The display of cautionary day and night signals, by flags by day, and lights by night, has been made systematically as occasions of supposed especial danger at the following points, ports and harbors located upon the lakes, the Atlantic and the Gulf coasts:

Alpena, Mich.; Atlantic City, N. J.; Ashtabula, Ohio; Baltimore, Md.; Barnegat, N. J.; Bay City, Mich.; Booth Bay, Me.; Boston, Mass.; Buffalo, N. Y.; Cape Hatteras, N. C.; Cape Henry, Va.; Cape Lookout, N. C.; Cape May, N. J.; Cape Vincent, N. Y.; Cedar Keys, Fla.; Charleston, S. C.; Charlevoix, Mich.; Charlotte, N. Y.; Chatham, Mass.; Chicago, Ill.; Chincoteague, Va.; City Island, N. Y.; Cleveland, Ohio; Deer Island, Me.; Delaware Breakwater, Del.; Detroit, Mich.; Duluth, Minn.; Dunkirk, N. Y.; Eastport, Me.; East Tawas, Mich.; Erie, Pa.; Escanaba, Mich.; Fairport, Ohio; Fall River, Mass.; Forrester, Mich.; Fort Macon, N. C.; Frankfort, Mich.; Galveston, Tex.; Gloucester, Mass.; Grand Haven, Mich.; Green Bay, Wis.; Highland Light, Mass.; Horn's Pier, Wis.; Houghton, Mich.; Hyannis, Mass.; Indianola, Tex.; Jacksonville, Fla.; Kenosha, Wis.; Kewaunee, Wis.; Key West, Fla.; Kittyhawk, N. C.; Lewes, Del.; Ludington, Mich.; Mackinac City, Mich.; Manitowoc, Wis.; Marblehead, Mass.; Marquette, Mich.; Menomonee, Mich.; Milwaukee, Wis.; Mobile, Ala.; Monroe, Mich.; Muskegon, Mich.; New Bedford, Mass.; Newburyport, Mass.; New Haven, Conn.; New Haven Light, Conn.; New London, Conn.; New Orleans, La.; Newport, R. I.; New York City; Norfolk, Va.; Northport, Mich.; Oswego, N. Y.; Pensacola, Fla.; Pentwater, Mich.; Port Austin, Mich.; Port Eads, La.; Port Huron, Mich.; Portland, Me.; Portsmouth, N. H.; Provincetown, Mass.; Racine, Wis.; Rochester, N. Y.; Rockland, Me.; Rogers City, Mich.; Saint Joseph, Mich.; Saint Marks, Fla.; Sand Beach, Mich.; Sandusky, Ohio; Sandy Hook, N. J.; Savannah, Ga.; Sheboygan, Wis.; Smithville, N. C.; South Haven, Mich.; Stonington, Conn.; Sturgeon Bay, Wis.; Thatcher's Island, Mass.; Toledo, Ohio;

Traverse City, Mich.; Tybee Island, Ga.; Wilmington, N. C., and Wood's Holl, Mass.

During the year ending June 30, 1880, two thousand eight hundred and thirty-five signals have been ordered, counting each separate display at each port as a separate signal, in anticipation of one hundred and five dangerous storms.

Of the number of cautionary signals displayed, eighty-two and four-tenths per cent. have been afterward reported as justified by the occurrence of winds, &c.

Of the number of off-shore signals displayed, eighty-seven per cent. have been afterward reported as justified.

The following table exhibits the number of signals (cautionary and off-shore) ordered during each month, and the percentage of verifications for each month; also the total number of signals ordered during the year, with the total number verified and annual percentage of verifications:

Month and year.	Cautionary signals.	Verified.	Per cent.	Cautionary off-shore signals.	Verified.	Per cent.	Total number of signals.	Total number verified.	Per cent.
1879.									
July	98	82	83.7	0	0	0.0	98	82	83.7
August	87	73	83.9	13	13	100.0	100	86	86.0
September	170	117	68.8	29	19	65.5	199	136	67.3
October	166	114	68.7	51	44	86.3	217	158	72.8
November	236	219	92.8	82	80	97.6	318	299	94.0
December	270	220	81.5	82	63	76.8	352	283	80.4
1880.									
January	160	119	74.4	46	40	87.0	206	159	77.2
February	166	156	94.0	107	98	91.6	273	254	93.0
March	260	225	86.5	94	85	90.4	354	310	87.6
April	292	254	87.0	104	91	87.5	396	345	87.1
May	188	142	75.0	33	27	81.8	221	169	76.5
June	89	76	85.4	12	8	66.7	101	84	83.2
Totals	2,182	1,797	82.4	653	568	87.0	2,835	2,365	83.4

Of the total number of cautionary and off-shore signals thus displayed, eighty-three and four-tenths per cent. have been afterward reported as justified by the occurrence of winds held to warrant them at the points where the signals were displayed, or within the radius of one hundred miles distant of these points, as set forth in the rules of the office. In the cases reported as failures of justification following the display, the winds did not attain, at the port or within the described radius, a violence held to justify the warning. The signal ordered by this office is always cautionary in its character, not announcing that a storm will come, but that the indications are sufficiently threatening to call for caution, both as to going to sea and preparation for rough weather if vessels are about to sail.

The following tables show the location of the cautionary and cautionary off-shore signal display stations under the direction of the office of the Chief Signal Officer, the date on which each was established, the names of the displaymen, the number of cautionary and cautionary off-shore signals displayed, the number reported justified, and the number reported not justified, from July 1, 1879, to June 30, 1880, except in cases where they were established subsequent to July 1, 1879:

SECTION No. 1, ON OR NEAR LAKE MICHIGAN.

Stations.	Date of establishment.	Name of displayman.	Cautionary signals.			
			Number ordered displayed.	Number reported justified.	Number reported not justified.	Number not reported upon.
Green Bay, Wis	Sept. 16, 1877	David Soper	41	28	13	0
Horn's Pier, Wis	Mar. 15, 1878	W. H. Horn	50	32	13	5
*Kenosha, Wis	Sept. 16, 1877	H. R. Simmons				
Kewaunee, Wis	Sept. 16, 1877	A. D. Laughlin, P. M	47	29	16	2
Manitowoc, Wis	Sept. 16, 1877	W. W. De Lano	43	30	13	0
Menomonee, Mich	Sept. 16, 1877	N. Gram	46	32	14	0
Racine, Wis	Sept. 16, 1877	G. W. Scanlon	48	27	21	0
Sheboygan, Wis	Sept. 16, 1877	J. L. Mallery	45	26	19	0
Sturgeon Bay, Wis	Sept. 16, 1877	J. B. Scott	45	31	14	0

* Reports incomplete.

Section No. 1 is under the charge of the sergeant at Milwaukee, Wis., through whom all signal orders are sent.

SECTION No. 3, ON OR NEAR LAKE MICHIGAN.

Frankfort, Mich	July 20, 1878	C. S. Collier	47	35	12	0
Ludington, Mich	Jan. 20, 1878	H. F. Alexander	64	47	17	0
Muskegon, Mich	Feb. 15, 1879	Lafayette Freeman	45	19	19	7
Northport, Mich	July 20, 1878	William Gill, P. M	47	36	11	0
Pentwater, Mich	July 20, 1878	M. A. Rice	43	34	9	0
South Haven, Mich	Aug. 10, 1878	J. S. Donahue	46	19	27	0
Saint Joseph, Mich	Aug. 10, 1878	J. H. King	51	29	20	2
Traverse City, Mich	July 20, 1878	S. C. Fuller, P. M	45	26	19	0
Charlevoix, Mich	Aug. 1, 1879	W. A. Smith	38	33	5	0

Section No. 3 is under the charge of the sergeant at Detroit, Mich., through whom all signal orders are sent.

During the suspension of navigation, signals are ordered for Ludington direct from the office of the Chief Signal Officer.

SECTION No. 4, ON OR NEAR LAKE HURON.

Bay City, Mich	Aug. 1, 1878	James Roberts	49	33	16	0
East Tawas, Mich	Aug. 1, 1878	E. C. French	45	33	12	0
Forrester, Mich	Aug. 1, 1878	F. T. Smith	41	21	20	0
Port Austin, Mich	Aug. 1, 1878	Philip Winsor	42	33	8	1
Rogers City, Mich	Aug. 1, 1878	Henry Clothier	40	33	7	0
Monroe, Mich	Aug. 1, 1878	J. J. Hubbell	45	36	9	0
Sand Beach, Mich	Sept. 20, 1879	R. W. Irwin	37	26	11	0

Section No. 4 is under the charge of the sergeant at Detroit, Mich., through whom all signal orders are sent.

SECTION No. 5, ON LAKE ERIE.

Ashtabula, Ohio	Aug. 1, 1878	W. O. Nettleton	47	38	9	0
Dunkirk, N. Y	Aug. 1, 1878	S. T. Blakeney	48	26	22	0
Fairport, Ohio	Aug. 28, 1878	A. P. Sanford	50	39	11	0

Section No. 5 is under the charge of the sergeant at Cleveland, Ohio, through whom all signal orders are sent.

SECTION No. 7, ON THE NEW ENGLAND COAST.

Station.	Date of establishment.	Name of displayman.	Cautionary signals.				Cautionary off-shore signals.				
			Number ordered displayed.	Number reported justified.	Number reported not justified.	Number not reported upon.	Number ordered displayed.	Number reported fully justified.	Number reported justified as to direction.	Number reported justified as to velocity.	Number reported not justified.
Booth Bay, Me	Aug. 29, 1878	John O'Brien	46	28	19	0	22	14	6	....	2
Deer Isle, Me	Apr. 1, 1879	F. H. Gross	44	24	20	0	23	17	5	....	1
Portsmouth, N. H	Aug. 20, 1878	G. H. Nutter	44	15	29	0	22	10	12	....	0
Rockland, Me	June 1, 1879	W. J. Rideout	44	25	19	0	21	13	5	1	2

Section No. 7 is under the charge of the sergeant at Portland, Me., through whom all signal orders are sent.

SECTION No. 8, ON THE NEW ENGLAND COAST.

Station.	Date of establishment.	Name of displayman.	Cautionary signals.			Cautionary off-shore signals.					
			Number ordered displayed.	Number reported justified.	Number reported not justified.	Number ordered displayed.	Number reported fully justified.	Number reported justified as to direction.	Number reported justified as to velocity.	Number reported not justified.	Number not reported upon.
Chatham, Mass	Aug. 15, 1878	C. S. Nickerson	56	35	21	30	20	8	1	1	0
Fall River, Mass	Oct. 18, 1878	W. G. Bennett	17	6	11	16	5	5	2	4	0
Gloucester, Mass	Sept. 25, 1878	Edward McQuinn	50	35	15	30	17	13	0	0	0
Highland Light, Mass	Aug. 15, 1878	Isaac M. Small	50	38	12	29	21	6	2	0	0
Hyannis, Mass	Aug. 15, 1878	E. F. Lothrop	53	41	12	29	22	2	2	3	0
Marblehead, Mass	Aug. 15, 1878	Frank Dodge	52	20	32	33	16	16	0	0	1
New Bedford, Mass	Aug. 15, 1878	G. A. Gifford	51	20	31	27	13	10	4	0	0
Newburyport, Mass	Aug. 15, 1878	Capt. J. W. Sargent	52	21	31	28	13	3	0	12	0
Provincetown, Mass	Sept. 1, 1879	A. M. Kemp	46	36	10	24	18	4	0	2	0

Section No. 8 is under the charge of the sergeant at Boston, Mass., through whom all signal orders are sent.
The display of signals was suspended at Fall River, Mass., from May 12, 1879, to February 17, 1880.

List of display stations not in sections, but which receive their orders from a designated station or direct from the office of the Chief Signal Officer.

Station.	Date of establishment.	Name of display-man.	Designated station from which orders are received.	Cautionary signals.				Cautionary off-shore signals.				
				Number ordered displayed.	Number reported justified.	Number reported not justified.	Number not reported upon.	Number ordered displayed.	Number reported fully justified.	Number reported justified as to direction.	Number reported justified as to velocity.	Number reported not justified.
Cape Vincent, N. Y	Aug. 1, 1878	C. C. Brown	Oswego, N. Y	35	23	12	0	......	......	......	......	......
Charlotte, N. Y	Aug. 1, 1878	A. J. Mulligan	Rochester, N. Y	37	22	13	2	......	......	......	......	......
City Island, N. Y	Feb. 1, 1879	H. B. Roberts	New York, N. Y	51	40	11	0	30	29	1	0	0
Houghton, Mich	Aug. 1, 1879	J. R. Dee	Office Chief Signal Officer	36	17	19	0	......	......	......	......	......
Lewes, Del	Feb. 25, 1878	C. M. Marshall	......do	50	39	11	0	32	29	3	0	0
Mackinac City, Mich	Oct. 4, 1878	J. F. Stimpson	......do	38	29	9	0	......	......	......	......	......
Pensacola, Fla	Nov. 10, 1878	James Brown, jr	Mobile, Ala	4	4	0	0	......	......	......	......	......
Port Eads, La	Oct. 10, 1878	F. C. Welschans	Office Chief Signal Officer, through the sergeant at New Orleans, La.	16	10	6	0	9	5	1	0	3
Stonington, Conn	Oct. 10, 1878	S. O. Pendleton	New London, Conn	43	16	27	0	28	14	10	2	2
Tybee Island, Ga	Feb. 15, 1879	H. J. Valleau	Savannah, Ga	10	5	5	0	......	......	......	......	......

The station at Lewes was transferred to Delaware Breakwater January 27, 1880.
Pensacola became a station of the first class October 27, 1879.

It is one of the most difficult tasks which fall to the office to determine in advance over what ports to be selected, to the exclusion of others, an advancing storm-area will pass, and in such a manner as to be accompanied at these ports with a given wind-velocity. The direction of movement of storm-areas changes sometimes unexpectedly, and ports are then threatened at which, while the signal may be exhibited, it cannot be shown far enough in advance to avoid the coming danger. Within the same area the winds differ in force at different points. They differ also with different contours of the earth's surface. There is the danger that warnings unnecessarily given may delay the movements of shipping. A heavy responsibility is incurred if the warnings are not given when they ought to be. Time, increasing experience, and increasing facilities will insure improvement.

The storm of a storm-area with wind registering a wind-velocity of twenty-five miles per hour on land, indicating, as it frequently does, a wind-velocity of forty-five or fifty miles at a distance of ten or twenty miles from the land, is regarded as the lowest velocity justifying a signal.

There is no work of the office in which it has been felt necessary to progress with more caution than in that relating to the display of cautionary signals. None had ever been shown in the United States when the duty of making such displays devolved upon this office, and it was in debate whether any had ever been shown with practical success elsewhere.

Two classes of signals, the cautionary signal and the cautionary off-shore signal, are in use on the coasts of the United States. The "cautionary signal," *i. e.*, a red flag with black square in the center by day, or a red light by night, calls for caution in view of an approaching storm, and is so "cautionary" with reference to winds blowing from any direction. The cautionary off-shore signal, *i. e.*, a white flag with black square in the center, shown above a red flag with black square in the center by day, or a white light shown above a red light by night, is "cautionary" with reference to winds expected to blow from a northern or western direction, or off-shore, at or near the place at which it may be displayed. This latter signal is displayed at and on the regular place and staff, and consists of a *white flag with a square black center* shown above a *red flag with a square black center* by day, or a *white light* shown above a *red light* by night. This signal is known as the "cautionary off-shore signal," and indicates, when shown, that while the storm disturbance is considered at the office of the Chief Signal Officer as not yet passed for the port or place at which the signal is displayed, and the winds may yet be high, and there may be danger, the winds are expected to blow from a northern or western direction or "off-shore," at or near the port or place where the signal may be.

The display of this signal will often follow and must be distinguished from the display of the usual "cautionary signal," *i. e.*, a square red flag with a square black center by day or a red light shown at night, which retains, when shown alone, its usual meaning. The display of either is always cautionary.

It is of important utility in the management of vessels and for the safety of them to be thus preadvised as to the direction in which coming winds will blow.

The plan for subordinate stations at which cautionary signals might be displayed (systems of these stations being managed as subordinate to and in connection with the signal stations of the first class, established at the principal cities and ports of the United States, and immediately controlled from this office) has been continued in operation. As described in the last annual report these subordinate stations are known as "display-stations." They are located at the smaller lake or sea-ports, and are classed several together in sections. Each section is numbered as "Section One," "Section Two," &c., and is under the immediate supervision of a sergeant of the Signal Corps, located at a named station at some neighboring principal port. The duties at display-stations are limited to this display, upon the receipt of the telegraphic order by day or at night, of the cautionary signals or cautionary off-shore signals.

Since the date of the last annual report additional display-stations have been established on Lakes Huron, Michigan and Superior, as follows: In Section Three, controlled from Detroit, Mich., Charlevoix, Mich., August 1, 1879. In Section Four, controlled from Detroit, Mich., Sand Beach, Mich., September 20, 1879; Houghton, Mich., August 1, 1879. Signals are displayed when ordered direct from this office. On the sea-coast as follows: In Section Eight, Provincetown, Mass., September 1, 1879, and Fall River, Mass., February 17, 1880. The display of signals at the latter station had been suspended since May 12, 1879. Of signals displayed at display-stations, the record shows 65 per cent. considered verified at the stations themselves.

Before the organization of the display system, signals were displayed at forty-six ports only; they are now displayed, when need be, at one hundred and six ports.

The warnings of the service have been doubled in utility by the adoption of the off-shore signal and the organization of the system of display-stations.

An additional safeguard is offered on the lake coasts, where either full signal stations or display-stations exist, by the fact that whenever it is found necessary to display a warning signal of any character upon any station on those coasts, notice and warning of the fact is announced by telegraph at every other station along the lakes.

There are no other coasts so fully guarded by the display of storm signals as are now those of the United States.

A completeness of work, which a few years ago seemed not to be attainable on the part of the office for many years, is, by the experience gained in those duties within the few years past, already accomplished.

If the duties of this office are done and its warnings exhibited at its warning stations as they ought to be, the record of disasters cannot fail to show, by the lessened number of them, the good effects of this watchful care. It is a pleasant thought that the protecting vigilance of the United States is offered in this regard, and in all matters pertaining to this duty, equally to the shipping of every foreign people with the shipping of its own.

Compilations of statistics have been made to determine definitely, and to the satisfaction of the office, what certain benefits to shipping have followed the displays of cautionary signals. A series of tables of disasters to shipping, compiled for a number of years, have seemed to show that the annual average of disasters occurring at or near points at which cautionary signals have been displayed has been lessened by a considerable percentage for the years during which the displays have been had. The discrimination made by insurance companies against insurance risks, taken for the sea and lake-ports and places which have no signal stations, exhibits, by the increased pecuniary consideration demanded for such risks, amounting in the aggregate to a very considerable sum, an evidence of appreciation of the value of them. The reports of the observers at stations give instances in which numerous vessels have remained in different ports in recognition of the warnings given. In these cases danger has been avoided. In other cases the displays of signals on dangerous coasts have been followed by the making to sea for an offing of all of the vessels in sight of the display. In other instances reported, vessels going to sea in disregard of the warnings have been driven back, have suffered injury, or have been lost. So far as can be judged at this office, a proper attention is paid to its warnings, particularly on the part of the coasting or smaller classes of vessels on the seacoast, and by shipping generally on the lakes. Especially does this happen at those times of the year recognized by seamen as the stormy seasons.

During the year ending June 30, 1880, four hundred and thirty-five storm warnings for Canadian stations were telegraphed from this office to the Superintendent of the Dominion Meteorological Service, at Toronto, Canada. The uses made of these warnings, or their results when displayed, have not been communicated to this office.

The plan of exhibiting as widely as possible in the agricultural districts throughout the United States the results of the daily office studies in the form of printed forecasts for the benefit of the agricultural populations, frequently described in former reports, has been continued in operation. The effort to cover so wide an extent of territory has made the labor great. The continuance of the work has seemed to be warranted by the favor with which it has been received. It has been considered due to the farming populations that they should have an opportunity to profit by whatever information could be given them. With the active co-operation of the Post-Office Department, with which there is an arrangement for this purpose, six thousand one hundred and sixty-seven printed Farmers' Bulletins, on which have appeared daily the reports of this office, have been distributed and displayed in frames daily at as many different cities, villages, and hamlets in different States. There are numerous and especial requests to increase this number. At 1 o'clock a. m. of each day, except Sunday, the midnight report of the office for the ensuing day has been telegraphed during the year ending June 30, 1880, to seventeen centers of distribution, located in the following-named cities: Albany, N. Y., 265; Bangor, Me., 163; Boston, Mass., 659; Buafflo, N. Y., 280; Burlington, Iowa, 189; Chicago, Ill., 634; Cincinnati, Ohio, 543; Des Moines, Iowa, 62; Detroit, Mich., 335; Leavenworth, Kans., 45; Logansport, Ind., 185;* Memphis, Tenn., 16; Nashville, Tenn., 97; New York, N. Y., 719; Pittsburgh, Pa., 312; Philadelphia, Pa., 827; Saint Louis, Mo., 366. Four hundred and seventy copies of the bulletin are also issued daily from the central office in Washington. In addition thereto a miscellaneous issue of five hundred copies is made at the several printing stations above mentioned. At five of these stations the bulletins are printed by civilian employés upon the office presses, and under the immediate supervision of the sergeants in charge. At the other thirteen stations the work is wholly done by enlisted men of the Signal Corps.

The numbers placed after the names of the cities denote the number of hamlets, post-offices, or railway stations supplied from each city as a center.

These centers have been carefully chosen as in the midst of the denser agricultural populations of the United States, and at points whence the facilities of communication would enable the surrounding districts to be most rapidly supplied.

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* The printing of the Farmers' Bulletins at Memphis was discontinued April 7, 1880. Since that date it has been written in manifold.

The telegraphic report of forecast telegraphed from the central office at 1 a. m. of each day, and received at a center of distribution, is at once there printed on bulletin forms provided for that purpose. These are enveloped as rapidly as printed, addressed to each designated post-office within the district to be supplied, and which can be reached by the swiftest conveyance by the hour of 2 p. m. of the date, and are then placed in charge of the Post-Office Department under an arrangement by which each postmaster receiving a bulletin has the order of the Postmaster-General to display it instantly in a frame furnished by this office for that purpose, and to report in writing the fact and time of its receipt and its display to the Chief Signal Officer.

The bulletins have reached the different offices and have been displayed in each of the frames at the average hour of 11 a. m., averaging thus ten hours from the time the report has left the office of the Chief Signal Officer until it has appeared bulletined in the midst of the farming populations, and accessible to them in the distant parts of the country.

The information given on these bulletins has a value in addition to the forecasts. Facts relating to the climatology of the different sections are condensed into brief notes, which are published with the telegraphed reports. For instance, each bulletin announces for the geographical district in which it is displayed, and in addition to the forecast for the day, what winds in each month have been found most likely and what least likely to be followed by rain at the stations within each district. The simple foot-note has its effect in increasing the gains and reducing the losses of harvesting.

These bulletins will improve for the uses for which they are intended as the experience of the office permits the information they exhibit to be supplemented with further data and other rules. With each year the popular knowledge of the uses of the bulletin and some increased interest in and study of meteorology render the farming communities better able to judge of its correctness and to benefit by its contents. It is contemplated, as the work of the office progresses, to add to the bulletins such brief instructions as may be developed in regard to its uses in connection with such local instruments as may be had for local use. Reference has been made in preceding reports to the economy of this work. Careful estimates have shown that if the total cost for each bulletin station at which the bulletin is displayed at each different post-office, hamlet, village, or city were computed to be 27 cents per day, the sum so resulting would meet all the expenses caused by the Signal Service. A little saving of any one crop of grain to any interest, made on any one day in the vicinity of each station, supposing nothing to be saved on any other day of the year at or near that station, would more than counterbalance the expenditure.

The distribution of the instrument known as the Weather Case, or Farmers' Weather Indicator, has been continued. Brief rules for use accompany each instrument. (Paper 30.) This instrument will supplement with local signs and with the local indications of the several instruments; it combines in simple form the general indications given in the bulletin reports. It will, it is hoped, enable agriculturists and others to determine for themselves in advance something as to the character of the coming weather from local indications alone, when added means of information cannot be reached or may fail.

Whenever appropriations at the control of the office shall make it possible to publish, to accompany the Farmers' Bulletin, or in the columns of newspaper journals, graphic weather charts, simply drawn and so explained as to be comprehended as to their meaning by persons of ordinary education without special study, the use, it is to be hoped, of instruments of this character will be found very available. The use of the Weather Case alone at isolated places, where other reports or information other than that had from the readings and the use of the instrument itself cannot be had, will, with little practice, fill a want long felt among the agricultural populations, and often afford to them valuable results. It cannot fail to turn thought and study in a useful direction.

It is in contemplation, when the amounts of the appropriations for the service and its strength permits, to place such instruments, should experience warrant, both at the farmers' post-offices now reached by the Farmers' Bulletin and at others not reached by either the bulletin, the daily press, or the telegraph, for the use of the farming population.

The railway bulletin service has been increased during the year, and continues to give satisfaction as a rapid means of disseminating the Indications issued from this office. As stated in the last annual report, this service is established on lines of railway, which have entered into an arrangement with the War Department, by which they receive at the time of the midnight report and by telegraph a copy of the office report, then made. This is the most important report of the day, the report exhibiting the Synopses and Indications, which appear so generally published in the columns of the daily journals. The report received by the railway companies is at once distributed under the direct supervision of the superintendents of the companies and of the railway telegraphs to designated railway stations along the several railway lines; ninety-five railway companies, with a total of two thousand eight hundred and eighty-nine railway stations, are now coöperating in this service. The report received at a railway station is by standing order of the railway officers immediately there bulletined by the railway agents on forms provided by this office, and check reports are made by the agents to this office in order that the attention of superintendents may be called to any delay or error in the work. The work is yet in its infancy, but promises to be of great utility. It is capable of indefinite extension, and will exhibit the forecasts of this office daily, in a few hours after their issue, to the traveling public and the vast number of farmers and other residents in the great extent of country through which the railway lines pass, and which could not be otherwise reached. The railway companies rendering this service to the United States, without charge, are not rendering a gratuitous service. A benefit is returned to them in the full knowledge given the managers of the railway lines of the weather conditions prevailing upon them. A further benefit comes to the companies that they render everywhere to the homes of the people, in the midst of which the lines pass, a daily service recognized with gratitude. The companies which have entered into this coöperation with the service, with the number of stations on each, are as follows:

Chicago, Burlington and Quincy Railroad, T. J. Potter, superintendent, Burlington, Iowa, 258 stations; Pittsburgh, Cincinnati and Saint Louis Railroad, D. W. Caldwell, superintendent, Columbus, Ohio, 55 stations; Scioto Valley Railroad, J. B. Peters, superintendent, Columbus, Ohio, 11 stations; Marietta and Cincinnati Railroad, John Waddle, superintendent, Cincinnati, Ohio, 9 stations; Cairo and Saint Louis Railroad, L. M. Johnson, superintendent, Saint Louis, Mo., 19 stations; Alleghany Valley Railroad, David McCargo, superintendent, Pittsburgh, Pa., 34 stations; Atchison, Topeka and Santa Fé Railroad, W. B. Strong, superintendent, Topeka, Kans., 43 stations; Kansas City, Saint Joseph and Council Bluffs Railroad, George H. Nettleton, superintendent, Kansas City, Mo., 11 stations; Kansas City, Lawrence and Southern Railroad, H. C. Sprague, superintendent of telegraph, Kansas City, Mo., 19 stations; Atchison and Nebraska Railroad, H. W. Forman, superintendent of telegraph, Atchison, Kans., 25 stations; Kansas City, Fort Scott and Gulf Railroad, H. C. Sprague, superintendent of telegraph, Kansas City, Mo., 20 stations; Saint Louis and Southeastern Railroad, J. H. Wilson, superintendent, Evansville, Mo., 22 stations; Chicago and Northwestern Railroad, W. H. Stennet, superintendent, Chicago, Ill., 87 stations; Pittsburgh, Fort Wayne and Chicago Railroad, C. E. Gorham, superintendent, Pittsburgh, Pa., 35 stations; Cleveland, Columbus, Cincinnati and Indianapolis Railroad, E. B. Thomas, superintendent, Cleveland, Ohio, 35 stations; Indianapolis, Cincinnati and Lafayette Railroad, M. E. Ingalls, superintendent, Cincinnati, Ohio, 21 stations; Chicago and Alton Railroad, J. C. McMullen, superintendent, Chicago, Ill., 99 stations; Chicago and Eastern Illinois Railroad, O. S. Lyford, superintendent, Chicago, Ill., 25 stations; Central Iowa Railroad, D. E. Pickering, superintendent, Marshalltown, Iowa, 11 stations; Burlington, Cedar Rapids and Northern Railroad, J. D. Fox, superintendent of telegraph, Cedar Rapids, Iowa, 66 stations; Trans-Ohio Division (Baltimore and Ohio Railroad), D. H. Hudson, superintendent, Chicago, Ill., 62 stations; Saint Louis, Vandalia, Terre Haute and Indianapolis Railroad, J. E. Simpson, superintendent, Cincinnati Ohio, 21 stations; Milwaukee, Lake Shore and Western Railroad, H. G. H. Reed, superintendent, Milwaukee, Wis., 10 stations; Saint Louis and San Francisco Railroad, Capt. C. W. Rogers, superintendent, Saint Louis, Mo., 37 stations; Detroit, Lansing and Northern Railroad, J. B. Mullikin, superintendent, Detroit, Mich., 10 stations; Louisville, Nashville and Great Southern Railroad, D. W. C. Rowland, superintendent, Louisville, Ky., 39 stations; Evansville, Terre Haute and Chicago Railroad, Joseph Collett, superintendent, Terre Haute, Ind., 7 stations; Evansville and Terre Haute Railroad, J. E. Martin, superintendent, Evansville, Ind., 8 stations; Fort Wayne, Muncie and Cincinnati Railroad, W. W. Worthington, superintendent, Fort Wayne, Ind., 13 stations; White Water Railroad, W. W. Worthington, superintendent, Fort Wayne, Ind., 5 stations; Fort Wayne, Jackson and Saginaw Railroad, R. B. Loomis, superintendent, Jackson, Mich., 13 stations; Toledo and Ann Harbor Railroad, George L. Peck, superintendent of telegraph, Toledo, Ohio, 6 stations; Cleveland, Mount Vernon and Columbus Railroad, General G. A. Jones, superintendent, Mount Vernon, Ohio, 9 stations; Cincinnati, Sandusky and Cleveland Railroad, D. W. C. Brown, superintendent, Sandusky, Ohio, 16 stations; Northwestern Grand Trunk Railroad, Charles B. Peck, superintendent, Port Huron, Mich., 22 stations; Southern Minnesota Railway, P. M. Myers, superintendent, LaCrosse, Wis., 41 stations; Old Colony Railroad, James H. French, assistant superintendent, Boston, Mass., 108 stations; Detroit, Grand Haven and Milwaukee Railroad, W. J. Morgan, assistant superintendent, Detroit, Mich., 4 stations; Eastern Railroad, E. B. Phillips, president, Boston, Mass., 54 stations; Buffalo and Southwestern Railroad, John F. Moulton, superintendent, Buffalo, N. Y., 8 stations; New York, Pennsylvania and Ohio (formerly Atlantic and Great Western Railroad), J. H. Devereux, receiver, Cleveland, Ohio, 22 stations; Boston and Albany Railroad, Charles O. Russell, superintendent, Springfield, Mass., 14 stations; New York Central and Hudson River Railroad, J. M. Toucey, superintendent, New York City, N. Y., 31 stations; Portland and Rochester Railroad, George P. Wescott, receiver, Portland, Me., 7 stations; Richmond, Fredericksburg and Potomac Railroad, Maj. E. T. D. Myers, superintendent, Richmond, Va., 6 stations; Richmond and Danville Railroad, Col. T. M. A. Talcott, superintendent, Richmond, Va., 12 stations; Camden and Atlantic Railroad, F. A. Lister, superintendent, Camden, N. J., 12 stations; Philadelphia, Wilmington and Baltimore Railroad, H. F. Kenny, superintendent, Philadelphia, Pa., 43 stations; Philadelphia and Reading Railroad, Franklin B. Gowan, receiver, Philadelphia, Pa., 85 stations; Grand Rapids and Indiana Railroad, F. A. Gorham, auditor, Grand Rapids, Mich., 64 stations; Portland and Ogdensburgh Railroad, Jonas Hamilton, superintendent, Portland, Me., 5 stations; Maine Central Railroad, Payson Tucker, superintendent, Portland, Me., 12 stations; Cumberland Valley Railroad, I. T. Boyd, superintendent, Chambersburg, Pa., 9 stations; Atlantic, Mississippi and Ohio Railroad, Col. Frank Huger, master of transportation, Lynchburg, Va., 14 stations; Mobile and Montgomery Railroad, Capt. E. L. Tyler, superintendent, Montgomery, Ala., 17 stations; Connecticut Central* Railroad, D. D. Warren, president, Springfield, Mass., 7 stations; Baltimore and Ohio Railroad, Chas. A. Tinker, superintendent, Baltimore, Md., 37 stations; Huntingdon and Broad Top Railroad, G. F. Gage, superintendent, Huntingdon, Pa., 6 stations; Northern Central Railway Company, G. C. Wilkins, superintendent, Baltimore, Md., 9 stations; Baltimore and Potomac Railroad, G. C. Wilkins, superintendent, Baltimore, Md., 5 stations; West Jersey Division Pennsylvania Railroad, General W. J. Sewell, general superintendent, Camden, N. J., 20 stations; Frederick Division, Pennsylvania Railroad, H. H. Carter, superintendent, York, Pa., 13 stations; Elmira and Canandaigua Division, Pennsylvania Railroad, Robert Neilson, superintendent, Elmira, N. Y., 20 stations; Philadelphia and Erie Division, Pennsylvania Railroad, William A. Baldwin, general superintendent, Williamsport, Pa., 31 stations; Main Line Philadelphia to Pittsburgh, Pennsylvania, Railroad, Charles C. Pugh, general superintendent, Altoona, Pa., 94 stations; New York Division, Pennsylvania Railroad, James McCrea, superintendent, Jersey City, N. J., 36 stations; Belvidere Division, Pennsylvania Railroad, John Anderson, superintendent, Lambertville, N. J., 14 stations; Amboy Division, Pennsylvania Railroad, J. S. Buckelew, superintendent, Camden, N. J., 24 stations; Boston and Maine Railroad, J. F. Furber, superintendent, Boston, Mass., 34 stations; Boston and Providence Railroad, A. A. Folsom, general superintendent, Boston, Mass., 15 stations; New York and New England Railroad, H. M. Britton, superintendent, Boston, Mass., 16 stations; Boston, Revere Beach and Lynn Railroad, E. H. Whorf, superintendent, Boston, Mass., 9 stations; Lehigh Valley Railroad, R. H. Sayre, superintendent, Bethlehem, Pa., 28 stations; Indianapolis, Bloomington and Western Railroad, B. S. Henning, superintendent, Indianapolis, Ind., 24 stations; Providence and Worcester Railroad, W. E. Chamberlain, superintendent, Providence, R. I., 13 stations; Boston, Barre and Gardner and Monadnock Railroad, H. M. Witter, superintendent, Worcester, Mass., 19 stations; Marietta, Pittsburgh and Cleveland Railroad, S. C. Baldwin, superintendent, Marietta, Ohio, 16 stations; Carolina Central Railroad, Dr. C. Roberts, superintendent, Wilmington, N. C., 9 stations; Savannah and Charleston Railroad, C. S. Gadsden, superintendent, Charleston, S. C., 6 stations; Southern Central Railroad, James G. Knapp, superintendent, Auburn, N. Y., 21 stations; Boston and Lowell Railroad, A. A. Hobart, superintendent, Boston, Mass., 13 stations; Little Miami Division of Pittsburgh, Cincinnati and Saint Louis Railroad, J. D. Ellison, superintendent, Cincinnati, Ohio, 10 stations; Mississippi and Tennessee Railroad, M. Burke, superintendent, Memphis, Tenn., 9 stations;

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* Transferred to New York and New England Railroad June 1, 1880.

Memphis and Charleston Railroad, J. A. Grant, superintendent, Memphis, Tenn., 12 stations; Indianapolis, Peru and Chicago Railroad, V. T. Malott, general manager, Indianapolis, Ind., 22 stations; Grand Rapids, Newaygo and Lake Shore Railroad, C. Warren, superintendent, Grand Rapids, Mich., 8 stations; Chesapeake and Ohio Railroad, W. C. Wickham, second vice-president, Richmond, Va., 25 stations; Rome, Watertown and Ogdensburg Railroad, F. A. Van Horn, superintendent, Oswego, N. Y., 17 stations; Greenville and Columbia Railroad, R. H. Temple, superintendent, Columbia, S. C., 12 stations; Chicago, Milwaukee and Saint Paul Railroad, B. L. Lennox, general superintendent, Milwaukee, Wis., 358 stations; Chicago and West Michigan Railroad, A. Nichols, general superintendent, Grand Rapids, Mich., 41 stations; New York and Oswego Midland (now New York, Ontario and Western Railroad), Theo. Houston, general manager, New York City, N. Y., 49 stations; Memphis and Little Rock Railroad, W. E. Smith, superintendent, Memphis, Tenn., 13 stations; Grand Trunk Railroad, J. Stevenson, assistant superintendent, Island Pond, Vt., 14 stations; Flint and Pere Marquette Railroad, H. C. Potter, receiver, East Saginaw, Mich., 9 stations. Total, 2,889 stations. This office furnishes the blank bulletins, the frames for displaying them, and the necessary forms, envelopes, and stamps for making regular reports of the receipt and display of the bulletins.

The river reports, giving the average depth of water in the different great rivers of the interior, and notices of the dangerous rises for the benefit of the river commerce and the populations in the river valleys, have been regularly made, telegraphed, bulletined in frames, and also published by the press at the different river ports and cities. River stations have been opened on the principal California rivers.

The manner in which these reports are prepared and used, and the mode by which a "danger-line," with water below which there is considered to be no danger, while every rise above it is dangerous, have been sufficiently explained in preceding annual reports.

The uses of the information published in reference to this danger-line had in connection with the daily reports of this office have, on the occurrence of river floods, enabled those interested to judge of the probable limits of the rises of the water to be expected at the different places on the river-banks, and of the dangers to be anticipated. This knowledge has made possible many and necessary precautions for safety.

The data had at this office from stations making river reports permit a foreknowledge of changes likely to happen, and make it possible to give useful warnings of coming floods, ice floods, or of sudden and great rises of the river water-levels. The daily reports are useful also at times of low water, the information they then give permitting river shipping to be moved with intelligent foreknowledge of the probable depths of water to be found in the river channels at different points upon the river's course. These reports are especially useful to those for whom they are intended, as having an official character.

In instances which have attracted the attention of this office, the notices of the probable heights floods anticipated or then passing would attain, have been followed by preparations made to guard against danger.

A brief examination of the charts of changes of the river-levels accompanying this and preceding reports shows that the river rises to occur at the different localities can be judged of frequently as to the time at which they will occur, and their extent by the conditions existing at points sometimes far distant. Accumulating data render studies of this kind valuable. In connection with these studies the examination of the daily weather-charts, showing places at which precipitation has occurred or is likely to occur, and the amount of such precipitation, had with the study of the charts of the river basins, which enable it to be determined what rivers will be affected by precipitation, are found to be of value in furnishing correct prognostications. This subject has been referred to in preceding reports.

The Chief Signal Officer has before expressed the opinion that with proper study of the river floods, and with stations properly placed, reporting at times of especial danger, it can be made almost impossible for a flood to follow a river course without notice given in advance of its coming at the localities threatened.

Daily bulletins of river reports have been regularly displayed during the year at the following-named stations: Augusta, Ga.; Cairo, Ill.; Chattanooga, Tenn.; Cincinnati, Ohio; Davenport, Iowa; Dubuque, Iowa; Keokuk, Iowa; La Crosse, Wis.; Leavenworth, Kans.; Little Rock, Ark.; Louisville, Ky.; Memphis, Tenn.; Morgantown, W. Va.; Nashville, Tenn.; New Orleans, La.; Omaha, Nebr.; Pittsburgh, Pa.; Portland, Oreg.; Red Bluff, Cal.; from December 15, 1879, to March 15, 1880: Shreveport, La.; Saint Louis, Mo.; Saint Paul, Minn.; Umatilla, Oreg.; Vicksburg, Miss., and Yankton, Dak.

Systematic reports of river observations, carefully made and closely studied, are had daily by telegraph and weekly by mail, on established forms, from the stations above named. Reports of similar observations, made daily, are also had from special river stations, named elsewhere in this report. These observers constitute a river guard. For the months in which floods more frequently happen, and at any time in any case of especial danger, the reports are telegraphed. For those months of the year in which danger is not anticipated from floods, these reports are forwarded by mail.

Charts of the changes in the principal Western rivers for the year ending June 30, 1880, and upon which stations reporting to this office have been established, are given in charts 10 to 21.

It will be noted that by the study of such charts, continued from year to year, those seasons in which floods are more likely to occur on any water-course can be predetermined, and it can be ascertained what amounts of precipitation, occurring in the different river-basins, and under what circumstances, will be followed by floods, and, approximately, what will be the extent of floods shown in this way to be anticipated. Whenever the facilities of the Signal Service are so far extended as to permit systematic observations to be had of any river-course and telegraphic warnings to be given in instances of danger, the serious loss of property or life caused by floods can be, and with comparative little expense, guarded against on any river throughout the United States. The occasions occur on the separate streams at long intervals only. The levee systems of the Mississippi and other great rivers can be in no way better guarded themselves, and made in their turn safeguards to the immense agricultural interests they are intended to protect, than by systems of river reports, which will warn of danger in time, and summon, if need be, the strength of the State to watch and strengthen these State constructions.

The system of river reports is now extended to the rivers of California and Oregon, as well as to the principal rivers east of the Rocky Mountains.

Arrangements are now being perfected for the construction of river gauges at Brownsville, Rio Grande, Edinburg, and Laredo, Texas, when daily reports of the stage of water in the Rio Grande River will be transmitted, by telegraph, to the former place and bulletined for the benefit of the public.

Table showing the location of the special river stations east of the Rocky Mountains reporting to the Chief Signal Officer, the names of the observers, the date at which each began reporting originally, and the highest and lowest water at each, during the year ending June 30, 1880.

Stations.	Rivers.	Name of observer.	Commenced reporting.	Highest water.		Date of highest water.	Lowest water.		Date of lowest water.
				Feet.	Inches.		Feet.	Inches.	
1 Freeport, Pa.	Alleghany	M. H. Alter	Apr. 17, 1873	17	6	January 1, 1880	—0	*6	October 16, 17, 19, 20, 23 and 24, 1879.
2 Hermann, Mo.	Missouri	Edward Kehr	Apr. 24, 1873	15	1	July 2, 1879	—0	*10	December 22, 1879.
3 Jefferson City, Mo.	...do	Louis C. Lohman	May 12, 1873	14	4	July 1 and 2, 1879	0	4	December 22 to 25, 1879.
4 Oil City, Pa.	Alleghany	W. R. Stevenson, C. E.	Apr. 20, 1873	7	2	November 16, 1879	—0	*6	October 6 and 7, and 16 to 18, 1879.
5 Brownsville, Pa.	Monongahela	J. Allen Hubbs	June 6, 1873	23	0	February 14, 1880	2	7	October 18, 19, 24 and 25, 1879.
6 Evansville, Ind.	Ohio	J. P. Elliott	Apr. 21, 1873	42	1	February 21, 1880	0	5	October 28 and 29, 1879.
7 Confluence, Pa.	Youghiogheny	M. Tannehill	Apr. 23, 1873	9	7	June 15, 1880	—0	*8	October 8 to 10, 1879.
8 New Geneva, Pa.	Monongahela	H. T. Davenport	Apr. 24, 1873	26	3	February 14, 1880	0	9	November 1 to 9, 1879.
9 Lexington, Mo.	Missouri	Z. S. Mitchell	Apr. 28, 1873	16	3	July 1, 1879	0	1	January 10 to 12, and 22, and Feb. 7, 1880.
10 Kansas City, Mo.	...do	W. A. M. Vaughan	Apr. 21, 1873	18	9	July 7, 1879	2	7	March 19, 1880.
11 Brunswick, Mo.	...do	G. D. Kennedy	May 1, 1873	12	3	July 1, 1879	—4	*0	March 20, 21, and 22, 1880.
12 Plattsmouth, Nebr.	...do	A. L. Child, M. D.	Apr. 20, 1873	11	11	July 5, 1879	—1	*3	March 15, 1880.
13 Marietta, Ohio	Ohio	C. J. Best	Apr. 19, 1873	31	6	February 16, 1880	1	8	Oct. 25 and 28, and Oct. 31 to Nov. 1, 1879.
14 Saint Joseph, Mo	Missouri	Robert Gunn	May 8, 1873	15	0	July 1, 1879	—0	*2	December 20 and 27, 1879.
15 Warsaw, Ill.	Mississippi	D. H. Cox	May 7, 1873	19	9	June 28, 1880	0	10	December 21 and 22, 1879.
16 Paducah, Ky.	Ohio	John Bachmann	May 1, 1873	44	0	May 22 and 23, 1880	0	8	October 16, 1879.
17 Boonville, Mo.	Missouri	Charles W. Hazell	Apr. 28, 1873	17	0	July 1, 1879	—2	*5	December 20, 1879.
18 Le Claire, Iowa	Mississippi	C. P. Disney	June 2, 1873	14	6	June 25, 1880	0	8	December 15, 1879, and February 3, 1880.
19 Helena, Ark	...do	J. B. Miles	Feb. 25, 1874	43	8	March 30, 1880	4	11	November 14, 1879.
20 Decatur, Ala.	Tennessee	Miss A. G. Hoxter	Oct. 1, 1875	21	8	March 19 to 22, 1880	0	1	October 3 to 10, 1879.
21 Johnsonville, Tenn	...do	W. H. Johnson	Oct. 1, 1875	37	8	March 23 and 24, 1880	†0	0	September 27 to October 1, 1879.
22 Muscatine, Iowa	Mississippi	William Molis	Jan. 1, 1878	17	6	July 26 and 27, 1879	1	11	September 26 to October 12, 1879.
23 Fort Smith, Ark	Arkansas	George H. Williams	Apr. 13, 1879	5	11	April 5, 1880	—5	*7	October 7 to 15, 1879.

* Below bench-mark.

† At bench-mark.

Table showing the location of the special river stations on the Pacific Slope reporting to the Chief Signal Officer, the names of the observers, the date at which each began reporting originally, the highest and lowest water at each, and the period in which observations were taken, during the year ending June 30, 1880.

Station.	Rivers.	Name of observer.	Commenced reporting.	Period in which observations were taken.	Highest water.		Date of highest water.	Lowest water.		Date of lowest water.
					Feet.	Inches.		Feet.	Inches.	
1 Albany, Oreg	Willamette	A. Monteith	Nov. 24, 1878	June 29, 1879, to May 1, 1880	23	6	Dec. 7, 1879	0	2	September 25 to 27, 1879.
2 Colusa, Cal	Sacramento	P. L. Washburn	Jan. 19, 1879	November 2, 1879, to April 24, 1880.	25	4	Dec. 21, 1879	0	5	November 3, 4, 5 and 6, 1879.
3 Eugene City, Oreg	Willamette	J. Kemble Peters	Dec. 1, 1878	November 15 to December 15, 1879, and February 15 to March 15, 1880.	17	0	Dec. 5, 1879	1	9	November 28, 29 and 30, 1879.
4 Folsom City, Cal	American	C. L. Ecklon	Dec. 15, 1878	December 15, 1879, to March 15, 1880.	10	9	Dec. 20, 1879	5	9	January 6 and 7, 1880.
5 Marysville, Cal	Yuba	E. J. Lockwood	Dec. 15, 1878	November 2, 1879, to March 20, 1880.	4	4	Dec. 20, 1879	—0	*1	February 2, 3, 4 and 5, 1880.
6 Oroville, Cal	Feather	R. W. Smith	Dec. 15, 1878	November 2, 1879, to April 24, 1880.	6	5	Dec. 27, 1879	1	3	November 2, 3, 4, 5 and 6, 1879.

* Water below bench-mark.

Observations are taken at these stations during the rainy season, and when the water approaches the danger line reports of the depth of the same are telegraphed daily to certain designated stations on the lower waters of the rivers on which they are located, and continued until danger to property along the banks is passed. Mail reports are also forwarded weekly to this office.

The daily reports of the surface and bottom water temperatures, at designated points upon the lakes and sea-coasts, have been continued throughout the year, and copies of them furnished, as in preceding years. These reports are furnished at the request of Prof. Spencer F. Baird, United States Commissioner of Fish and Fisheries, the object had in view being to determine the proper waters in which to place the different varieties of food-fishes.

It is necessary for this purpose to ascertain the extremes and means for the year of the water temperatures in the different localities. This series of reports has now continued for seven years. Statistics of this kind—the depth of the water in the different streams being, as it is, daily noted—form the basis of a systematic study of pisciculture, in which are considered, by students attached to the commission, both the amount of the water supplies in different channels or basins at the different seasons of the year, and the temperatures to be expected in each. There is no more ready way for furnishing cheap food for the people than by the culture of food-fishes, and every facility for the work within the control of this office is gladly furnished to this end. It is quite possible that the great fisheries on or near the Atlantic coasts, or on the fishing banks, could be materially aided by the preannouncement of the barometric or other atmospheric changes approaching, were the office informed of the precise nature of the reports to be desired. It is anticipated that under the laws providing for the sea-coast service of the Signal Service, it will, in the near future, be possible to furnish officially series of reports suitable for this purpose from observations taken at points on and near the coast at stations contemplated in existing laws.

The series of reports, being the announcement from day to day of such approaching changes of temperature as would be likely to cause the closing of canals by freezing, or, as in other cases, would open them, were continued during the days of closing canal navigation of the fall and winter of the past year. This series of reports has now been continued for eight years. The commerce moving upon the canals of the United States, as the closing of the canals draws near, is sometimes of greater value than at any other portion of the season. These water-routes are then thronged with hundreds of laden barges, each of which must move with reference to the danger of the closing of the routes by freezing. The market rates at the great cities are influenced by the probabilities that the merchandise or grain thus afloat will reach or fail to reach the points for which it is intended. These reports are received with satisfaction by the canal companies, and by the commercial associations of cities. They constitute, for the months of November, December and January, one of the regular issues of the office.

The exhibition of symbol maps, on which the meteoric conditions are shown by symbols, changing for each report, at the rooms of boards of trade, chambers of commerce, and of commercial associations in the principal cities, and at places of public resort, for the benefit of shipping and other interests; the display of bulletins, the distribution of weather maps, and the employment of other methods for rapidly diffusing, for public use, the information had at this office, have been continued for the year ending June 30, 1880. The purpose had in view by this regular distribution has been to induce an effort on the part of those examining the different charts and papers to foretell to some extent the changing weather for themselves. The official reports of the office relate to districts, at special localities, in which districts the local indications may point to modified conditions. These local studies are also useful in many ways which space here would fail to describe. The expectation of the office has been well realized in this regard, and in many places there are among the citizens and business men careful students of the data daily symbolized, who use their own judgment to determine to what extent the conditions announced for the district will prevail at the places in which they may be, or consider approaching changes foreshadowed by the symbols upon the chart, but which are yet too remote to be announced as indicated. Investigations of this character ought to be encouraged.

The instruments prepared for local use (the Weather Case), and before referred to, will greatly aid such studies.

For a number of years past the attention of the office has been given to the subject of the preparation of a weather chart of such character as to appear printed in the newspaper journals throughout the United States. Charts of this character have been much sought for as aiding such studies as those just described above. The popular demand has been pressing. The office has fully appreciated the propriety of the demand and the value of the results to be had from the study of such charts could they be made to appear simultaneously in the different cities.

The work has been surrounded with unusual difficulties. The preparation of newspaper weather charts is not difficult, and such charts have long since appeared in some of the prominent European cities. The journals in which these charts have appeared have been located, however, in the city in which was the office at which the meteorological charts had been prepared. It was not of record that a weather chart, prepared at any central office in Europe or the United States, had been so arranged for that it could be telegraphed in such form as to appear in the lines of its charting simultaneously in the journals of different cities, each city widely separated from the others, and this telegraphing and printing so rapidly done that the map might accompany the printing at any city of the data for the day, from the study of which data the map itself had been charted at the central office in some other city. The duties of this office are of such a nature that all of the chart-telegraphing must be based upon plans which will enable all of the conditions thus stated to be filled. An attempt to transmit journal charts of this description to answer such a purpose was made at the time of the Centennial Exhibition of the United States, when a daily weather chart to accompany the daily weather report issued daily at that Exhibition was telegraphed each morning from the office of the Chief Signal Officer at Washington to the station of the Signal Service exhibit in the Government Building at the Exhibition at Philadelphia, and appeared each day as the official weather chart issued in separate copies at the Exhibition and also in the columns of a daily journal there printed for daily issue.

These charts were transmitted by process of autographic telegraphy which could not be effected at great distances. They required special instruments. Within a year past the studies and experiments conducted at this office and having relation to this subject have resulted in such plans that it is now found not difficult to transmit to any city which can be reached by telegraph, and without the use of special telegraphic instruments, such data as will permit the charts prepared in the office to be exhibited in any city or cities to which the data are sent, in chartings precisely similar, of any size, and to appear printed in the columns of the daily journals at the same time that the forecasts had at this office, from the study of the original chart, appear printed in the same journal.

The difficulty no longer exists as to the telegraphic transmission of the chart. On May 9, 1879, the issue, daily, of a chart so transmitted by telegraph, from Washington, was commenced in the Daily Graphic, a journal printed in New York, and this issue has been continued daily, except Sundays. The processes are not yet considered perfect. It is hoped to obtain more satisfactory results.

It is not necessary to dilate here upon the advantages to result from the power of transmitting to any number of places and to any distance at which telegraphing is possible, with the rapidity of a telegraphic dispatch, copies of the charting of the weather conditions over any extent of the earth's surface, the copies exactly similar and made at any central office at which the proper data have been concentrated.

The forms of the bulletins heretofore referred to as those published daily for the use of farmers, of the special bulletins issued for the use of seamen, for the river reports, for the canal reports, for railway bulletins, and for the varied interests which the information borne upon the bulletins is intended to benefit, change gradually with increasing knowledge and facilities. Each form has its object. The number of bulletins issued at each station is closely scrutinized and is reduced to the smallest number which can be wisely used.

The publication of the Monthly Weather Review and of the Weekly Weather Chronicle has been continued during the year. The monthly issues of the Review are given in the appendix (Papers 33 to 44).

The scope of the Monthly Review has become coextensive with the number of reports received both by telegraph and mail, all of which are valuable for reference, and a study of which enters necessarily into the study for the preparation of each Review. The collection of material for this paper permits also the study of especial storms, descriptions of or facts relating to which are given in the local journals of the region over which they pass, or in the shipping news communicated by vessels encountering them at sea. The charts which accompany each issue of the Review exhibit the uses made of meteorological data. Each of these charts is to some extent the reduction of data first chronicled on two hundred and forty study-charts for the month. It will be readily understood how much this monthly reduction simplifies the work of generalization for the year. The Review exemplifies, also, to some extent, the consideration of the great mass of data before mentioned as entering upon the files at this office. Each issue of the Review contains, under the head of "Notes and Extracts," a brief summary of meteorological intelligence, compiled from the publications received at this office, and by which the marked advances in meteorological science are readily brought to the notice of the numerous correspondents cooperating with the service. The section added in 1877, under the heading of "International Meteorology," has been continued during the year just passed. Additional charts, embracing the northern hemisphere, now accompany the Review and will be found referred to and described in the text of the Reviews under this heading. The wide circulation given this Review meets, in part, the popular wish expressed, here and in foreign countries, for generalization prepared at this office, while the receipt of a copy of the Review by each one of the hundreds of the voluntary observers, now its correspondents, at points extending in their range around the earth, is accepted by them as at once a sufficient acknowledgment of, and compensation for, the labor of making their daily reports.

It is an advantage of the chart issues of the Review that they are continued from month to month, and thus enable the meteoric conditions existing upon the earth's surface to be studied continuously and in a regular sequence.

The preparation of the matter for the publication of the "Synopses, Indications, and Facts," commenced in 1872, has been continued. Thirty-five volumes of the bound Daily Bulletins, with accompanying charts, had been issued up to June 30, 1880, and other volumes are expected to follow as rapidly as they can be obtained from the printer.

As described in preceding annual reports, these volumes, issued in sequence, one for each month, contain the records of all the tri-daily telegraphic reports received at the office from the dates at which such records commenced; the tri-daily charts, upon the study of which each report was on that day issued, together with a statement of "facts" or meteoric conditions which subsequent reports have shown as actually existing during the time and in the district for which each forecast was made. The maps afford a meteorological record as compact as ought to be desired for especial researches or for generalization to be based upon continued series of meteorological observations. The volumes themselves are useful for purposes of exchange, and bring to the office publications sent in return exchange fully equaling their value. They constitute a meteoric record more full, perhaps, than any other now issued.

It was estimated in the last annual report that by the publications of this office, which have been above referred to; by the cautionary signals displayed by day or at night on coasts or at ports in times of probable danger; by the announcement of probable changes of weather in the Synopses and Indications furnished thrice daily to the press; the Farmer's Bulletin, exhibited at so many villages and hamlets in the interior; the river and canal reports made with reference to river and canal interests; the bulletins and data exhibited at all the great cities and ports; the symbol maps displayed in boards of trade rooms and rooms of chambers of commerce; the Weekly Chronicle and Monthly Weather Review furnished to agricultural societies, commercial associations, and correspondents of the office; the daily weather maps; the monthly charts; and, finally, the charts condensing the results of years of observation, the information emanating from this office was received in some form daily at no less than one-third of all the households of the United States.

To this wide diffusion there has been added, since the date of that report, the increased circulation had by the two thousand eight hundred and eighty-nine railway bulletin stations heretofore referred to.

As hitherto related in this report, while treating of the subject of international meteorology, the work of the office reaches later, by its publications, nearly every prominent establishment in the world. It is considered that it contributes to the world's work published material valuable now, to be more so in the future, and sufficient of itself to compensate for the whole cost of this service from its commencement.

The different reports of the office, of which mention has thus been made, continue to be favorably received in the communities for which they have been furnished. Their uses are acknowledged by commercial associations and other official bodies.

The regular daily publication of the reports of forecasts by the press, now continued for nine years without cost to the United States, is considered as an evidence of their usefulness and of the favor with which they are received by the communities for which they are intended.

The office continues to be in correspondence, in reference to its duties, with committees appointed for the purpose by the boards of trade and chambers of commerce of the principal cities in the Union, and also with a large number of agricultural societies.

Permanent committees, appointed by boards of trade, chambers of commerce, &c., have been in co-operation with this office since 1877. These committees inspect, in compliance with the request of the Chief Signal Officer, the local offices of the service at the places in which the committees may be appointed, and report monthly to this office upon the condition and utility of the service in their vicinities. The boards in this way at once co-operate with this office and share the responsibility for its success.

The resolution upon which these committees were established, as adopted by a number of the prominent associations of the United States, is as follows:

> *Resolved,* That the meteorological committee of the board of trade (or chamber of commerce) shall be a permanent committee, and that the names of the members, and any changes in membership, be, in each case, formally notified to the Chief Signal Officer of the Army. The committee will confer with the Chief Signal Officer and will bring before the board (or chamber) all matters requiring its action, as relating to, or needed for, the improvement of the Signal Service.

The organizations which have adopted this resolution are enumerated in Paper 45. There are rules for the government of these committees, together with the form of reports they are desired to furnish monthly.

The appointment of these committees affords at once a board of reference, to which questions of local interest may be referred for their views, and provides an authorized source from which this office may learn of its successes or failures, and be thus enabled to direct its efforts in the several localities. It furnishes also a local supervision by parties interested themselves through their personal interests in the successful discharge of the duties of the service, and who will strive, for this reason, to best advise how that success may be attained.

The services of these committees have been found to render important aid to the work of the office. The supervision had by them is very necessary, and has had a good effect. Their duties involve a responsibility which has been appreciated by the members of the committee.

A list of disasters upon the lakes, comprising those only which have resulted from stress of weather, during the year ending June 30, 1880, compiled by Sergeant William Finn, Signal Corps, U. S. A., in charge of the Milwaukee station, is given in Paper 46.

Paper 47 contains the names of places from which requests have been received for the establishment of signal stations, but at which stations had not been established June 30, 1880.

The total solar eclipse that occurred on the 29th of July, 1878, was made the occasion of numerous interesting observations throughout the United States by the officers and enlisted men and the co-operating voluntary observers of the Signal Service.

A full account of these observations, together with some of the results to be deduced therefrom, will be found in the accompanying report by Cleveland Abbe, assistant. (Paper 48.)

It appears from this report that the data accumulated in the archives of the Signal Office were made useful by the preparation in advance of a table showing the probable character of the weather to be expected that day, by means of which observers were enabled to select stations having prospects of clear or fair weather.

Most extensive preparations were made at many Signal Service stations. Among which may be specially mentioned Pike's Peak, Colorado Springs, Virginia City, Key West, Havana. The expedition to the summit of Pike's Peak was under the personal supervision of the late Chief Signal Officer and his assistant, Professor Abbe.

In all there were received reports from 300 stations or localities, 100 of which are published in full in this general report.

It is believed that special interest and value attaches to the observations and suggestions made in connection with the subject of the extension of the solar corona, its connection with streams of meteors, the reliability of Regnault's psychrometric formula, the total amount of light received from the solar corona, the fall of temperature during totality, the official phenomena attending totality, and the position of the shadow band or belt of total obscuration as defined by observations of duration of eclipse.

A collection of 29 engravings accompanies the report, giving, thus, a graphic representation of the appearance of the corona to observers scattered all along the belt of totality from Idaho to Cuba, and all which combine to demonstrate that the corona in all its main features remained unchanged during the hours occupied by the shadow in traversing this distance.

Professor Abbe has given a very full collection of references to the sources of our knowledge of the latitudes and longitudes of the stations occupied by the eclipse observers, to which those desiring to pursue further investigations will probably have frequent occasion to refer. He has also added a brief study of the theory of the August psychrometer, whence he infers that if the Signal Service is to continue the use of this instrument there should be at once instituted a satisfactory comparison, at high and low and at very dry stations, with the Dew-point apparatus of Regnault, Dives, &c. Incidentally to this he gives the result of a comparison of thermometers, which enforces the importance of adopting in the Signal Service work the latest requirements in thermometry.

Especial thanks are due to the voluntary observers Prof. F. H. Loud, C. G. Boerner, and to the sergeants of the Signal Service J. A. Barwick, Wm. Black, Rufus Choate, E. McGovern, M. J. Shanefelter and the Signal Service Observer Chas. Hasselbrink, for the ability and energy shown by them in the execution of the work undertaken.

To the hearty co-operation of the Engineer Bureau, the Quartermaster's and Surgeon-General's Offices, the officers of the U. S. Geological and Geographical Survey, of the Coast Survey, and of the telegraph and railroad companies the office is also much indebted.

By direction of the Chief Signal Officer, Private John P. Finley, Signal Corps, U. S. A., investigated and prepared a report upon the remarkable tornadoes of May 29 and 30, 1879, occurring in the States of Kansas, Missouri, Nebraska and Iowa. The storms, thirteen in number, most of which passed through Central Kansas and Western Missouri, developed unusual violence and the characteristic peculiarities of this class of atmospheric disturbances. In no instance was there an exception reported to the usual direction of translation of the storm-cloud, viz: from southwest to northeast; and with equal invariability the movement of the whirling air within the cloud vortex was, according to all the statements collected from eye-witnesses, from right to left, or contrary to the direction of the hands of a watch. (Paper 49.)

By means of charts, both topographical and meteorological, and a large number of carefully-prepared sketches accompanying the text, a faithful effort has been made to present an exhaustive consideration of all of the available data.

Particular attention has been given to a most important feature in the study of this class of storms, viz: the reference of every object acted upon by the wind to its relative position regarding the supposed center of the storm-track. This treatment gives at once the most available factors in determining the various actions of the storm-cloud, its peculiar form at different points in the storm-track, and an opportunity to investigate intelligently any irregularities or departures from the usual mode of action. A collection of data and its proper disposition with a view to elucidate the mooted question of the tornado's origin has been attempted with much earnestness, and it is hoped with equal success. The independent character of these storms which distinguishes their rightful claim as a distinct class of atmospheric phenomena, strictly termed tornadoes, is attested by a strong chain of evidence. This point is more elaborately considered under the head of a general essay on tornadoes accompanying the report, covering a field of investigation which includes the most important storms of this class examined in previous years under the direction of the Chief Signal Officer, and embodied in his annual report. In connection therewith, and having the same end in view, a series of tables were prepared combining a collection of some three hundred tornadoes, reaching back as far as 1794, and arranged under a classification of some fifteen general characteristics, showing very graphically their marked individuality.

Twelve charts have been prepared by First Lieut. A. W. Greely, acting signal officer, which shows by isothermal lines for each five degrees the mean temperature of the United States from 1871–1880, for each month of the year. They are drawn on the same scale, and are intended for reference and comparison with the monthly charts of temperature which are regularly issued from this office with the "Monthly Weather Review."

On these maps is graphically represented the following data:

1st. Monthly mean temperatures at the Signal Service stations from July 1, 1871 (or from the various dates of establishment of the later stations), to October 1, 1880.

2d. Monthly mean temperatures given in the reports of the Army post surgeons from July 1, 1874, to October 1, 1880.

3d. Monthly mean temperatures observed and reported by voluntary observers of the Signal Service from January 1, 1874, to October 1, 1880. These reports are sufficiently numerous to render possible such charting as shows with considerable accuracy the mean monthly thermal conditions of the country east of the 97° meridian for the past nine years, and to the westward for the past six years. No means, Signal Service or voluntary, have been used which do not cover at least three consecutive years, and but very few of less than six years' duration. The means relating to regular Signal Service stations are generally one-fourth the sum of the 7 a. m., 2 p. m., and twice the 9 p. m. (local mean time) observed temperatures.

At certain telegraphic stations of the Signal Service in Arizona, Dakota, New Mexico and Texas, where only simultaneous observations at 7.35 a. m., 4.35 p. m., and 11 p. m. (Washington mean time), have been made, one-third of their sums have been used as a mean; such means will be found to differ but slightly from the true means.

The means reported by the Army post surgeons are one-third of the sums of the observed temperatures at 7 a. m., 2 p. m., and 9 p. m. (local mean time), as also are the greater part of those reported by voluntary observers. For the purpose had in view, it was deemed best not to correct for want of uniformity in methods of deducing daily means. The discrepancies, resulting from dissimilar methods of obtaining such means, are evidently less important than those arising from systematic errors of observers, from the use of unreliable instruments, which have not been compared with an accepted standard, and above all are from the widely different methods of exposing thermometers. To insure accuracy, the Signal Service means on which these charts are based have been carefully compared and checked, and in doubtful cases the monthly mean has been computed anew from the original observations.

In determining the direction of the isotherms the greatest, indeed predominating, weight has been given to the Signal Service means.

The isotherms, where crossing mountain ranges, express the temperature not of the peaks or elevated and isolated stations, but of adjacent valleys.

The method has been adopted of connecting mean temperatures of equal value in contiguous valleys or plateaus by a nearly direct route, giving the lines only such curves and directions as have been suggested by the data collected.

It is evident that the isotherms of the tops of mountain ranges vary most materially from those of the valleys at their bases, and that the outlines of isotherms on such mountains depend very largely on the contour of the ranges at any given elevation.

Even were it desirable to draw lines based on elevation and the very scanty data available from elevated stations, the size of these charts would have precluded it. These charts are not for insertion in this report, but may be had on application to this office.

Lieut. A. W. Greely, acting signal officer, has prepared a list of auroras for insertion in this annual report. (Paper 50.) The list comprises all auroras (in North America) reported to this office by Signal Service and voluntary observers, from August 1, 1873, to December 31, 1875. The arrangement is chronological and geographical. The places at which the aurora has been observed have been entered alphabetically under the name of the State or political division in which these places are situated. Following the name of the place is given, when practicable, the hour of commencement and ending of the display. In cases where the time was given by the observer as evening or morning, "p. m." and "a. m." are respectively used. Where no time is given the observer has simply reported that an aurora occurred on that date.

Wherever a. m. occurs it refers to time preceding sunrise of the date given; p. m., in like manner, refers to time after sunset on the day named. Without it is otherwise specified, mean local time is given.

Many of the auroras for which no time is given were probably observed at 9 p. m., local time, that being the only hour of darkness at which volunteer observations are regularly made by the voluntary observers of the Signal Service.

In cases where it is very doubtful if the phenomena were auroras an interrogation point has been inserted. Such marks have been sparingly used.

Where the observer has reported a display as continuing at his last observation, where its obscuration has occurred while yet bright, where the hour of commencement but not of ending has been reported (and *vice versa*), in such cases there have been respectively used "till after," "obscured," "from," and "till."

Lieutenant Greely has also prepared an index to the appendices of the Annual Reports of the Chief Signal Officer of the Army from 1870 to 1879, inclusive. Charts and maps are given their running numbers. (Paper 51.)

In the instrument-room of the office one thousand four hundred and fifty-eight meteorological instruments have been carefully compared with the official standards during the year ending June 30, 1880, and one thousand one hundred and sixty-seven have been issued during the same period. Experiments with different forms of self-registering apparatus have been continued systematically with the view of securing forms adapted to general use on station.

Seven hundred and eighty-eight meteorological instruments have been purchased for station use and seven hundred and fifty-seven have been issued during the year ending June 30, 1880.

The artisan work in the instrument-room and repair-shop of the office continues to increase steadily in amount with the increased distribution of instruments and the number of stations.

The practice of sending instruments by mail, in the charge of postal agents, under the special arrangement for this purpose made with the Postmaster-General, continues to be of material benefit to this office. The superintendent of the railway mail service and his assistants of the Post-Office Department have rendered careful and energetic aid in this work of transportation. Such aid is important to a service which reaches into every portion of the United States.

A considerable number of instruments, anemometers, hygrometers, water-thermometers, rain-gauges, &c., have been issued to the Chief of the Bureau of Navigation of the Navy Department for use on vessels of the United States Navy in making, in co-operation with this office, the naval series of simultaneous observations directed by the honorable Secretary of the Navy in General Order No. 220, dated December 25, 1876. This office supplies, upon proper application and receipt, any instruments required for this purpose. Reports of naval observations transmitted to this office are entered on the International Bulletin and are charted upon the International Weather Charts.

A number of instruments have been furnished for temporary use on vessels of the commercial marine engaged in similar co-operation upon the marine series of observations.

The regular weather reports have been received during the year over the wires of the Western Union, Northwestern, International Ocean, and American Union Telegraph Companies. Seven hundred and forty-eight thousand three hundred and eighty-four cipher words of weather reports have been received at, and thirty-six thousand six hundred sent from this office during the year ending June 30, 1880. Eighteen thousand five hundred and sixty telegraphic messages (exclusive of those sent and received by the sea-coast line), other than weather reports, were received, and thirteen thousand five hundred and seventy sent in the same period. There were also received during the same period seven thousand and seventy-six cipher words of special river reports.

The plans of working forms of telegraphic circuits, and the rapidity of telegraphic work by them assured to the service, have been sufficiently referred to in preceding reports. They have given satisfactory results throughout the year past.

The average time elapsing from the time at which the reading of the instruments have been had at the two hundred and forty-seven separate stations scattered throughout the United States and Territories to that at which the reports based on these readings have been telegraphed to the press and to the distributing stations has been one hour and forty minutes.

It has been mentioned in preceding reports, but it is proper to again call attention to the fact, as one of the consequences resulting from the organization of this office, that, by the use of ciphers, improved with the experience of years, the facility with which constant practice has rendered practicable the telegraphic work necessary for the reports, and the understandings arrived at with telegraphic companies, the annual cost of the telegraphic communications of the office has been reduced by many thousand dollars. As an actual annual saving, this must be considered as a saving to the Treasury of the United States of an equal number of thousands of dollars. In the early days of the duty the telegraphic companies overestimated the labor required for the service, and the difficulties to be encountered by them in discharging it with the regularity and the vigor demanded. With the long experience of years the difficulties of this nature have vanished.

With the plans now for ten years tested on this continent there has been found no difficulty in collecting with sufficient rapidity meteorological data had over the widest extent of this continent's surface, and reaching from the Atlantic to the Pacific Ocean.

The application of similar plans for the telegraphic collection of data for any similar purpose whenever undertaken by any government or combination of governments upon the distant continents, as those of Europe, Asia, or Africa, cannot fail to be attended with similar results.

The relations of the office with the telegraphic companies are now cordial everywhere. It has come to be recognized that when this office insists upon work at very economical rates, and sometimes upon unusual telegraphic facilities, it is compelled to do so by the plainest dictates of duty.

The duties of this office, as charged with the supervision of the telegraphic duties of the War Department, and especially responsible, when need be, for the prompt transmission and proper care of the messages of the President and Secretary of War, and other superior authorities, together with the recognized position of the Chief Signal Officer, as the agent of the Secretary of War, in the control and management of the interior lines now constructed and worked upon the frontier, and connecting as well military posts and stations as the villages and hamlets of the advancing frontier populations, devolve upon the office many cares and the settlement of many and novel questions involving the relations of the United States and the different telegraph companies. In all these matters, the assistance and advice formerly given the office by the distinguished lawyers, then acting as special assistants to the Attorney-General, the Hon. William Whiting, at one time Solicitor of the War Department, and the Hon. Reverdy Johnson, formerly Attorney-General of the United States, both then acting as special assistants to the Attorney-General, have proven of the greatest advantage.

Few questions have arisen, or are likely to arise, which will fail to find their settlement in the lucid opinions and wise instructions prepared by these gentlemen.

With the increasing population of the country, the unusual progress of civilization in the interior west of the Mississippi, the multiplicity of the public business, and the habitually greater use of telegraphy in public affairs, render it more important that the dispatches of the superior civil and military authorities should certainly reach the persons to whom they are addressed, and be securely protected from inspection by improper persons. The gravest affairs may be complicated by the delay or the improper revelation of official telegraphic dispatches. The care of the office is always given to this protection when informed that it is desired.

The relations of the office with the different telegraphic companies enable it to secure, in time of need, a rapidity and a certainty of transmission of particular dispatches, which may especially need such action, perhaps not to be had by any other agency. The experience already had in the management of frontier lines, under the novel circumstances in which those existing upon the frontier have been placed, has afforded such suggestions as to plans of working them as to warrant the belief that, as facilities permit, they will compare favorably in the rapidity of their work with those existing wholly within the limits of civilized and settled regions.

The increasing use of the United States lines for commercial purposes, as they extend into the interior and upon the frontiers, into regions the development of which they greatly advance, place upon the wires many important messages entitled, as is matter passing through the mails of the United States, to official protection.

The sea-coast service of the Signal Service, in connection with the Life-Saving Service, has been referred to and described in preceding reports. The total length of the sea-coast lines constructed by this office is now six hundred and ten miles. There is left for this report little more than rehearsal. The coast lines are connected with this office by leased wires from Cape May, Lewes and Norfolk. The telegraphic lines, reaching from Sandy Hook to Cape May, from Cape Henlopen to Chincoteague, and from Norfolk by the way of Cape Hatteras to Wilmington and the mouth of Cape Fear River, on the most frequented and in some places the most dangerous coasts of the United States, have been continued in operation. The stations upon these lines are occupied and the telegraphic lines are operated by enlisted men of the Signal Corps. (Map 22.)

During the year a telegraph line was constructed by enlisted men of the Signal Corps, under the immediate supervision of First Lieut. W. E. Berkhimer, acting signal officer, from the Delaware Breakwater, Del., to Chincoteague, Va. The line, 60 miles in length, was commenced October 18, 1879, and completed November 9, 1879. The poles are iron, placed 25 to the mile, and far enough back from the surf line to be secure from storms and at the same time easy of access in cases of vessels coming ashore. The construction of this line has practically proven the value of iron over wooden poles for sea-coast telegraph lines. From the date of its completion, November 9, 1879, to June 30, 1880, not a single pole was misplaced, nor a break in the wire. Virtually speaking, the line has worked 8 months without interruption.

The establishment of a full signal station on the Delaware Breakwater has proven its value to the commerce of Philadelphia and for vessels making that a harbor. Cautionary signals are displayed from a flagstaff on the Breakwater, where they can be readily observed both day and night by passing vessels and those in the harbor. All vessels passing the station are reported by telegraph to Philadelphia and to the Chief Signal Officer as soon as sighted, and copies of the telegrams furnished to the different shipping exchanges at once by messenger, and to the public through the columns of the daily press.

The act of Congress requiring this service contemplates the establishment of signal stations at life-saving stations and light-houses at points along the coast in such manner that the coast and sea in their vicinity may be at once kept under observation, warning of approaching storms be given to vessels within signal distance, and information of disasters and other incidents occurring be rapidly conveyed to the chain of life-saving stations, to light-houses, ports from which aid may come in case of need, and to this office.

These lines and stations are on the sea-coast itself, and in positions whence they command a view of the sea, and where they can have knowledge of disasters to occur from shipwreck. The reports of the weather conditions and of the state of the sea had by them, and not attainable in any other way, are necessary. Vessels passing in view can be at once warned by signals of coming danger, or be communicated with by signals, and can be aided if in distress. The telegraphic wires connect each station with the War Department.

It is an advantage of telegraphic lines thus managed and worked by the force of the Signal Corps that the breaking of the wires at inlets or in violent gales need not break the communication along the coast. In cases occurring during past years, messages have been transmitted for weeks together over extensive breaks of wire lines reaching past inlets by means of the usual day and night signals with flags and torches. Similar methods may be used in the instances of broken lines in the interior.

The enlisted men at these stations are taught to take and report meteorological observations, and, as signal-men, are practiced in both the Army and Navy codes, in the usual semaphores, and in codes of permanent flag signals, to enable them to communicate with vessels of any nationality. The service has proven its usefulness in the cases of disasters to shipping and for the meteorological purposes for which it was established. It has been firmly established by its utility.

The sea-coast service stations in operation are located at Sandy Hook, Barnegat, Little Egg Harbor, Atlantic City and Cape May, N. J.; Norfolk and Cape Henry, Va.; Station No. 5, Kittyhawk, Cape Hatteras, Portsmouth, Cape Lookout, Fort Macon, New River Inlet, Sloop Point, Wilmington and Smithville, N. C.; Delaware Breakwater, Del.; Ocean City, Md.; and Chincoteague, Va.

The constant changes occurring in the width of the numerous inlets, across which the line upon the coast is carried by cables between Cape Hatteras and Wilmington, the character of the outer beach, the only land upon which the lines could be placed, the destruction of portions of the lines and changes in the coast itself, caused by storms, have continued to make the maintenance and operation of the line south of Cape Henry a work of difficulty.

It is not necessary to explain at length the importance of a service of this character on our sea-coasts. The reasons for its maintenance and the benefits to be expected from it are manifest. The commerce which approaches a coast on which a thorough sea-coast service exists is spared disasters, in comparison with the cost of which the cost of the service is little.

The watch kept by the service and the prompt transmission of a few messages have, in time of danger, saved life and property.

It has been a source of complaint among the seafaring men on all those coasts on which storm-signals have been attempted to be displayed that, while it might be learned by vessels lying in port and from the display of such signals, with reasonable certainty, whether or not a storm was so impending as to render it unsafe to risk exposure at sea, there was no plan of storm-signals devised or devisable by which it could be communicated to vessels themselves actually at sea, and in sight of the stations, beyond the mere fact that a storm was threatening, and from what direction it was to be expected. It was not possible to advise on what coasts it would be dangerous; whether or not any particular voyage might be continued in safety, or when and where shelter ought to be sought. The fortunate connection had by this office by means of telegraphic lines with all its sea-coast stations has lessened these difficulties.

On February 4, 1878, an order was issued by which are announced the stations of the service prepared to hold communication by the international code of flag-signals with vessels of any nation at sea coming within the proper signal distance. It is so arranged that any question as to weather changes anticipated so signaled from the vessel to the shore-station is immediately transmitted by telegraph to the central office, whence prompt reply is ordered.

This reply, on reaching the coast stations, is signaled by flags, if need be, to the inquiring vessel. It is possible thus to gain any needed information without landing a boat. It does not appear how a system of storm-warning or coast-signaling can be given a greater scope than is arrived at by this process. The instance may be imagined, for illustration, of a vessel sailing from New York for a southern port and making inquiries off the Capes of the Delaware whether it will be safe to pass Cape Hatteras, and advised from this office in reply to the inquiry transmitted to this office that a storm at the time is moving near Hatteras, and to take shelter at the Delaware Breakwater until the disturbance shall have passed northward. In the occurrences of each year there have been instances in which steamers moving along the coast have conducted their voyages from port to port upon the answers to special inquiries addressed from the ports in which they might be to the office. There have been instances in which such special inquiries have been signaled from the vessel to the station, telegraphed thence to the office, and the telegraphic answer signaled again to the vessel. With proper appliances such plans of communication might be established along the extent of the coasts of the United States.

In the last annual report several disasters were described as occurring upon the Atlantic coast, and the action of those of the Signal Corps occupying the stations upon the coast, was related at some length to illustrate by the different incidents the character of the especial service it was expected to render. Since the date of that report several severe storms have swept the same coasts. It is since that report, that the systems of display-stations established by this office has rendered it possible to exhibit warning signals at almost every navigable inlet. There have been no disasters of magnitude to record. The hope may be indulged that this decrease in the number of disasters has been in part due to the more extensive display of warning signals referred to, and in part to the greater attention paid by shippers and seafaring men to the warnings.

The following instances, occurring during the year, are given as illustrations of the varied uses to which the sea-coast service can be applied:

The Haytien brig Tropic, Captain Potter, from Marigone, Hayti, for New York, with logwood, 15 days out, came ashore near Barnegat, N. J., at 3.30 a. m., March 16, at a point 14 miles south of station, during a dense fog. Private Burrows, the repairman from this station, was on his way south, and, upon his arrival at the scene of wreck he immediately cut the wire and made telegraphic report to the Chief Signal Officer, via Sandy Hook. The line being down south, he then proceeded and repaired it, then retured to the wreck and reopened wreck station at 5 p. m., March 18, reporting direct to the Chief Signal Officer.

January 26, Captain Fitzgerald wrote to this office and stated that he intended taking the H. B. Plant, a small river steamer, from Wilmington, Del., to Jacksonville, Fla., by sea, and that before leaving Delaware Bay he would telegraph for the "Indications" for the next twenty-four hours; on the same date he was informed, by letter from this office, that any telegram received from him, relative to the weather, would be promptly answered; at the same time he was furnished with a list of the stations of the Signal Service on the Atlantic coast from Delaware Breakwater, Del., to Jacksonville, Fla., and with the circular on the coast signal service, giving danger or distress signals. On February 9, Captain Fitzgerald telegraphed this office that steamer Plant would be at Lewes, Del., at midnight, and requested a special report as to wind and sea from Cape Henlopen to Savannah. The required information was telegraphed him at the Signal Service station at Delaware Breakwater. On the same date (February 9), Captain Fitzgerald wrote to this office from Wilmington, Del., stating that he intended to leave port at 3 p. m., and would stop at Delaware Breakwater for midnight Indications, and that in going down the coast, if he passed near enough the shore for the observers in charge of the stations of the Signal Service to see him, he would request that if bad weather be expected the "Union Jack" would be hoisted; if good weather the American flag be hoisted. Instructions were immediately telegraphed, from this office, to the observers in charge of the stations at Cape Henry, Va., Cape Hatteras, Cape Lookout, and Smithville N. C., to look out for the steamer Plant, give all possible information, and ask for information from this office; also to signal him as desired. On the mornings of February 10 and 11, the Indications were telegraphed to Captain Fitzgerald at Delaware Breakwater. The Plant arrived off Cape Henry, Va., on the 11th. The captain sent a boat ashore and telegraphed to this office for a special report of weather. He was telegraphed in reply as follows: "Severe storm approaching from the west; it will not be safe to leave Norfolk to-night or to-morrow." Upon the receipt of this telegram the captain ran his vessel into Hampton Roads and came to anchor. Captain Fitzgerald states in regard to this warning that it certainly saved his life and his vessel, as she could not have lived outside that night. He was telegraphed again from this office on the morning of the 12th, "Telegram of last night holds good to-day; no change in Indications; if any favorable change to-day will notify you at six o'clock." And again at 6 p. m., "Remain at Norfolk until notified of safety; second storm coming from southwest." At 12.42 a. m., February 15, the observer at Cape Henry was ordered to signal Captain Fitzgerald the following message and to prevent his leaving that station: "Will not be safe for you to leave Norfolk to-night." The Plant arrived Beaufort Harbor on the 17th and telegraphed to this office for Indications, and received the following answer: "Light southerly winds and a quiet sea expected." She then proceeded on her way and reached Jacksonville in safety.

The total number of messages received over the sea-coast line during the year ending June 30, 1880, was ten thousand seven hundred and fifty-two; the total number sent in same period, twelve thousand eight hundred and forty-two, or a total of twenty-three thousand five hundred and ninety-four messages received and sent; which would have cost, at regular tariff rates, fifteen thousand five hundred and eighty-one dollars and thirty-nine cents.

The Chief Signal Officer urges, as in preceding years, the maintenance, proper equipment, extension, and rapid working of the sea-coast lines and the sea-coast service. The temper of the nation can well be judged from the experience had in the instances of the Huron and Metropolis disasters. There is no thought on the part of the people of any parsimonious economy nor tolerance of delay in the impatience with which they demand, on occasions of disaster, that succor shall be given to any imperiled life on the instant without consideration of cost. There is no question of the general joy with which every report of successful effort in this direction is received. There is no time for slow-paced messengers when disasters are announced.

Whatever the difficulties of maintaining these lines practically on the sea-coast itself, and where the beaches and lines upon them are sometimes swept away together by the surge, the lines must be maintained. The saving of a single ship or of a single life compensates the cost of repairs. The fields of usefulness are so wide that it would be criminal to turn from them.

If wooden lines fail, as they may on the coast, there is every reason to believe the iron lines will not. Orders are now issued to substitute as rapidly as possible iron for wooden supports. One hundred and fifty miles of "iron line" are now standing on the coasts. The records of the coming year will show whether the results expected from these lines are overestimated. The time is not far distant when the possession of a coast not covered by sea-coast telegraph, not guarded by a sea-coast storm-signal and signal service, and not supplied with the force and means of aid at life-saving stations, will be held as much an evidence of semi-barbarism as is now among civilized nations the holding of any national coast without a system of light-house lights.

The description of the sea-coast service has been made minute in this and in preceding reports, because it is desired to show that a force of trained soldiers doing a land duty on shore, displaying signals hoisted on land though answered from ships; watching as sentinels, each his special "beat" of sea and shore; telegraphing messages by electric wires to summon aid, or telegraphing them by the same flag and torch signals they use in war when the lines are gone; erecting and keeping up their own wire lines of telegraph; displaying storm warnings by day or at night; making the regular meteorological observations, that the warnings may be ordered—in effect, a regular sentinel force to warn and to aid in any danger, all in strict military subordination to each other by their grades, and all to the central office, are a force of soldiers as usefully employed for purpose of peace, and as ready by training for war, as a force can be kept.

There is devolved upon this office by law the duty of providing all signals to be officially displayed as coast-signals, or recognized as such on the coasts of the United States.

To carry into effect the provisions of this law, there was issued from this office in January, 1878, a partial code of danger or distress signals to be used and recognized anywhere on the coasts of the United States, where there may be sea-coast stations of the Signal Service, and by official co-operation of the Life-Saving Service, to be organized also at any life-saving station. Copies of this code are furnished gratuitously to every vessel, of whatever nationality, taking clearance at any of our principal ports, and to coasting as well as other vessels upon application to this office. It is the aim to permit no ship within the protection of the United States, within its ports or upon its coasts, to be in case of danger or distress without the means of communicating with the land or with the parties whose duty it may be to aid in the rescue. A further simple code of night-signals is in preparation.

In pursuance of the acts of Congress authorizing the construction and operation of telegraphic lines in the interior and upon the frontier, for connecting military posts and stations, and for the protection of the population from Indian and other depredations, officers and enlisted men of the Signal Corps have been continued upon these duties. The lines in Arizona, New Mexico, and upon the Texan frontier, hitherto provided for, are completed. The lines in the Northwest, for which provision is made, are pushed rapidly forward. The work of construction has been in large part done by working parties furnished by the active co-operation of department commanders. A total length of five thousand and seventy-nine miles of frontier line is now operated and maintained in the care of officers and enlisted men of the Signal Corps. (Map 22.)

The uses of the frontier telegraph lines passing through the Indian country, as employed in military operations against war parties of Indians in motion, as well as their uses in advancing the progress of civilization by the safety and sense of protection they give to settlers near the scattered hamlets or military posts, have been referred to. A telegraph line, well worked, forms one of the most efficient of barriers against the raids of Indian war parties. The country on the frontier through which such lines pass has but few points at which water can be had. The posts occupied by the Army are scattered along the line at intervals of several hundreds of miles. The object in view, with Indian war parties, is to pass between the posts and settlements without disturbing any of them; and they very much dread to leave any danger in their rear, or to so alarm the country as to cause their retreat to be cut off in their return toward the region occupied by their tribe. The existence of the telegraph line enhances both these dangers. It is useless to break it as the parties pass toward the scene of their incursion, for this alarms both the posts and the settlements on both sides of the break, and brings repairmen and guards at once to the point of the break and upon their trail; nor does it stop communication between the posts, for messages may be sent circuitously by other wires, perhaps covering hundreds of miles of distance around the point at which the line has been disabled. If the wire is not broken when the trail passes the line, the troops can of course be very readily called upon whenever or wherever the parties may be discovered. But even if the line is passed safely and the trail is not detected, the danger the electric wires cause is not ended.

Wherever the party may strike, if the blow falls near any settlement or station connected with the telegraphic network, the alarm becomes in a few hours general. The troops on the line they have just passed know there is a war party in the field; other troops and other settlements can be aroused. The line of the Indian retreat, the points they must pass to reach water, are approximately known, and while the pursuit goes on in the field, other forces can occupy the passes and points in advance of the flying tribe. There can be no constructions more important for holding a frontier or protecting the first steps of advancing civilization than the telegraph lines. In instances occurring in Texas, New Mexico and Arizona, the movement of troops and of material, directed by telegraph, upon alarm sent by telegraph from settlements upon the frontier system of lines, has been so timely as to have attained results which could not, without the rapid action made possible by the lines, have been hoped for. How much of life and property have been saved from attacks thus guarded against, which else might have been made on defenseless communities, can be conjectured only.

From each of the stations on the telegraph lines thus in charge of the Signal Corps, a daily meteorological report is had and used, the whole forming a valuable portion of the office data each day discussed. The lines thus doubly useful are economically and successfully conducted.

The saving in the cost of reports and the sums received for commercial messages make the lines in part self-supporting.

The existence of the lines in the interior of Texas has long permitted warnings to be exhibited on the coast of that State where they were before impracticable. The lines in the Northwest will permit a series of reports not otherwise attainable, the study of which is of the first importance to a proper care for the commerce of the lakes and to other great interests east of the Mississippi.

Appropriations made by Congress have permitted work to be continued, and to be pressed with rapidity upon telegraphic lines extending westward in the vicinity of and covering the northwestern frontier. These lines mentioned as necessary in preceding reports of the Chief Signal Officer are already completed, and telegraphic connection is now established with lines extending eastward from the Pacific coast. These lines are of the first importance for the protection and development of this frontier and the regions through which they pass. There is no region in which the proportional increase of values, or the number of enterprises undertaken, have been greater during the year closing with the date of this report.

Fewer difficulties than were anticipated have been encountered in the construction. It would be difficult, after the experience of the service in line constructions in Western Texas, parts of New Mexico, and Southern Arizona, to encounter any which would be held to render such constructions impracticable. The adoption of iron supports makes it possible to carry a line over any ground on which the supports can be made to stand.

The force of the Signal Service will enable it to successfully occupy the lines already contemplated in existing legislation without additional details.

Arizona division.—First Lieut. C. A. Booth has remained in immediate charge of the lines in this division, pursuant to Special Orders No. 46, Adjutant-General's Office, February 28, 1878, and instructions from the Chief Signal Officer. The total length of line now in operation in this division is nine hundred and seventy-four miles. There are eighteen stations, from six of which full meteorological reports are received tri-daily by telegraph. From twelve of these a sunset observation is forwarded daily by telegraph. The lines have undergone general repairs during the year. The total receipts of the line during the year ending June 30,1880, were twenty-five thousand three hundred and ninety-two dollars and twenty-four cents, of which amount ten thousand one hundred and four dollars and eighty-seven cents were receipts for this line, and fifteen thousand two hundred and eighty-seven dollars and thirty-seven cents were received to be paid to other lines. The amount of official business not charged, for the same period, was, estimated at regular rates, ten thousand seven hundred and eighty dollars and eighty-seven cents.

The following-named stations were in operation June 30, 1880: Burkes, Ariz.; Campo, Cal.; Camp Thomas, Fort Apache, Fort Bowie, Fort Grant, Fort Lowell, Fort Verde, Florence, Maricopa, Phœnix, Prescott, and San Carlos, Ariz.; San Diego, Cal.; Tres Alamos, Tucson, Wickenburg and Yuma, Ariz.

The station at San Carlos, established December 6, 1879, is the only additional one opened during the year. Owing to the nature of the country through which they pass, these lines are maintained with great difficulty. During the past year the lines have been rebuilt in many places, and extensive repairs have been made, in some sections iron poles being substituted for wooden ones. Notwithstanding the many difficulties encountered, the lines have worked better this past year than during any year since their construction.

The following-named stations were inspected during the year: Burkes, during September; Campo, August and November; Camp Thomas, October and December; Fort Apache, December; Fort Bowie, October and January; Fort Grant, October and September; Florence, October and December; Maricopa, January; Fort Lowell, October and December; Fort Verde, September and December; Phœnix, September and December; Prescott, September and December; San Diego, October and November; Tres Alamos, October and December; Tucson, October and December; Wickenburg, September and December; Yuma, September and November.

New Mexico division.—First Lieut. James Allen, acting signal officer, has been in charge of this division during the fiscal year ending June 30, 1880. The total length of line now in operation is 486 miles.

The line from Shakspeare to Santa Fé received thorough repair during the year. A great many special and local repairs were made by operators and repairmen as they were needed.

The establishment of a station at Shakspeare, nearly midway between Silver City and Fort Bowie, has facilitated repairs in that section and has served to keep up a better communication between this and the Arizona division.

In the field operations against hostile Indians, in which the United States troops have been engaged during the year, the line has proven of inestimable benefit to the government. It has enabled the department commander, General John Pope, and district commander, Col. Edward Hatch, to communicate rapidly with troops in the field and at posts, to warn exposed settlements, and to receive early and reliable news of the depredations and whereabouts of hostile Indians, thereby saving the lives and property of citizens and preventing unnecessary hardships and loss of time in connection with the movements of troops, by all of which the government was spared untold expense.

The city of Santa Fé is to-day a very important military post, the operations of more than four regiments of United States troops being directed from headquarters in this city, and the headquarters of a district or department commander will more than probably remain in this city for years to come. A line, therefore, owned and operated by the government, connecting the different military posts, is of great value and importance.

The district commander, Col. Edward Hatch, has taken a deep interest in the line, and owing to his generous and prompt assistance it has been possible to keep the line in good condition and repair during the year.

There are thirteen stations on this line, at five of which complete observations are taken and telegraphed daily.

The following-named stations were in active operation June 30, 1880: Albuquerque, Aleman and Belen, N. Mex.; El Paso, Tex.; Fort Bayard Fort Craig, Fort Cummings, La Mesilla, Los Lunas, Santa Fé, Shakspeare, Silver City, and Socorro, N. Mex.

The total receipts of the line during the year ending June 30, 1880, were twelve thousand eight hundred and forty-nine dollars and fifty-one cents, of which amount seven thousand five hundred and twenty-two dollars and three cents were receipts of this line, and four thousand three hundred and twenty-seven dollars and forty-eight cents were received to be paid to other lines.

The following is the record of inspections made of stations on this line during the year by Lieut. James A. Buchanan, acting signal officer: Albuquerque, Aleman, Belen, El Paso, Fort Bayard, Fort Craig, Fort Cummings, La Mesilla, Los Lunas, Santa Fé, Silver City, and Socorro, during the month of May.

Texas division.—First Lieut. C. A. Tingle, acting signal officer, has been in charge during the year.

During the past year two hundred and sixty-three miles of telegraph line have been constructed, making the total length of line in this division one thousand seven hundred and twenty-three miles.

This extension was constructed under the supervision of Lieut. James A. Swift, Signal Corps, U. S. A., and reaches from Fort Sill, Ind. T., to Fort Elliot, Tex., passing through Wichita Indian Agency, Fort Reno, Cantonment, and Fort Supply, at each of which points offices have been established.

The line has worked well during the year. Automatic repeaters have been substituted for button repeaters at Concho and Jacksborough, and soon will be at Stockton, when it will be practicable to work the entire lines in this division over one circuit.

During the last half of the fiscal year, owing to the fact that all available transportation in the Department of Texas has been engaged in moving troops, it has been difficult to obtain details and transportation for general, and even for ordinary, repairs. Only such repairs have been made as were absolutely necessary for the removal of interruptions to the working of the lines. As soon as transportation is again available extensive repairs will be made.

The substitution of iron for wooden supports has progressed as rapidly as possible, and there are now 5,718 iron poles in use in this division. Kenosha insulators have been replaced by screw glass, except on several sections soon to be rebuilt.

The increase in the business of the line during the past year has been sensibly felt in its operation, and, in connection with the additional strain on its capacity, induced by working the entire line in one circuit, has kept the line constantly busy.

During the month of October, through the courtesy of the Missouri, Kansas and Texas Railway Company, a loop was run from their line in this city into this office, by which arrangement observatory time has been procured from Jefferson City, Mo., and Denison time is now telegraphed daily to all offices in this division, and also to Mesilla, N. Mex., from whence it is supplied to the stations in the New Mexico and in the California and Arizona divisions.

The following-named stations were in active operation in the division June 30, 1880, viz: Denison, Pilot Point, Decatur, Jacksborough, Henrietta, Tex; Sill, Ind. T.; Graham, Griffin, Coleman City, Concho, Stockton, Davis, McKavett, Mason, Fredericksburg, Boerne, San Antonio, Castroville, Uvalde, Brackettville, Eagle Pass, Laredo, Rio Grande City, Edinburgh, Santa Maria, Brownsville, Live Oak Ranche, Tex.; Wichita Agency, Fort Reno, Cantonment, Supply, Ind. T.; and Elliot, Calahan, and Grierson Springs, Tex.

The following-named stations were inspected during the year: Boerne, May, 1880; Brackettville, May, 1880; Brownsville, April, 1880; Castroville, May, 1880; Coleman City, March, 1880; Concho, March, 1880; Davis, April, 1880; Decatur, March, 1880; Denison, March, 1880; Eagle Pass, May, 1880; Edinburg, April, 1880; Fredericksburg, May, 1880; Graham, January and March, 1880; Griffin, January, 1880; Jacksborough, March, 1880; Laredo, April, 1880; Mason, June, 1880;

McKavett, June, 1880; Pilot Point, March, 1880; Rio Grande City, April, 1880; San Antonio, May, 1880; Stockton, April, 1880; Uvalde, May, 1880; Supply, December, 1879.

The aggregate cash receipts from telegraph tolls on messages transmitted over the lines of this division for the year ending June 30, 1880, were twenty-four thousand six hundred and six dollars and fifty-one cents, of which amount sixteen thousand and twenty-three dollars and sixteen cents were receipts for this line, and eight thousand five hundred and eighty-three dollars and thirty-five cents were received to be paid to other lines. The amount of official business, not charged, for the same period, was ten thousand eight hundred and seventy-two dollars and twelve cents.

Northwestern division.—First Lieut. George S. Grimes has remained in immediate charge of the lines in this division, pursuant to Special Orders No. 215, Adjutant General's Office, dated October 5, 1878, and instructions from the Chief Signal Officer.

The total length of line now in operation in this division is 1,652$\frac{199}{300}$ miles. There are thirty-seven stations, from eleven of which full meteorological reports are received tri-daily by telegraph, and from one, partial reports; from fourteen of these sunset observations are forwarded.

The line in operation on June 30, 1880 (854.51 miles), has been kept in thorough repair, and in addition 798$\frac{23}{150}$ have been added to the division, extending the system from Bozeman, the western terminus, through Helena, Fort Shaw, and Benton, Mont., to Fort Assinniboine, Mont., the present northern terminus, and from Helena west through Deer Lodge to Fort Missoula, Mont., the western terminus.

The line terminating at Fort Meade, Dak., has been extended east through Rapid City to Fort Bennett, Dak., on the west bank of the Missouri River, and to Fort Sully, Dak., on the east bank; thence north along the east bank to Fort Yates, Dak., and Fort Abraham Lincoln, Dak., and the west bank to Bismarck, Dak.

The total receipts of the line during the year ending June 30, 1880, were fifteen thousand nine hundred dollars and forty-five cents, of which amount eight thousand four hundred and twenty-six dollars and nine cents were receipts for this line, and seven thousand four hundred and seventy-four dollars and thirty-six cents were received to be paid to other lines. The amount of official business not charged for the same period was, estimated at regular rates, seven thousand nine hundred and eighty-seven dollars and seventy-five cents.

The following stations were in operation June 30, 1880: Bismarck, Dak.; Bozeman, Burns' Ranch, Coal Banks and Coulsen, Mont.; Deadwood, Dak.; Deer Lodge, Ferry Point and Fort Assinniboine, Mont.; Fort Bennett, Dak.; Fort Benton, Mont.; Fort Buford, Dak.; Fort Custer, Fort Ellis and Fort Keogh, Mont.; Fort A. Lincoln and Fort Meade, Dak.; Fort Missoula, Mont.; Fort Shaw, Fort Stevenson, Fort Sully, Fort Yates and Grinnell's Ranch, Dak.; Helena, La Bean's, Little Missouri and New Chicago, Mont.; Plum Creek, Dak.; Powder River and Radersburg; Rapid City, Dak.; Rock Creek, Rose Bud and Shield's River, Mont.; Smithville, Dak.; and Stillwater and Terry's Landing, Mont.

The following-named stations were established during the year: Regular stations, Bozeman, Helena, Fort Shaw, Fort Benton, Fort Assinniboine, Deer Lodge, New Chicago, and Fort Missoula, in Montana; and Fort A. Lincoln, Fort Yates, Fort Sully, Fort Bennett, and Rapid City, in Dakota. Repair stations: Rock Creek, Coal Banks, and Radersburg, in Montana; and Smithville, Plum Creek, and La Bean's, in Dakota.

In consequence of the extra labor and responsibility imposed on the officer in charge, caused by the extension and working of the lines of the division from $854\frac{51}{100}$ miles on June 30, 1879, to $1,652\frac{199}{300}$ miles on June 30, 1880, no formal inspection has been made of the several stations.

Washington Territory division.—The line had been completed and offices equipped at Dayton and Pomeroy, Wash., and at Lewiston and Fort Lapwai, Idaho, on July 1, 1879. These offices have been maintained, and no others on this portion of the line have been opened during the year. Communication over the whole length of the line from Dayton, Wash., to Fort Lapwai, Idaho (72 miles), has been interrupted only upon one occasion, from January 9 until January 17, 1880, caused by the span across Snake River at Lewiston blowing down during a severe gale. Communication was then maintained by flying station at the break. The work on the extension of the line from Pomeroy to Cœur d'Alene and thence eastward toward Missoula was begun at Pomeroy, Wash., on June 15, 1880. The working force consists of Company C, Twenty-first Infantry, under command of Lieut. F. J. Patten. The line was built to Almota, a distance of 23 miles, on June 27, and the span of 1,500 feet successfully stretched across Snake River with the assistance of Captain Gore, with the Oregon Railroad and Navigation Company's steamboat, the Almota. The office at Almota was equipped on June 28, 1880, but not manned, owing to a scarcity of operators. The work of extension is being vigorously pushed northward at the average rate of 2½ miles per day. Every assistance for which application to headquarters of the department has been made has been speedily granted.

The line was in charge of First Lieut. S. C. Vedder, Nineteenth Infantry, acting signal officer, from July 1, 1879, until November 7, 1879, at which time Sergeant Frank Greene, Signal Corps, U. S. A., was placed in temporary charge and remained until May 10, 1880, when First Lieut. Wm. E. Birkhimer, Third Artillery, acting signal officer, assumed charge of the line and remains in charge. It has not been visited by an inspecting officer since its construction, nor have the different offices been officially inspected by the superintendent, owing to his being wholly (almost) employed in preparing for and prosecuting the work of extending the military line to Cœur d'Alene Fort, and thence to the summit of the mountains. I have seen, however, the line from Dayton to Lewiston, and it is a credit to its builders.

The total receipts of the line during the year ending June 30, 1880, were two thousand three hundred and five dollars and twenty-eight cents, of which amount eight hundred and thirty-three dollars and twenty-six cents were receipts for this line and one thousand four hundred and seventy-two dollars and two cents were received to be paid to other lines. The amount of free business not charged for the same period was five hundred and fifty-eight dollars and fifty-three cents.

This rapid extension of all the lines has been made possible by the energetic assistance rendered by the local military authorities, by whom the transportation of material has been largely furnished. The troops at the several posts have performed most of the manual labor of constructing the line. Without such help the small appropriation available would not have furnished the desired telegraphic communication.

The Chief Signal Officer proposes, in the next annual report, to make mention of all officers who have been commended for services in the construction of these lines. The list is not yet complete.

The difficulties surrounding the work of construction and the management of these lines have been before referred to. At the inception, the undertaking was a new one; the appropriations small; the country difficult; a force had to be provided and organized to work the lines while the lines themselves were in construction; the laws controlling the duty were hardly understood; the service was subject to interferences not legal and to oppositions wholly unwise. It was not understood often that services of this kind must grow slowly.

It was not considered often that the difficulties of the construction, repair, and operations of these lines, limited to a single wire, extended for hundreds of miles through wildernesses, in sparsely-settled territories, without railways, and threatened always by Indians or other hostile forces, are different, much greater, and not at all to be compared with those of maintaining commercial lines, following railways, existing in the midst of settled civilization, and with every appurtenance at hand at many points, to move instantly by rail, along the lines, for their immediate restoration and repair, if they chance to be damaged. It is, however, from the anxious settlers in this wilderness and upon the distant frontiers that the most urgent appeals are forwarded, both that existing lines may be maintained and that additional lines may be constructed. It is here they are located by law, and it is for the commercial development as well as the protection of these regions that the lines are of the greatest importance. It is an absolute necessity for the especial duties of this office that these regions be penetrated.

The difficulties above referred to lessen. It is better understood in each ensuing year that systems of telegraphic lines to be worked at all must be worked as a unit. The laws of the United States and the orders which have so determined are more closely obeyed. Illegal and unauthorized interferences are less frequent. It is better comprehended that lines conveying, as they may, commercial or official business from one extreme of the United States to another, ought not by possibility to be interfered with in their working by any subordinate authority.

Tests of the accuracy and rapidity of the working of these lines, made for a comparison in these respects with other lines under different management, but in country similar in character, have given satisfactory results. The working of the lines improves steadily. When it shall have become possible, as it will with better knowledge of their usefulness, to station along the lines repair parties, sufficient in number and properly located, and to provide material at depots so distributed as to be always and easily accessible, there will be no reason why these lines should be disabled for other than very brief periods. It is impossible to protect absolutely from frequent brief interruptions any line constructed with a single wire. It is in view to double the wires as rapidly as the appropriation and powers of the office will permit.

The fact that the especial duties of this office require reports from all the lengths of all its lines three times daily in the regular discharge of its daily duties, affords opportunities for and causes an inspection more regular and frequent, perhaps, than that had on any lines not under similar supervision.

The use of iron supports, succeeding as it has under the tests to which it has been this year subjected, by the practical uses of such supports in the lines actually constructed, has shown a great advance in line construction. It is difficult to estimate the importance to the United States and to the service of a mode and material for line construction capable of being put in use and lasting everywhere.

The tests made with the telephone at this office and on the sea-coast assure the fact that many posts and stations near main lines may have a telegraphic communication over those lines which has been hitherto impossible.

There are no constructions more economical, or returning, by their use, more fully their value to the people and the Army of the United States, than the electric lines now stretching among the frontier posts and settlements.

The office is again called upon to acknowledge the courteous and prompt aid with which the wishes of the Secretary of War have been met on the part of division, department, and district commanders, and the zeal with which the working parties of troops by them detailed have performed their duties.

In the different works of construction, important assistance has been rendered by Lieut. Gen. P. H. Sheridan, commanding Military Division of the Missouri; Brig. Gen. O. O. Howard, commanding Department of the Columbia; Brig. Gen. A. H. Terry, commanding Department of Dakota; Brig. Gen. E. O. C. Ord, commanding Department of Texas; Brevet Brig. Gen. Edward Hatch, commanding District of New Mexico; and Brevet Brig. Gen. O. B. Willcox, commanding Department of Arizona. The work would have failed in much of its success but for this powerful aid.

The military results foreshadowed as to follow the construction and use of these interior lines are already in part attained. The reports of officers commanding campaigns, or employed in other operations, evidence at once the wisdom with which these added facilities for communication have been employed, and the success of operations to which the rapid communication so secured have, under their direction, contributed.

In closing this report the Chief Signal Officer again refers to the frequent rehearsal of facts hitherto stated in preceding reports upon the service. The annual reports of the succeeding years, rehearsing, as they must, similar facts of organization and of service, become more closely repetitions of the preceding reports, to which are added, each year, such statements of progress as relate to the year present.

The Chief Signal Officer anticipates the best results to the Signal Service from the legislation of 1878. There could hardly have been an act wiser for the interests of the service or more just to the members of it. The favorable action of Congress has removed difficulties which had hampered the progress of the duty for years. If its work is permitted to go on as it has been planned, and is fairly sustained, it can hardly fail in continued success. There ought to be just provision for the permament employment and grades of the officers of the corps. It is recommended this be fixed by legislation. It is hoped there may be no failure in the appropriation for the service of the amounts estimated for this year. They have been estimated with careful economy.

The progress of the service through the years of duty past has been attended with steady and satisfactory success. There is no longer question as to the useful preannouncement of meteoric changes. The plans extend more broadly in each succeeding year, by which to aid in every interest of commerce and agriculture. The popular confidence and support have been unchanging and considerate. A world-wide study has been developed, and aims to attain results not contemplated a few years ago as possible. The scope of practical usefulness increases with each year. The road grows broader and plainer as it leads towards success.

R. C. DRUM,

Adjutant-General, and Acting Chief Signal Officer of the Army.

PAPER 1.

COURSE AT FORT WHIPPLE, VIRGINIA.

(Exclusive of the drills in the arms, with trains or for permanent construction.)

OFFICERS.

The course of instruction for officers is both practical and theoretical. The theoretical portion comprises instruction in the following books, viz: The Manual of Signals, The International Code of Flag Signals, Official Danger and Distress Signals, Pope's Practical Telegraphy, Culley's Hand-book of Telegraphy, Loomis' Meteorology, Instructions to Observer Sergeants, the Cipher Manual. The supplementary course of reading comprises in the cases of officers permanently detailed for the full duties of the Signal Service, in addition to especial works from time to time designated: The Practical Uses of Meteorological Reports and Weather Maps, Smithsonian Directions for Meteorological Observations, Buchan's Handy Book of Meteorology, Piddington's Horn Book, Espy's Philosophy of Storms, Fitz Roy's Weather Book, Martin's Rotary Theory of Storms, Ley's Laws of the Winds, Espy's First Meteorological Report, Espy's Fourth Meteorological Report. The practical portion consists of wand practice, which is continued until the officer can read messages at the rate of ten words per minute; practice in the field with flag and torch in general service; homographic, chronosemic, and international codes of flag-signals and various kinds of ciphers, and practice with the heliograph in the General Service Code.

The ranges for practice are from a few hundred yards to eighteen miles in extent with flag and torch, and extreme long range of thirty-one miles with the heliograph.

The officers have practical instructions in telegraphy (General Service Code) until they can send and receive at the rate of ten words per minute, and are required to make drawings of the various telegraph instruments and electrical batteries in use in the Signal Service.

ENLISTED MEN.

Instruction No. 36.

WAR DEPARTMENT,
OFFICE OF THE CHIEF SIGNAL OFFICER,
Washington, D. C., April 16, 1878.

The following course of instructions is prescribed for enlisted men at the School of Instruction of the Signal Service at Fort Whipple, Va.:

Sergeants ordered to Fort Whipple, Va., for change of station, misconduct, or any cause other than "review of theoretical course" will report to the instructor for wand, for field, and for telegraph practice, and for such duties, as non-commissioned officers, in connection with the course of instruction as may be necessary.

Sergeants ordered in from station for review of course, candidates for promotion, and recruits will be instructed in the following theoretical and practical course:

Signal Manual, page 15, from "A sign or signal," to page 96; and from "Description of equipments," page 189, to "Semaphore telegraph," page 195; from "Flags on halyards," page 198, to "Distance line," page 199; from "When working at night," page 206, to "Candle bombs," page 207; from "Manual of the kit," page 258, to middle of page 273; from "Field telegraph train," page 378, to "General directions, &c.," page 393; from "Permanent lines" to "General service," pages 399 to 466; International Code of Signals; Loomis' Meteorology, to page 193, omitting articles 125, 126, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, and 369; Official Danger or Distress Signals; Pope's Modern Practice of the Electric Telegraph, chapter 1, to page 45; page 57 to page 64, article 103; chapter 6, page 73, to article 122, page 78; chapter 7 and 8; Culley's Hand-book of Practical Telegraphy, Part I, page 1, to article 49, page 18; Part III, page 45, to article 120, page 57; article 130, page 71, to Part IV, page 76; Instructions to Observer Sergeants, entire book; Cavalry Tactics, through school of the company, dismounted.

Practical course.—Wand-practice daily for six weeks, or as much longer as necessary; field practice in the immediate vicinity of Fort Whipple daily, during theoretical course; practical instruction with Marean repeater and telephone; cleaning and setting up batteries; use and construction of all Morse instruments; establishing terminal and intermediate stations; cutting in on line; use and construction of all instruments used on station; method of correcting barometer; finding of dew-point and relative humidity; observation of clouds; cleaning barometer; telegraph practice daily, standard, ten words; practical instruction in splicing cables; forms, records of office, &c.

All men to have four tours of guard duty as non-commissioned officers; twelve days' and four nights' "field practice" in General Service Code, at long range; three days' practice in International Code, at long range.

Men on guard duty will not be excused from recitations; nor will they be excused from telegraph practice at hours when not actually on post. Men on duty in the observatory will be excused from company duty as now provided.

Recruits to perform company duty for two months previous to being ordered for theoretical instruction. Instruction during this time not to interfere with military duty.

All enlisted men reporting for duty to be instructed in cavalry tactics, through "school of the company," dismounted.

Flag, torch, train, &c., drills conducted as heretofore.

A schedule showing hourly occupation, from 9 a. m. to 9 p. m., of each man under instruction, will be kept by the instructor.

Instruction hours.—Recitations will commence at 9.45 a. m., and continue until all classes have recited. Telegraph practice at such hours between 9 a. m., and 9 p. m., as instructor may direct, each man to have, when practicable, at least two hours' practice daily. Study hours from 9 a. m., until 9 p. m., the time being so divided that each man may have at least three hours for the preparation of his daily lesson. During recitation and study hours the men under instruction will be required to be present at instruction building. The sergeant, or such other enlisted man as may be designated, will have charge of the study-room, and will be responsible to the instructor for the presence and orderly behavior of the classes during study and recitation hours. Instruction on Saturdays will be discontinued.

ALBERT J. MYER,

Brigadier-General (brevet assigned), Chief Signal Officer of the Army.

RECORD OF SIGNAL CAMP OF INSTRUCTION, FORT WHIPPLE, VA.

PAPER 2.

Officers instructed during the year ending June 30, 1880.

Name.	Rank and corps.	Reported for instruction.	Relieved from instruction.	Remarks.
J. A. Swift	Second lieutenant Signal Corps.	Mar. 19, 1879	....	Still under instruction.
L. E. Sebree	Second lieutenant Signal Corps.	Mar. 19, 1879	Mar. 1, 1880	Completed full course of signaling, telegraphy and meteorology.
W. S. Wyatt	First lieutenant Ninth Infantry.	Oct. 27, 1879	....	Still under instruction.
F. K. Ward	First lieutenant First Cavalry.	Nov. 17, 1879	May 24, 1880	Completed full course of signaling, telegraphy and meteorology.
J. S. Powell	Second lieutenant Signal Corps.	Feb. 5, 1880	May 24, 1880	Do.
W. A. Glassford	Second lieutenant Signal Corps.	Feb. 5, 1880	May 24, 1880	Do.
W. C. Buttler	Second lieutenant Third Infantry.	May 11, 1880	....	Still under instruction.
F. Von Schrader	First lieutenant Twelfth Infantry.	May 14, 1880	....	Do.

PAPER 3.

Amount of field practice had by each officer.

Name.	Rank and corps.	Number of days flag-practice was had.	Number of nights torch-practice was had.	Remarks.
J. A. Swift	Second lieutenant Signal Corps	2	3	
L. E. Sebree	Second lieutenant Signal Corps	5	3	
W. S. Wyatt	First lieutenant Ninth Infantry	21	11	
F. K. Ward	First lieutenant First Cavalry	17	8	
J. S. Powell	Second lieutenant Signal Corps	17	8	
W. A. Glassford	Second lieutenant Signal Corps	17	8	

PAPER 4.

Enlisted men instructed for the position of assistant to non-commissioned officers in charge of stations from July 1, 1879, *to June* 30, 1880.

Name.	Placed under instruction for assistant.	Reported qualified as assistant.	Ordered on station.	Remarks.
Coville P. Terrett	Mar. 6, 1879	July 7, 1879	July 11, 1879	Discharged the service of the United States Oct. 16, 1879.
William S. Dulin	Apr. 1, 1879	July 19, 1879	July 24, 1879	Discharged the service of the United States Sept. 27, 1879.
Frank Ridgway	Apr. 1, 1879	July 5, 1879	July 11, 1879	On duty as telegraph operator at Wickenburg, Ariz.
Presley T. Jenkins	Apr. 1, 1879	July 19, 1879	July 24, 1879	On duty as assistant at Portland, Me.
Charles S. Wixom	Apr. 1, 1879	July 5, 1879	July 9, 1879	Discharged the service of the United States Sept. 25, 1879.
Gwyn R. Tompkins	Apr. 1, 1879	Aug. 2, 1879	Aug. 6, 1879	On duty as telegraph operator at Deer Lodge, Mont.
Horace M. Woodward	Apr. 1, 1879	July 26, 1879	July 26, 1879	On duty as telegraph operator at Henrietta, Tex.
Frank P. Chaffee	Apr. 30, 1879	Aug. 2, 1879	Aug. 6, 1879	On duty as assistant at Cape Lookout, N. C.
Daniel J. Carroll	Apr. 30, 1879	Aug. 11, 1879	Aug. 14, 1879	On duty at Office of Chief Signal Officer.
George W. Taylor	Apr. 30, 1879	Aug. 25, 1879	Aug. 27, 1879	On duty as assistant at Sandy Hook, N. J.
Frederic H. Clarke	Apr. 30, 1879	Aug. 11, 1879	Aug. 12, 1879	On duty as assistant at Wilmington, N. C.
Thomas S. Outram	Apr. 30, 1879	Aug. 11, 1879	Aug. 14, 1879	On duty as assistant at Philadelphia, Pa.
Willis L. Moore	May 17, 1879	....	Aug. 1, 1879	On duty at Office of Chief Signal Officer.
Charles B. Tuch	May 31, 1879	Oct. 11, 1879	Oct. 8, 1879	Do.
Walter W. McConihe	May 31, 1879	Aug. 29, 1879	Aug. 29, 1879	On duty as telegraph operator at Concho, Tex.
Ransom White	June 1, 1879	Sept. 6, 1879	Sept. 16, 1879	On duty at Office of Chief Signal Officer.
Charles W. Chambers	June 1, 1879	Sept. 6, 1879	Sept. 6, 1879	On duty as assistant at Cincinnati, Ohio.
John O. Conway	June 1, 1879	Aug. 29, 1879	Aug. 27, 1879	In charge of station at Point Judith, R. I.
John B. Wildman	June 30, 1879	Oct. 25, 1879	....	Discharged the service of the United States Nov. 3, 1879.
Thomas M. Ambler	June 30, 1879	Oct. 16, 1879	Oct. 16, 1879	On duty as assistant at Chicago, Ill.
James A. Frear	June 30, 1879	Sept. 27, 1879	Sept. 27, 1879	On duty as assistant at Indianapolis, Ind.
John H. Jones	June 30, 1879	Oct. 24, 1879	Oct. 24, 1879	On duty as assistant at Smithville, N. C.
James P. Sherry	June 30, 1879	Sept. 27, 1879	Sept. 27, 1879	On duty as telegraph operator at Wichita Agency, Ind. T.
Charles H. Coburn	July 31, 1879	Nov. 8, 1879	Dec. 13, 1879	On duty at Office of Chief Signal Officer.
Nathan S. Eddy	July 31, 1879	Nov. 8, 1879	Nov. 17, 1879	Do.
J. Walter Mitchell	July 31, 1879	Jan. 5, 1880	Jan. 15, 1880	On duty as assistant at Buffalo, N. Y.
Frederick G. Cowie	July 31, 1879	Nov. 8, 1879	Dec. 8, 1879	Discharged the service of the United States April 27, 1880.
Fielding L Jones	July 31, 1879	Oct. 30, 1879	Oct. 27, 1879	On duty as assistant at Colorado Springs, Colo.
Richard Graham	July 31, 1879	Nov. 8, 1879	Dec. 1, 1879	In charge of station at Portsmouth, N. C.
John McNair Wright	July 31, 1879	Nov. 8, 1879	Dec. 1, 1879	On duty as assistant at Cape Hatteras, N. C.
James Stapleton	July 31, 1879	Oct. 30, 1879	Nov. 1, 1879	On duty at Office of Chief Signal Officer.
Frederick W. Conrad	Aug. 16, 1879	Jan. 5, 1880	Jan. 5, 1880	On duty as assistant at Chicago, Ill.
Elias B. Dunn	Aug. 16, 1879	Dec. 20, 1879	Dec. 22, 1879	On duty at Office of Chief Signal Officer.
John Fitzgerald	Aug. 16, 1879	Jan. 19, 1880	Jan. 20, 1880	On duty as assistant at Pittsburgh, Pa.
Hugo Worch	Sept. 1, 1879	Mar. 10, 1880	Mar. 11, 1880	On duty at Office of Chief Signal Officer.
Sutphen Bailey	Sept. 6, 1879	Mar. 25, 1880	Mar. 26, 1880	On duty as assistant at Sandy Hook, N. J.

Enlisted men instructed for the position of assistant to non-commissioned officers, &c.—Cont'd.

Name.	Placed under instruction for assistant.	Reported qualified as assistant.	Ordered on station.	Remarks.
George W. Felger	Sept. 15, 1879	Dec. 27, 1879	Jan. 7, 1880	On duty as assistant at Baltimore, Md.
Will C. Barnes	Sept. 15, 1879	Jan. 5, 1880	Dec. 31, 1879	On duty as telegraph operator at Apache, Ariz.
George A. Warren	Sept. 16, 1879	Dec. 27, 1879	Dec. 31, 1879	On duty as assistant at New York City.
Simon J. Farrell	Sept. 22, 1879	Jan. 31, 1880	Feb. 25, 1880	On duty at Office of Chief Signal Officer.
Thomas J. Elam	Sept. 26, 1879	Jan. 19, 1880	Jan. 21, 1880	Do.
Appleton Pritchard	Nov. 1, 1879	Feb. 14, 1880	Mar. 16, 1880	On duty as assistant at Chincoteague, Md.
Charles Ancor	Nov. 19, 1879	Mar. 9, 1880	Mar. 9, 1880	On duty as assistant at Oswego, N. Y.
Charles F. Merritt	Nov. 19, 1879	Mar. 11, 1880	Mar. 11, 1880	On duty as assistant at Cape Henry, Va.
John C. Graham	Nov. 19, 1879	Mar. 1, 1880	Mar. 1, 1880	Died at Evansville, Ind., June 22, 1880.
John H. Harmon, jr	Nov. 20, 1879	Mar. 25, 1880	Mar. 16, 1880	On duty as assistant at Louisville, Ky.
James F. Jirdinston	Nov. 20, 1879	Mar. 11, 1880	Mar. 10, 1880	On duty as assistant at Cape Henry, Va.
Hampden S. Gardiner	Nov. 20, 1879	Mar. 1, 1880	Mar. 1, 1880	In charge of station at Sloop Point, N. C.
Joseph S. Clarke	Dec. 30, 1879	Apr. 24, 1880	Apr. 26, 1880	On duty as telegraph operator at Fort Buford, Dak.
Eston Randolph	Dec. 30, 1879	Apr. 9, 1880	Apr. 9, 1880	On duty as assistant at Fort Macon, N. C.
James H. Young	Dec. 30, 1879	May 3, 1880	May 6, 1880	On duty as telegraph operator at Fort Stevenson, Dak.
Edward A. Thomas	Dec. 30, 1879	Apr. 24, 1880	Apr. 26, 1880	On duty as telegraph operator at Decatur, Tex.
Benjamin E. Hambleton	Dec. 30, 1879	Apr. 15, 1880	Apr. 15, 1880	On duty as assistant at Kittyhawk, N. C.
Meyer Herman	Jan. 6, 1880	Apr. 9, 1880	Apr. 9, 1880	On duty as assistant at Rochester, N. Y.
William A. Merchant	Jan. 6, 1880	Apr. 17, 1880	Apr. 21, 1880	On duty as telegraph operator at Los Lunas, N. Mex.
William H. Farrington	Jan. 6, 1880	May 15, 1880	May 15, 1880	On duty at Office of Chief Signal Officer.
Louis Leonardy	Jan. 16, 1880	Apr. 19, 1880	Apr. 21, 1880	In charge of station at Kittyhawk, N. C.
Lewis N. Jesunofsky	Feb. 6, 1880	May 24, 1880	June 2, 1880	In charge of station at Nashville, Tenn.
John B. Wells	Feb. 17, 1880		May 6, 1880	In charge of station at Eastport, Me.
William Bolton	Feb. 17, 1880	May 24, 1880	May 27, 1880	Promoted corporal June 2, 1880. In charge of station at Delaware Breakwater, Del.
Edward A. Evans	Feb. 17, 1880	June 12, 1880	June 21, 1880	On duty as assistant at Port Huron, Mich.
John B. Marbury	Feb. 17, 1880	May 24, 1880	May 25, 1880	On duty as assistant at Escanaba, Mich.
Samuel I. Frankenfield	Feb. 17, 1880	May 24, 1880	May 25, 1880	On duty as assistant at Buffalo, N. Y.
Louis P. Sutor	Mar. 11, 1880			Still under instruction.
Wirt W. Gwin	Mar. 13, 1880	June 23, 1880	June 23, 1880	On duty as assistant at Delaware Breakwater, Del.
Henry C. Anderson	Mar. 13, 1880			Still under instruction.
Ver Planck Temple	Mar. 13, 1880			Do.
Dudley B. Notson	Apr. 13, 1880			Do.
Henry Pennywitt	Apr. 13, 1880			Do.
James F. Du Hamel	Apr. 27, 1880			Do.
George W. Dunn	Apr. 27, 1880			Do.
John Grover	Apr. 27, 1880			Do.
Frank H. White	Apr. 27, 1880			Do.
Erastus P. Callaway	May 15, 1880			Do.
Charles B. Kitchen	May 15, 1880			Do.
Basil O. Lenoir	May 15, 1880			Do.
Walter L. Seward	May 15, 1880			Do.
George H. Willson	May 25, 1880			Do.
E. Herbert Thompson	May 25, 1880			Do.
Clarence E. King	May 25, 1880			Do.
Christian H. Schaap	May 25, 1880			Do.
Frank Burke	June 19, 1880			Do.

PAPER 5.

Table showing the instruction of candidates for the grades of sergeant and corporal from July 1, 1879, to June 30, 1880.

Name.	Instruction commenced.	Date of promotion.	Remarks.
SERGEANTS.			
John Healy	Sept. 22, 1879	Jan. 1, 1880	In charge of station at Wood's Holl, Mass.
CORPORALS.			
John B. Merrill	Nov. 19, 1879	Feb. 20, 1880	In charge of station at Morgantown, W. Va.
James J. Fitzgerald	Nov. 1, 1879	Feb. 24, 1880	In charge of station at Cape May, N. J.
William Bolton	Feb. 17, 1880	June 23, 1880	In charge of station at Delaware Breakwater, Del.
John H. Sherman	June 21, 1880	....	Still under instruction.

PAPER 6.

Exhibiting the communications sent from and received at the office of the Chief Signal Officer (exclusive of telegrams) from July 1, 1879, to June 30, 1880.

SENT.

Division of telegrams and reports for the benefit of commerce and agriculture.

To heads of departments and bureaus	840
To non-commissioned officers in charge of stations, in reference to their duties	10, 880
In reply to applications for stations and others similar	34
To telegraph companies, in reference to transmission of weather reports and the erection of telegraph lines, &c	113
To boards of trade, chambers of commerce, agricultural societies, &c	136
To postmasters, in reference to weather bulletins	40
To foreign correspondents, relating to this division in general	202
To foreign correspondents, relating to simultaneous reports	747
To volunteer observers throughout the United States	399
General and special orders and circulars, with reference to this division	11, 769
Miscellaneous	1, 486
Total	26, 646

Signal Division.

To heads of departments and bureaus	163
Relating to duties and discipline at Signal Service school of instruction and post of Fort Whipple, Va	117
Relating to recruiting and enlistment	1, 133
Answers to applications for enlistment in the Signal Corps, United States Army	680
General and special orders and circulars, with reference to this division	3, 124
Miscellaneous	403
Total	5, 620

Property Division.

To heads of departments and bureaus	522
To manufacturers and others, in reference to instruments, equipments, &c	3, 806
To non-commissioned officers in charge of stations and other enlisted men, in reference to property and money accounts	8, 175
In reference to quarterly returns of officers	1, 353
Regarding property transferred to stations	3, 023
Miscellaneous	8, 523
Total	25, 402
Aggregate	57, 668

RECEIVED.

Division of telegrams and reports for the benefit of commerce and agriculture.

From heads of departments and bureaus	220
Applications for the establishment of new stations	42
From telegraph companies, in reference to the transmission of weather reports and the construction of telegraph lines, &c	203
From non-commissioned officers in charge of stations, in reference to their duties	12,761
From boards of trade, chambers of commerce, and agricultural societies	251
From foreign correspondents, relating to simultaneous weather reports	6,252
From volunteer observers throughout the United States, relating to observations and reports	4,617
From foreign correspondents, relating to this division in general	7
Reports relative to instruction of non-commissioned officers and assistants	723
Mailed reports from non-commissioned officers in charge of stations	291,480
From United States naval vessels and stations (received through the Navy Department)	1,237
Meteorological charts, abstracts of journals, forms, &c., received from non-commissioned officers in charge of stations, railroad stations, &c	207,153
From commercial steamship companies	443
Reports from postmasters throughout the United States in reference to weather bulletins received and posted by them	161,318
Miscellaneous	3,482
Total	690,189

Signal Division.

From heads of departments and bureaus	220
Relating to duties and discipline at Signal Service school of instruction and post of Fort Whipple, Va	185
Relating to instruction in signaling at Fort Whipple, Va., and in different military departments	182
Relating to recruiting and enlistment	200
Applications for enlistment in the Signal Corps, United States Army	597
Miscellaneous	1,574
Total	2,958

Property Division.

From heads of departments and bureaus	1,103
From manufacturers and others, relating to instruments, equipments, &c	1,037
From officers, concerning property, quarterly returns, &c	2,289
From non-commissioned officers in charge of stations, and other enlisted men, relating to property and money accounts	40,502
Regarding property transferred to stations	6,386
Miscellaneous	5,557
Total	56,874
Aggregate	750,021

Aggregate sent	57,668
Aggregate received	750,021
Aggregate sent and received	807,689

Table showing the number of cipher-words and messages sent and received by telegraph at the central office, Washington, D. C., from July 1, 1879, to June 30, 1880.

Cipher-words of weather reports sent	36,600
Telegraphic messages other than weather reports sent	13,570
Cipher-words of weather reports received	748,384
Cipher-words of special river reports received	7,076
Telegraphic messages other than weather reports received	18,560

PAPER 7.

Table showing meteorological data furnished from the records of the office of the Chief Signal Officer of the Army, upon the request of the applicants named, during the fiscal year ending June 30, 1880.

Wm. McMurtrie, esq., chemist, Department of Agriculture, Washington, D. C., furnished, July 8, 1879, with table showing average humidity for each month of the year at Burlington, Vt.; Denver, Colo.; Dodge City, Kans.; Galveston, Tex.; Indianapolis, Ind.; Jacksonville, Fla.; Memphis, Tenn.; Montgomery, Ala.; Nashville, Tenn.; New Orleans, La.; New York, N. Y.; Omaha, Nebr.; Pittsburgh, Pa.; Portland, Me.; Portland, Oreg.; Rochester, N. Y.; San Diego and San Francisco, Cal.; Shreveport, La.; Saint Louis, Mo.; Saint Paul, Minn., and Wilmington, N. C., from July, 1873, to June, 1879, inclusive.

Capt. Geo. M. Wheeler, Corps of Engineers, U. S. A., furnished, July 12, 1879, with table showing the readings of the barometer corrected for temperature, readings of dry and wet bulb thermometers and corresponding relative humidity, at 7 a. m., 2 p. m., and 9 p. m., each day, at Pike's Peak, Colo., from May 23 to June 15, 1879, and at Fort Garland, Colo., from May 13 to 22, 1879.

Mr. J. C. Neilson, architect, Staunton, Va., furnished, July 22, 1879, with statement showing the amount of precipitation at Mount Solon, Va., for each month, from January, 1878, to June, 1879, inclusive.

Mr. A. S. Cushman, Boston, Mass., furnished, July 24, 1879, with tables showing maximum, minimum, and mean temperatures, mean relative humidity, total amount of precipitation and prevailing direction and maximum velocity of wind at Leavenworth, Kans., for each month, from September, 1871, to June, 1879.

Capt. Geo. M. Wheeler, Corps of Engineers, U. S. A., furnished, July 25, 1879, with tables showing readings of barometer (reduced to freezing), and attached and dry and wet bulb thermometers; also, corresponding relative humidity (at 7 a. m., 2 p. m., and 9 p. m., each day), at Pike's Peak, Colo., from May 13 to 22 and from June 16 to 24, inclusive, and at Sacramento, Cal., from May 16 to June 27, 1879.

Mr. T. R. Tannett, agent Oregon Steamship Company, &c., New York City, furnished, August 16, 1879, with tables showing monthly and annual amount of rain-fall and monthly maximum, minimum, and mean temperature, for each month, at Portland, Oreg., from January, 1878, to July, 1879; at Roseburg, Oreg., and Olympia, Wash., from July, 1877, to July, 1879, and at Umatilla, Oreg., from August, 1877, to July, 1879, inclusive.

Joseph M. Pray, esq., attorney at law, Brooklyn, N. Y., furnished, August 18, 1879, with tables showing state of weather at each observation, together with time of commencement and ending, and amount of all precipitation at New York City from November 1 to December 20, 1879.

Mr. G. A. N. Silgencrantz, U. S. Engineer's Office, Chicago, Ill., furnished, August 12, 1879, with tables showing daily maximun and minimum temperature at Chicago, New Orleans, San Francisco, and Washington from July 1, 1878, to June 30, 1879, inclusive.

Dr. C. Spinzig, Saint Louis, Mo., furnished, August 19, 1879, with tables showing mean barometer and temperature and amount of precipitation at Memphis, Tenn., for each month from January to July, 1879, and for each day from July 1 to August 9, 1879, inclusive.

Mr. William H. Fleming, North Conway, N. H., furnished, August 22, 1879, with statement showing mean humidity and extreme range of temperature, the humidity for each month of 1874, 1875 and 1876, and the range of temperature for each month in the years 1875, 1876 and 1877, at Sandy Hook, N. J.

Capt. Edwin Pollock, Ninth United States Infantry, Washington, D. C., furnished, September 3, 1879, with table of maximum, minimum, and mean temperature at Cheyenne and Camp Brown, Wyo., from January to December, 1877, inclusive.

Messrs. Hamilton & Co., produce and commission merchants, Louisville, Ky., furnished, September 15, 1879, with tables showing state of weather and readings of exposed maximum and minimum thermometers at each of the seven daily observations at Chicago, Ill., and Louisville, Ky., from December 27, 1878, to January 5, 1879.

Mr. F. C. Briggs, Waterville, N. H., furnished, September 15, 1879, with record of maximum, minimum, and mean temperatures at Fort Monroe and Norfolk, Va., from July, 1877, to June, 1879, inclusive.

Mr. Verplank Colvin, superintendent Adirondack survey, Albany, N. Y., furnished, September 16, 1879, with record of barometer, attached, exposed, dry, and wet bulb thermometers and directions of wind at Albany and Oswego, N. Y., and Burlington, Vt., on September 7 and 8, and November 7, 1877 (five observations each day).

Mr. C. B. Salmon, treasurer Eclipse Windmill Company, Beloit, Wis., furnished, September 16, 1879, with record of the average and maximum velocity of the wind (in miles per hour) for each month from January, 1878, to June, 1879, at Sacramento,

Boise City, Salt Lake City, Bismarck, Pembina, North Platte, Dodge City, San Antonio, Shreveport, Fort Gibson, Leavenworth, Omaha, Saint Louis, Vicksburgh, Montgomery, Jacksonville, Augusta, Nashville, Indianapolis, Columbus, Detroit, Lynchburgh, Washington, Philadelphia, Rochester, and Louisville.

Mr. George H. Cook, State geologist, New Brunswick, N. J., furnished, September 22, 1879, with table showing maximum, minimum, and mean temperatures at Blooming Grove, Pa., for each month from January, 1874, to December, 1878, inclusive.

Mr. Wm. H. Fleming, North Conway, N. H., furnished, September 23, 1879, with tables showing mean relative humidity for each month of the year 1877, and annual maximum, minimum, and range of temperature for the years 1874, 1875, 1876 and 1877, at Sandy Hook, N. J.

Smith Townshend, M. D., health officer, Washington, D. C., furnished, September 25, 1879, with statement showing mean thermometer, mean barometer, mean humidity, rainfall (in inches), and prevailing direction of wind for weeks ending July 6, 1878, to July 5, 1879, at Washington, D. C.

Messrs. Gray & Loring, Boston, Mass., furnished, September 27, 1879, with copies of anemometer and anemoscope sheets at Boston, from 12 noon of April 17 to 12 noon April 20, 1876.

Mr. C. B. Salmon, treasurer Eclipse Windmill Company, Beloit, Wis., furnished, September 30, 1879, with statement showing average hourly and monthly velocity of the wind at Portland, Me., Albany, N. Y., Grand Haven, Mich., Boston, Mass., Pittsburgh, Pa., Corsicana, Tex., Cheyenne, Wyo., for each month from January, 1878, to June, 1879, inclusive.

Mr. Charles D. Palmer, office No. 1, Old State House, Boston, Mass., furnished, September 30, 1879, with statement showing the highest velocities of wind at Boston, Mass., Cape Henry, Va., Capes Hatteras, Lookout, and Kittyhawk, N. C., Mount Washington, N. H., North Platte, Nebr., Pike's Peak, Colo., and Sandy Hook, N. J.

Mr. Henry I. Bowditch, 113 Boylston street, Boston, Mass., furnished, October 6, 1879, with statement showing the mean daily temperature at Eastport and Portland, Me., and Boston, Thatcher's Island and Wood's Holl, Mass., from June 16 to September 16, inclusive, for the years 1876, 1877, 1878 and 1879; also, statement showing the direction of the wind and the state of the weather at the same points, for the same months, but for the years 1876, 1878 and 1879.

Messrs. Stein Bros., Baltimore, Md., furnished, October 23, 1879, with statement showing monthly maximum, minimum, and mean temperatures, amount of rain-fall, and prevailing direction of wind at Menlo Park, Cal., from March, 1878, to September, 1879, inclusive.

Park Benjamin, 37 Park Row, New York City, furnished, October 29, 1879, with statement showing maximum velocity of wind at Buffalo, Albany, and New York City during year ending June 30, 1879.

M. Laupheimer, 268 West Pratt street, Baltimore, Md., furnished, October 28, 1879, with statement showing the mean monthly percentage of relative humidity at Los Angeles and San Diego, Cal., during two years ending June 30, 1879.

Messrs. Schiaffino & Cossa, 21 South Gay street, Baltimore, Md., furnished, October 30, 1879, with direction and velocity of wind at 9 and 11.08 p. m., March 3, 1878, at Cape May, N. J.

Mr. W. L. Fawcett, 120 La Salle street, Chicago, Ill., furnished, October 31, 1879, with statement showing average amount of rain-fall, by weeks, in Ohio Valley and Tennessee region, the Upper Mississippi region, and the Lower Missouri Valley, from August 5, to October 27, 1879, inclusive, and total rain-fall from August 18 to October 18, 1879, inclusive, at Cincinnati, Indianapolis, Keokuk, Leavenworth, Nashville, Pittsburgh, and Springfield (Ill.).

A. S. Abell & Co., Sun Iron Building, Baltimore, Md., furnished, November 10, 1879, with data for eight years, from 1871 to 1878, embracing mean monthly barometer and thermometer, direction and highest velocity of wind, amount of rain-fall, average readings of each month of mean barometer and thermometer, prevailing direction of wind, and amount of rain-fall at Baltimore, Md.

Mr. Albert Marwick, No. 15 Exchange street, Portland, Me., furnished, November 11, 1879, with statement showing velocity of wind and direction and state of weather at Wood's Holl, Mass., at 5.01 p. m., 9 p. m., and 11.26 p. m., September 14, 1879.

Prof. J. W. Chickering, Washington, D. C., furnished, November 11, 1879, with statement showing readings of barometer reduced to sea-level at Knoxville, Tenn., at 7 a. m., 2 and 9 p. m., from September 8 to September 13, 1879.

Commissioner of Agriculture, Washington, D. C., furnished, November 12, 1879, with a statement showing mean daily barometer, maximum, minimum, and daily temperature, mean daily relative humidity, prevailing direction of wind, rain-fall and melted snow (in inches), and the character of the day, for each day in the year from November 1, 1878 to October 31, 1879, inclusive, at Louisville, Ky.

Mr. F. Staut, 1701 Indiana Avenue, Washington, D. C., furnished, November 14, 1879, with a statement showing the principal rains which occurred at Washington.

D. C., during September, 1877, with the highest velocities and prevailing direction of the wind.

Mr. M. Accame, 21 South Gay Street, Baltimore, Md., furnished, November 14, 1879, with a statement showing the direction and velocity of the wind at Cape May, N. J., at 9 p. m. and 11.08 p. m., March 3, 1878; 7 and 7.43 a. m. and 12.08 p. m., March 4, 1878, and the maximum velocities of the wind on the above dates and between the hours specified.

Maj. J. W. Barlow, Board of Engineers, Army Building, New York City, furnished, November 20, 1879, with a statement showing the dates, duration, direction, and maximum velocity of wind during the southwest and west gales which occurred at stations on Long Island Sound from October 1, 1878 to October 1, 1879, as recorded at the stations of observation at New York, N. Y., New London, and New Haven, Conn., and Wood's Holl, Mass.

Mr. James E. Miller, corner of Fourteenth and C streets, N. W., Washington, D. C., furnished, November 21, 1879, with a statement showing the times of commencement, ending and amount (in inches and hundredths) of all precipitation at Washington, D. C., between the hours of 7 a. m., and 5 p. m., from July 3, 1879, to November 20, 1879, inclusive.

Dr. J. Chandler, secretary board of health, Memphis, Tenn., furnished, November 22, 1879, with a statement showing the mean temperature, mean relative humidity, amount of precipitation, and total movement of the wind at Memphis, Tenn., during the months of June, July, August and September of each year from 1873 to 1879, inclusive.

Mr. H. W Graffen, Pottstown, Pa., furnished, November 25, 1879, with a statement showing the total rain-fall during the year 1878 at the following points: Toronto, Quebec, Halifax, Chatham, Kingston, and Montreal.

Mr. Morton P. Henry, No. 416 Walnut street, Philadelphia, Pa., furnished with a statement showing the direction and velocity of the wind and state of the weather at Cape May, N. J., at 4.43, 9 and 11.08 p. m. (local time), March 3, 1878, and 7 a. m., (local time), March 4, 1878; also, copy of anemometer record sheet of the station from 12 m., March 3, to 12 m., March 4, 1878.

Mr. G. A. Ogle, No. 3 South Charles street, Baltimore, Md., furnished, December 5, 1879, with a statement showing certain specified dates, during the months of June, July, August and September, upon which heavy rain-storms, of short duration, occurred at Baltimore, Md., from 1872 to 1879, inclusive, with the amount of rain-fall between the hours specified.

Mr. R. T. Loper, jr., Stonington, Conn., furnished, December 6, 1879, with a statement showing the direction and velocity of the wind at New London, Conn., at 9 p. m. and 11.19 p. m., of November 19, 1879.

Mr. J. P. Woolman, auditor Territory of Montana, Helena, Mont., furnished, December 8, 1879, with a statement showing the mean, maximum, and minimum temperatures for each month of the year, the prevailing direction of the wind, mean relative humidity, average amount of precipitation, and number of cloudy days in Winter, Spring, Summer and Autumn at Virginia City, Mont.

Director U. S. Geological Survey, Department of the Interior, Washington, D. C., furnished, December 15, 1879, with a statement of barometric readings taken at Salt Lake City, Utah, at the hours of 7 a. m., 2 and 9 p. m., each day from July 1 to November 30, 1870.

Admiral R. H. Wyman, Superintendent Hydrographic Office, Washington, D. C., furnished, December 17, 1879, with a statement showing the mean monthly barometer (corrected for temperature, elevation, and instrumental error), for each month in the years 1871 to 1878, inclusive, and for each month in the year 1879, excepting December, at Boston, Mass., New York, N. Y., Norfolk, Va., Philadelphia, Pa., and Washington, D. C.

Dr. F. P. Houskeeper, Coatesville, Pa., furnished, December 22, 1879, with a statement showing the temperature, amount of clouds, and the state of the weather at Philadelphia, Pittsburgh and Erie, Pa., on April 21, 1879.

Mrs. I. Armour, Arlington Hotel, Washington, D. C., furnished, December 23, 1879, with a statement showing the mean, maximum and minimum temperature for the months of December, January and February, 1876, 1877 and 1878, at Chicago, Ill., and Washington, D. C.

Secretary of the New Orleans Cotton Exchange, New Orleans, La., furnished, December 27, 1879, with a statement giving the rain-fall (in inches and hundredths), for each month in the year from September, 1876, to November, 1879, inclusive, at the following stations: Augusta, Ga., Baltimore, Md., Charleston S. C., Cincinnati, Ohio, Corsicana, Tex., Fort Gibson, Ind. T., Galveston and Indianola, Tex., Jacksonville and Saint Mark's, Fla., Knoxville, Memphis and Nashville, Tenn., Louisville, Ky., Lynchburgh, Va., Mobile and Montgomery, Ala., New Orleans and Shreveport, La., Norfolk, Va., Savanah, Ga., Vicksburgh, Miss., and Wilmington, N. C.

Mr. B. S. Fitch, general freight agent Chesapeake and Ohio Railroad, Richmond, Va., furnished, December 30, 1879, with a statement showing the state of the weather and amount of precipitation recorded at the stations of observation at Saint Louis, Mo., Little Rock, Ark., Shreveport, La., Cario, Ill., and Memphis, Tenn., on August 23, 24, 25 and 26, 1879.

Capt. W. A. Shaw, steamer Geo. M. Bird, Jacksonville, Fla., furnished, December 31, 1879, with a statement showing the direction and velocity of the wind at Jacksonville and Punta Rassa, Fla., at certain hours on December 27 and 28, 1878 and Februrary 5, 1879.

Mr. R. E. Craig, chairman meteorological committee, cotton exchange, New Orleans, La., furnished, January 3, 1880, with a statement showing the amount of rain-fall during the months of September, October and November, 1879, as compared with the same months of 1878, as recorded at the following-named stations of observation: Augusta, Cincinnati, Galveston, Knoxville, Memphis, Nashville, Savannah, Vicksburgh, Baltimore, Corsicana, Indianola, Louisville, Mobile, New Orleans, Shreveport, Wilmington, Charleston, Fort Gibson, Jacksonville, Lynchburgh, Montgomery, Norfolk and Saint Mark's.

Mr. Albert H. Campbell, Charleston, W. Va., furnished (through Col. John G. Parke, Corps of Engineers, U. S. A.), January 9, 1880, with a statement, showing the reduced barometer readings, the temperature and relative humidity, at the telegraphic observations taken tri-daily at Washington, D. C., Lynchburg, Va., Pittsburgh, Pa., and Cincinnati, Ohio, for each day from November 29 to December 31, 1879, inclusive.

Dr. C. C. Lathrop, secretary Colorado Medical Society, Denver, Colo., furnished, January 16, 1880, with a statement showing the maximum, minimum, and mean temperatures, mean relative humidity, prevailing direction of wind, total movement of the wind, and amount of precipitation, for each month of 1878 and 1879, at Cheyenne, Wyo., Denver, Colo., and Santa Fé, N. Mex.

Mr. Lawrence Moran, Aurora, Ind., furnished, January 16, 1880, with the total movement of wind, in miles, during the year 1879 at the following stations of the Signal Service, U. S. A., viz: Denver, Colo., Saint Paul, Minn., Sacramento, Cal., Dodge City, Kans., and Key West, Fla.

Mr. Treadwell Cleveland, New York City, furnished, January 16, 1880, with a statement showing the state of the weather, direction and velocity of the wind at each of the observations taken at Cape May, N. J., from October 1 to October 31, 1879, inclusive.

Messrs. Ropes, Gray & Loring, attorneys at law, Boston, Mass., furnished January 26, 1880, with copies of the record sheets from the self-registering attachment to the anemometer and anemograph at Boston, Mass., from 12 m., April 17 to 12 m., April 19, 1879.

Mr. George H. Boehmer, Smithsonian Institution, furnished, January 29, 1880, with a statement showing the amount of rain-fall at Fort Sully, Dak., for each month of the years 1874 and 1875.

Department of Agriculture, Washington, D. C., furnished, February 2, 1880, with a statement showing the monthly averages of rain-fall, temperature and relative humidity, and number of rainy days at Portland and Eastport, Me., Burlington, Vt., and Boston, Mass., for the year 1879.

John R. Fellows, attorney at law, New York City, furnished, February 9, 1880, with a statement showing the state of the weather at Sandy Hook and Barnegat, N. J., at 9 and 11.12 p. m., on July 30, 1879.

Mr. Woodbury Wheeler, attorney at law, Washington, D. C., furnished, February 10, 1880, with a statement showing the highest and lowest readings observed from a standard thermometer, read seven times daily, between 7 a. m. and 11 p. m., and the maximum and minimum temperatures from the self-registering maximum and minimum thermometers at 11 p. m., for each day from December 1, 1878, to January 15, 1879, inclusive, as recorded at the station of observation at Washington, D. C.

Mr. L. M. Zinicker, furnished (through General Stewart Van Vliet, Acting Quartermaster-General, U. S. A.), February 10, 1880, with a statement of the daily mean barometer and mean temperature for the year 1879, as deduced from observations taken at Washington, D. C.

Mr. Lawrence Moran, Aurora, Ind., furnished, February 12, 1880, with a statement showing the total movement of the wind, in miles, during the year 1879, at the following-named places: Leavenworth, Kans., Omaha, Nebr., Davenport, Keokuk and Des Moines, Iowa, Cairo and Springfield, Ill., Salt Lake City, Utah, Winnemucca, Nev., Indianola, Tex., and La Crosse, Wis.

Maj. W. J. Twining, Engineer Corps, U. S. A., Washington, D. C., furnished, February 17, 1880, with a statement showing the number of days on which rain fell, the amount of rain-fall, and the heaviest amount in any one day from April 26 to May 1, inclusive, and from May 16 to 21, inclusive, during the years from 1871 to 1879, inclusive, at Washington, D. C.

Mr. Clarence King, Director U. S. Geological Survey, Washington, D. C., furnished, February 19, 1880, with a statement showing the readings of the barometer, corrected for temperature and instrumental error, and the dry bulb thermometer and the relative humidity at Salt Lake City, Utah, at each observation from October 6, 1879, to January 25, 1880, inclusive.

Mr. Henry A. Hersey, Chicago, Ill., furnished, February 19, 1880, with a statement showing the mean relative humidity for each month of 1879 at Chicago, Saint Louis Cincinnati, New York and Louisville.

Mr. Thos. Jenkins, Commercial Publishing Company, Buffalo, N. Y., furnished, February 26, 1880, with a statement showing the mean temperature and mean range of temperature; the total amount of precipitation and total movement of the wind for each year from 1875 to 1879, inclusive, at Buffalo, Cleveland, Chicago, Rochester, Albany, Philadelphia, New York, Boston, Saint Louis, Saint Paul, San Francisco, New Orleans, Denver and Pittsburgh.

Mr. Clarence King, Director U. S. Geological Survey, furnished, February 28, 1880, with a statement showing the relative humidity at Salt Lake City, Utah, at the 7 a. m., 2 and 9 p. m., observations of each day from July 1 to November 3, 1879, inclusive.

Mr. Joseph Baker, Baker Wrecking Company, Norfolk, Va., furnished, March 1, 1880, with copies of the weather observations taken at Cape Henry, Va., on the 22d, 23d and 24th days of October, 1879.

Mr. W. H. Addrick, Philadelphia, Pa., furnished, March 5, 1880, with certain rain-fall data in connection with the storm at Nashville, Tenn., on February 12, 13 and 14, 1880.

General M. C. Meigs, Quartermaster-General, U. S. A., furnished, March 9, 1880, with a statement showing the amount of precipitation which fell at Fort Meade, Dak., from July 1, 1879, to January 31, 1880, inclusive; at Deadwood, Dak., from January 1, 1878, to January 31, 1880, inclusive, and at Lead City, Dak., from June 1 to October 31, 1878, inclusive.

General M. C. Meigs, Quartermaster-General, U. S. A., furnished, March 17, 1880, with a statement showing the amount of precipitation which fell at Washington, D. C., from May 1, 1879, to January 31, 1880.

Mr. W. H. Gardner, chairman meteorological committee, cotton exchange, Mobile, Ala., furnished, March 23, 1880, with a statement showing the monthly rain-fall at the following places, viz: Augusta, Ga., September, 1871, to March, 1880; Atlanta, Ga., October, 1878, to March, 1880; Charleston, S. C., September, 1871, to March, 1880; Corsicana, Tex., October, 1874, to March, 1880; Galveston, Tex., September, 1871, to March, 1880; Indianola, Tex., May, 1872, to March, 1880; Little Rock, Ark., July, 1879, to March, 1880; Memphis, Tenn., September, 1871, to March, 1880; Mobile, Ala., September, 1871, to March, 1880; Montgomery, Ala., October, 1872, to March, 1880; Nashville, Tenn., January, 1871, to March, 1880; New Orleans, La., September, 1871, to March, 1880; Savannah, Ga., September, 1871, to March, 1880; Shreveport, La., November, 1871, to March, 1880, Vicksburgh, Miss., September, 1871, to March, 1880.

Mr. E. W. Huntington, attorney at law, New Orleans, La., furnished, April 1, 1880, with a statement showing the direction and velocity of the wind and the state of the weather at Galveston and Indianola, Tex., at each observation from September 16, 1875, to November 13, 1875.

Mr. W. E. Smith, superintendent Memphis and Little Rock Railroad Company, Memphis, Tenn., furnished, April 2, 1880, with a statement showing the dates of highest and lowest water in the Mississippi River at Cairo, Ill., during the months of April, May and June, 1874, and in the Tennessee River at Chattanooga, Tenn., from September 19, 1875, to March 27, 1880.

Mr. H. S. Holden, Syracuse, N. Y., furnished, April 2, 1880, with a statement showing the total movement and maximum hourly velocity of the wind, in miles, at Buffalo, Rochester, Oswego, Albany and New York City, N. Y., for each month of the year 1879.

Mr. Maxwell Hall, meteorological observatory, Montego Bay, Jamaica, W. I., furnished, April 14, 1880, with a statement showing the annual mean barometer and thermometer, rain-fall, and prevailing wind from 1872 to 1879, inclusive; and the annual mean maximum and minimum temperatures, mean relative humidity, and maximum velocity of wind from 1874 to 1879, inclusive, at Punta Rassa and Key West, Fla.

Mr. H. C. Clagett, attorney at law, Washington, D. C., furnished, April 14, 1880, with a statement showing the kind and amount of clouds, the state of the weather, and the rain-fall at the several observations on February 27, 1880, at Washington, D. C.

Mr. Crosby Gray, health officer, Pittsburgh, Pa., furnished, April 20, 1880, with a statement showing the stage of the water in the Monongahela River at Brownsville, Pa., and Morgantown, W. Va., during the months of February and March, 1880; also the state of the weather at the latter place for the same period.

Mr. M. H. Clark, Clarksville, Tenn., furnished, April 21, 1880, with a statement showing the mean barometer, mean temperature, and total amount of rain-fall during the months of June to December, 1876, inclusive; January and February, 1877; October, 1878, and September and October, 1879, at Nashville, Tenn.

Dr. C. J. Kenworthy, Jacksonville, Fla., furnished, April 22, 1880, with a statement showing the mean relative humidity for November and December, 1875; November, December, January, February and March, 1876, '77, '78, '79, and January, February, and March, 1880; mean for the five months named, and the mean for calendar years ending December 31, 1875, '76, '77, '78 and '79, at Atlantic City, N. J.; Breckenridge, Duluth and Saint Paul, Minn.; Augusta, Ga.; Punta Rassa and Key West, Fla., and Denver, Colo.

George F. Gunther, tobacco broker, Louisville, Ky., furnished, May 4, 1880, with a statement showing maximum, minimum, and mean temperatures and total rain-fall for each month from January, 1873, to March, 1880, inclusive, at Cincinnati, Ohio and Nashville, Tenn.

Mr. L. Bell, city counselor, Saint Louis, Mo., furnished, May 15, 1880, with a statement showing the velocity of the wind at Saint Louis, Mo., at 9 and 10.42 p. m. (local time), on March 30, 1872.

Messrs. Mather, Foard & Co., ship and steamboat agents and brokers, 54 South Gay street, Baltimore, Md., furnished, May 31, 1880, with a statement showing the state of weather, direction and velocity of wind, and character and direction of ocean swell at Cape Henry, Va., at each observation from 7 a. m., May 9, to 11.04 a. m., May 11, 1880. Also, extract from Abstract of Journal for May 9, 10 and 11, 1880.

Mr. H. C. Warinner, attorney at law, 38 Madison street, Memphis, Tenn., furnished, June 12, 1880, with a statement showing the state of weather, the beginning, ending and amount of rain-fall at Memphis, Tenn., during the months of November and December, 1875.

Mr. S. C. Busey, 1525 I street, N. W., Washington, D. C., furnished, June 12, 1880, with a statement showing the periods in the months of June, July, August and September of the years 1876, 1877, 1878 and 1879, during which the temperature of the air rose 10° or more above the July normal at Baltimore, Md., Chicago, Ill., New York City, N. Y., and Washington, D. C. Also showing the mean temperature, mean relative humidity and total rain-fall for each day during the specified periods.

Mr. Robert A. Caskie, Rocheport, Boone County, Mo., furnished, June 15, 1880, with a statement showing the amount of snow-fall at Boise City, Idaho; Denver, Colo.; Salt Lake City, Utah and Santa Fé, N. Mex., during December, 1879, and January, February, March and April, 1880.

General M. C. Meigs, Quartermaster-General, U. S. A., furnished, June 21, 1880, with a statement showing the mean daily barometer and thermometer at Washington, D. C., from January 1 to June 1, 1880.

Hon. Commissioner of Agriculture, furnished, June 25, 1880, with a statement showing the average preciptiation for the months of March, April and May, and the actual amount for the same months of 1879 and 1880; the average precipitation for the months of July, August, September and November, with the actual amount for same months of 1878 and 1879; also the average mean temperature of December, January and February, with the mean for the same months during the winters of 1878–'79 and 1879–'80 at Baltimore, Md., Chattanooga, Tenn., Charlotte, N. C., Cairo, Ill., New London, Conn., New York, N. Y., Norfolk, Va., Philadelphia, Pa., Saint Louis, Mo., and Washington, D. C.

Maj. C. B. Comstock, Corps of Engineers, U. S. A., Detroit, Mich., furnished weekly during the year with a report of the stage of water in rivers at following stations:

REGULAR STATIONS.

Cairo, Ill.,
Cincinnati, Ohio.
Davenport, Iowa.
Dubuque, Iowa.
Keokuk, Iowa.
La Crosse, Wis.
Leavenworth, Kans.
Louisville, Ky.
Memphis, Tenn.
New Orleans, La.
Omaha, Nebr.
Pittsburgh, Pa.
Shreveport, La.
Saint Louis, Mo.
Saint Paul, Minn.
Vicksburg, Miss.
Yankton, Dak.

SPECIAL STATIONS.

Booneville, Mo.
Brunswick, Mo.
Evansville, Ind.
Helena, Ark.
Hermann, Mo.
Jefferson City, Mo.
Kansas City, Mo.
Le Claire, Iowa.
Lexington, Mo.
Little Rock, Ark.
Marietta, Ohio.
Paducah, Ky.
Plattsmouth, Mo.
Saint Joseph, Mo.
Warsaw, Ill.

Capt. M. R. Brown, Corps of Engineers, U. S. A., Port Eads, South Pass, La., furnished weekly during the year with a report of the stage of water in river at the following stations: Cairo, Ill., Cincinnati, Ohio, Keokuk, Iowa, Leavenworth, Kans., Little Rock, Ark., Louisville, Ky., Nashville, Tenn., New Orleans, La., Pittsburgh, Pa., Shreveport, La., Saint Louis, Mo., Vicksburg, Miss., and Yankton, Dak.

Health officer, Washington, D. C., furnished monthly during the year with an abstract of the meteorological observations made at the office of the Chief Signal Officer, Washington, D. C.

New Jersey State board of health, Metuchen, N. J., furnished monthly during the year with an extract of the meteorological observations made at Cape May, N. J.

Michigan State board of health, Lansing, Mich., furnished monthly during the year with an abstract of the meteorological observations made at Grand Haven, Marquette, Alpena, Detroit, Escanaba and Port Huron, Mich.

Cotton exchanges at Memphis and Nashville, Tenn., Saint Louis, Mo., and Boston, Mass., furnished weekly during the year with the daily and total rain-fall of the week at Augusta, Ga.; Baltimore, Md.; Cedar Keys, Fla.; Charleston, S. C.; Cincinnati, Ohio; Corsicana, Denison, Galveston, Indianola and San Antonio, Tex.; Fort Gibson, Ind. T.; Jacksonville, Fla.; Knoxville, Memphis and Nashville, Tenn.; Little Rock, Ark.; Louisville, Ky.; Lynchburgh and Norfolk, Va.; Mobile and Montgomery, Ala.; New Orleans and Shreveport, La.; Savannah, Ga.; Vicksburg, Miss.; and Wilmington, N. C.

Messrs. W. B. Dana & Co., New York City, furnished monthly during the year with a report of the rain-fall, number of days on which rain fell, and highest and lowest and average temperature at Augusta and Savannah, Ga.; Cedar Keys and Jacksonville, Fla.; Charleston, S. C.; Corsicana, Galveston and Indianola, Tex.; Memphis and Nashville, Tenn.; Mobile and Montgomery, Ala.; New Orleans and Shreveport, La.; Norfolk, Va.; Vicksburg, Miss.; and Wilmington, N. C.

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List of publications received during the fiscal year ending June 30, 1880.

Eighth, ninth and tenth annual reports of the Geological Survey of Indiana, made during the years 1876-'77-'78. By E. T. Cox, State geologist. Indianapolis, 1879.

Port charges and requirements on vessels in the various ports of the world, with tables of moneys, weights and measures of all nations. By Theodore Hunter and Jarvis Patten. Parts 1 and 2. New York, 1879-'80.

Meteorological observations made at the U. S. Naval Observatory during the year 1876. Washington, 1879.

Ordnance Notes (Nos. 102, 105 to 108 and 110 to 125 inclusive), Ordnance Office, War Department, Washington, 1879-'80.

Proceedings of the Louisiana State Medical Association, held in the city of New Orleans, April, 1879.

A general index of the Agricultural Reports of the Patent Office, for twenty-five years, from 1837 to 1861, and the Department of Agriculture for fifteen years, from 1862 to 1876. By the Commissioner of Agriculture. Washington, 1879.

Bulletin of the United States National Museum, Contributions to the Natural History of Arctic America, made in connection with the Howgate Polar Expedition, 1877-'78. By Ludwig Kumlieu.

International Monetary Conference held in compliance with the invitation extended to certain governments of Europe by the Government of the United States in Paris in August, 1878.

Catalogue of Scientific Serials of all countries, including the transactions of learned societies in the natural, physical and mathematical sciences, 1633-1876. By S. H. Scudder. Cambridge, 1879.

(Department of Agriculture—Special Report No. 12.) Investigation of diseases of swine and infectious and contagious diseases incident to other domesticated animals. Washington, 1879.

Reports to the Saint Louis Medical Society on Yellow Fever. By W. Huston Ford, M. D.

Report on the Russian Army and its Campaigns in Turkey in 1877-'78. By Lieut. F. V. Greene, U. S. Army.

Annals of the Astronomical Observatory of Harvard College. Vol. XI.—Part I. Photometric observations during the years 1877-'79. By Edward C. Pickering. Harvard, 1879.

Report of the Commissioner of Education for the year 1877. Washington, 1879.

The Statutes at Large of the United States of America from October, 1877, to March, 1879, Vol. XX. Washington, 1879.

"Mathematics in a Dilemma." New York, 1879.

Protection to Forests a Necessity. By S. V. Dorrien. New York, 1879.
Annual report of the Operations of the United States Life-Saving Service for the fiscal year ending June 30, 1878.
Abridgment of the Nautical Almanac and Tide Tables 1880, published by John Bliss & Co.
Annual report of the Secretary of War for the year 1879.
Annual report of the General of the Army to the Secretary of War for the year 1879.
Tea culture as a probable American industry. By William Saunders. Washington, 1879.
Annual report of the Inspector-General of the Army to the Secretary of War for the year 1879.
Annual report of the Commissioner of Agriculture for the year 1878. Washington, 1879.
Annual report of the Surgeon-General, U. S. Army, for the year 1879.
Annual report of the Third Auditor of the Treasury for the year 1879.
Annual report of the Secretary of the Navy for the year 1879.
Annual report of the Secretary of the Interior for the year 1879.
Annual report of the Postmaster-General of the United States for the year 1879.
Annual report of the Director of the Mint for the year 1879.
Annual report of the Commissioner of Internal Revenue for the year 1879.
Report of the director of the New York, Meteorological Observatory, Department of Public Parks, city of New York for the years 1876 and 1878.
Annual report of the Treasurer of the United States for the year 1879.
Annual report of the Auditor of Railroad Accounts made to the Secretary of the Interior for the year ending June 30, 1879.
On the Coincidence of the Bright Lines of the Oxygen Spectrum with Bright Lines in the Solar Spectrum. By Henry Draper, M. D.
A unit of eight grammes, proposed by Robert Noxon Tappan. (International Coinage.)
Report of the Observations of the total Solar eclipse July 29, 1878, made at Fort Worth, Texas. Edited by Leonard Waldo, Cambridge, 1879.
United States Northern Boundary Commission: Declination of Fixed Stars. By Assistant Lewis Boss.
Annual report of the Quartermaster-General to the Secretary of War for the year 1879.
Annual report of the Director of the Astronomical Observatory of Harvard College for 1879 Cambridge, 1880.
Annual report of the Chief of Ordnance to the Secretary of War for the fiscal year ending June 30, 1879.
Thirty-first annual report of the Cincinnati Chamber of Commerce and Merchants' Exchange for the year ending August 31, 1879.
Catalogue of the Library of the United States Naval Observatory, Washington. Part I: Astronomical Bibliography. By Prof. E. S. Holden, U. S. N. Washington, 1879.
Contributions to Meteorology. By Prof. E. Loomis. (Twelfth paper.)
Bulletin of the United States Geological and Geographical Survey of the Territories, Vol. V, No. 3. Washington, 1879.
The tornado of April 14, 1879. By J. L. R. Wadsworth, M. D. and Francis E. Nipher.
Annals of the Astronomical Observatory of Harvard College, Vol. XI, Part II. Cambridge, 1879.
Proceedings and report of the Board of Army Officers, convened by Special Orders No. 78, Headquarters of the Army, Adjutant-General's Office, Washington, April 12, 1878, in the case of Fitz-John Porter. 3 vols. Washington, 1879.
Annual report of the Light-House Board to the Secretary of the Treasury for the year ending June 30, 1879.
Annual statement of the trade and commerce of Saint Louis for the year 1879, reported to the Merchants' Exchange of Saint Louis. By George H. Morgan, secretary. Saint Louis, 1880.
Report on Magnetic Determinations in Missouri, summer of 1879. By Prof. Francis E. Nipher.
Studies in relation to the production of pain by weather. By J. T. Everett, M. D. Chicago, 1879.
(Bulletin No. 3.) The Cotton Worm—Summary of its natural history, with an account of its enemies, and the best means of controlling it; being a report of progress of the work of the commission. By Chas. V. Riley, M. A.
Official Army Register, January, 1880.
A historical sketch of Henry's contribution to the electro-magnetic telegraph, with an account of the origin and development of Professor Morse's invention. By William B. Taylor. Washington, 1879.
Annual report of the Comptroller of the Currency to the second session of the Forty-sixth Congress of the United States, December 1, 1879.

Memorials, reports and statistics concerning improvements of New Haven Harbor. New Haven, 1879.

List of light-houses, lighted beacons and floating lights on the Atlantic, Gulf and Pacific coasts of the United States, corrected to January 1, 1880. Washington, 1880.

Report on the methods of surveying the public domain to the Secretary of the Interior, at the request of the National Academy of Sciences. By J. W. Powell, 1878.

Annual report of the Commissary-General of Subsistence to the Secretary of War for the year 1879.

Annual report of the Judge-Advocate-General of the Army to the Secretary of War for the year 1879.

Fourth annual report of the Johns Hopkins University. Baltimore, 1879.

Geological survey of the State of New Jersey. Annual report of the State geologist for the year 1878.

United States Coast and Geodetic Survey. Methods and results, secular change of magnetic declination in the United States and at some foreign stations. Washington, 1879.

Methods and results on a chart of the magnetic declination in the United States. Appendix No. 21, report of 1876. Washington, 1879.

Seventeenth annual report of the Secretary of the State Board of Agriculture of the State of Michigan for 1878. Lansing, 1878.

Transactions of the Connecticut Academy of Arts and Sciences, Vol. V, Part I. New Haven, 1880.

Rules for conducting business in the House of Representatives of the United States. Washington, 1880.

Circulars of Information of the Bureau of Education No. 5, 1879. American Education as described by the French Commission to the International Exhibition of 1876. Washington, 1879.

Subject index to the publications of the United States Naval Observatory, 1843–1875. By Edward S. Holden. Washington, 1879.

Annual report of the Board of Health of the State of Louisiana for the year 1879. New Orleans, 1880.

Thirteenth annual report of the Health Department of the Common Council of the City of Cincinnati for the year 1879. Cincinnati, 1880.

The Ordnance Department as a portion of the United States Military Establishment, being a historical statement of the rise and progress of the Ordnance Department, and a consideration of the legal relations of the Department to the Secretary of War and Army proper. Washington, 1876.

Official Gazette of the United States Patent Office, Vol. XVI, July 1 to December 30, inclusive, 1879. Washington, 1880.

Annual report of the Corporation of the Chamber of Commerce of the State of New York for the year 1879–'80. New York, 1880.

Papers relating to the Foreign Relations of the United States, transmitted to Congress, with the Annual Message of the President, December 1, 1879. Washington, 1879.

Transactions of the Academy of Science of Saint Louis, Vol. IV, No. I. Saint Louis, 1880.

Circular of information of the Bureau of Education, No. 1, 1880. College libraries as aids to instruction. Washington, 1880.

Address of Prof. Samuel P. Langley, vice-president, Section A, before the American Association for the Advancement of Science, at the Saratoga meeting, August, 1879. Salem, 1879.

Short memoirs on Meteorological Subjects, translated by Cleveland Abbe, reprinted from the Smithsonian Report for 1877. Washington, 1878.

Annual Report and Statistics of the Meteorology and Mortality of the city of Oakland, Cal., for the year 1879. By J. B. Trembley, M. D. San Francisco, 1880.

American inventions and improvements in breech-loading small-arms, heavy ordnance, &c. Compiled by Charles B. Norton, Brevet Brig. Gen., U. S. V.

Methods, discussions and results. Notes on measurements of terrestrial magnetism. Second edition. United States Coast Survey. Washington, 1877.

Results of Rain Observations made in New South Wales during 1878. By H. C. Russell. Sydney, 1879.

Description of Pattern C Heliostat. By Elphinstone Begbie.

Journal of the Scottish Meteorological Society, Nos. LVII, LVIII, LIX.

Daily Weather Reports, Meteorological Office, London, 1st July to 31st December, 1878, and 1st January to 30th June, 1879.

Symons's Monthly Meteorological Magazine. June, 1879, to May, 1880.

Natural History Journal, conducted by the Societies in Friends Schools. May 15, 1879, to May 15, 1880.

Quarterly Journal of the Meteorological Society. London, April, July and October, 1879, and January, 1880.

Forty-sixth Annual Report of the Royal Cornwall Polytechnic Society, 1878.

Papers and proceedings and report of the Royal Society of Tasmania, for 1877. Tasmania, 1878.

Report on the Rainfall of the N. W. Provinces and Oudh. By S. A. Hill. Allahabad, 1879.

Report of the proceedings of the Second International Meteorological Congress at Rome, 1879. Published by autority of the Meteorological Council. London, 1879.

Contributions to the Meteorology of the Pacific, No. 3. Samoan or Navigators Islands. By Robert H. Scott, M. A.

Contributions to our knowledge of the Meteorology of the Arctic Regions. Published by authority of the Meteorological Council. Part 1. London, 1879.

Report on the Madras Cyclone of May, 1877. By John Eliot, M. A. Calcutta, 1879.

Report on the Meteorology of India in 1877. By John Eliot, M. A. Calcutta, 1879.

Report on the Administration of the Meteorological Department of the Government of India in 1877–'78, and 1878–'79.

Report on the Meteorology of the Kerguelen Island. By Rev. S. J. Perry, S. J. Published by the authority of the Meteorological Council (Official No. 37).

The Solar Spectrum in 1877 and 1878, with some practical idea of its probable temperature of origination. By Piazza Smyth, F. R. S. E. Edinburgh, 1879.

Annual Report of the Kew Committee, for the year ending October 31, 1879.

Report of the Meteorological Council to the Royal Society, for the year ending 31st March, 1879. London, 1880.

Results of Observations in Meteorology, Terrestrial Magnetism, &c., &c., taken at the Melbourne Observatory during the year 1876, under the superintendence of Robt. L. J. Ellery, F. R. S. Vol. V.

Astronomical and Magnetical and Meteorological Observations made at the Royal Observatory, Greenwich, in the year 1877. London, 1879.

Results of Astronomical Observations made at the Royal Observatory, Greenwich, 1877.

Results of the Magnetical and Meteorological Observations made at the Royal Observatory, Greenwich, in the year 1877. London, 1879.

Results of Astronomical Observations made at the Royal Observatory, Cape of Good Hope, during the year 1876. Cape Town, 1879.

Cape of Good Hope.—Report of the Meteorological Commission for the year 1878. Cape Town, 1879.

Weekly results of Meteorological Observations taken at Silloth Rectory, Cumberland, in the year 1879. By the Rev. Francis Redford, M. A.

On the comparison of the standard barometers of the Royal Observatory, Greenwich, and the Kew Observatory. By G. M. Whipple.

Account of the Operations of the Great Trigonometrical Survey of India. Vols. II to V. By Col. J. T. Walker. Calcutta, 1879.

Indian Meteorological Memoirs; being occasional discussions and compilations of meteorological data relating to India and neighbouring countries, under the direction of Henry F. Blanford. Vol. I, Part III.

Journal and Proceedings of the Royal Society of New South Wales, 1878. Vol. XII. Sydney, 1879.

Thermometer exposure, Wall *versus* Stevenson Screens. By William Marriott.

Reduction of Meteorological Observations. By William Marriott.

Twelfth annual report of the Department of Marine and Fisheries, being for the fiscal year ended June 30, 1879. Ottawa, 1880.

Report on the Meteorological Service of the Dominion of Canada. By G. T. Kingston, M. A., for the year ending December 31, 1878.

Sur les dernières crues de la Seine. Par MM. L. Lalanne et G. Lemoine.

Ponts et Chaussées, Service Hydrométrique du Bassin de la Seine.

Résumé des Observations Centralisées pendant l'année 1877 et 1878. Par MM. L. Lalanne et G. Lemoine. Versailles 1879–'80.

Observations sur les cours d'eau et la pluie centralisées pendant l'année 1877 et 1878. Par MM. Belgrand et G. Lemoine.

Annales du Bureau Central Météorologique de France. Année 1878. Paris, 1879.

Annuaire de l'Observatoire de Montsouris pour l'an 1880.

Algérie. Météorologie. (Extrait de la Statistique générale de l'Algérie pour les années 1876 à 1878.) Paris, 1879.,

Rapport lu le 4 novembre 1879, à la première séance générale du conseil du Bureau Central, par le Président, conformément à l'Article 13 du décret du 14 mai 1878.

Des conditions climatologiques des années 1869 à 1879 en Normandie, et de leur influence sur la maturation des récoltes. Par M. Hervé Mangon.

Commission météorologique du département de Vaucluse, Compte-Rendu pour l'année 1878.

Résumé des Observations météorologiques faites á l'École normale d'Avignon pendant l'année agricole 1878–'79. Par M. Giraud. Avignon, 1879.

Système des quatre vents simultanés (Polaires et Équatoriaux derivé d'un principe de l'Orore physique de la nature, découvert par L. Purper.

Zeitschrift der österreichischen Gesellschaft für Meteorologie. Von Dr. J. Hann. XIII. und XIV. Band. Wien, 1878–79.

Jahrbücher der k. k. Central-Anstalt für Meteorologie und Erdmagnetismus. Jahrgang 1876 und 1877, XIII. und XIV. Band. Wien, 1877 und 1880.

Mittheilungen aus dem Gebiete des Seewesens. Herausgegeben vom k. k. Hydrographischen Amte, Marine-Bibliothek. Vol. VI. Pola, 1878.

Sull Origine delle Tempeste giusta le recenti investigazioni del Prof. Zenger. Vpraze, 1879.

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PAPER 9.

Monthly and annual mean barometer, corrected for temperature and instrumental error only (deduced from the three telegraphic observations), from July, 1879, to June, 1880, inclusive.

[The daily means are obtained by dividing the sum of the three telegraphic observations by three; the monthly means by dividing the sum of the daily means by the number of days in the month.]

Station.	Elevation of cistern of barometer above mean sea-level.	1879.						1880.						Annual mean.
		July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	
	Feet.													
Albany, N. Y	75.3	29.729	29.724	29.887	29.893	29.873	29.942	29.947	29.834	29.897	29.885	29.943	29.894	29.871
Alpena, Mich	608.2	29.283	29.303	29.380	29.405	29.334	29.381	29.329	29.287	29.399	29.262	29.305	29.282	29.329
Atlanta, Ga	1,131.3	28.883	28.853	28.953	28.979	29.031	28.990	28.972	28.977	28.898	28.919	28.929	28.920	28.942
Atlantic City, N. J	12.9	29.984	29.965	30.131	30.157	30.158	30.172	30.175	30.112	30.029	30.029	30.073	29.999	30.082
Augusta, Ga	185.3	29.842	29.833	29.945	30.017	30.049	30.025	30.000	30.002	29.916	29.935	29.936	29.896	29.950
Baltimore, Md	45.2	29.953	29.935	30.106	30.145	30.140	30.150	30.159	30.093	30.044	29.994	30.034	29.972	30.060
Barnegat, N. J	20.0	29.966	29.931	30.113	30.138	30.134	30.156	30.156	30.093	30.023	29.999	30.031	29.971	30.059
Bismarck, D. T	1,704.3	28.104	28.117	28.209	28.121	28.160	28.224	28.040	28.086	28.155	28.116	27.988	28.071	28.116
Boerne, Tex	1,507.6	a28.515	b28.490	c28.590	d28.621	e28.629	a28.589	f28.583	28.633	d28.536	28.528	g28.477	28.508	28.558
Boise City, Idaho	2,768.0	27.042	27.056	27.154	27.230	27.271	27.174	27.163	27.252	27.184	27.100	27.150	27.118	27.158
Boston, Mass	142.2	29.806	29.782	29.969	29.944	29.934	30.016	30.012	29.896	29.856	29.812	29.871	29.815	29.893
Brackettville, Tex	1,136.7	28.772	28.774	28.879	28.902	28.920	28.872	28.861	28.922	28.815	28.800	28.726	28.756	28.833
Breckinridge, Minn	966.5	28.876	28.888	28.991	28.902	28.981	29.063	28.884	28.915	29.001	28.860	28.797	28.855	28.918
Brownsville, Tex	43.4	29.870	29.817	29.911	29.935	30.028	29.999	29.982	30.040	29.918	29.902	29.831	29.873	29.925
Buffalo, N. Y	664.5	29.248	29.250	29.362	29.384	29.322	29.353	29.344	29.278	29.322	29.208	29.296	29.259	29.302
Burlington, Vt	268.0	29.631	29.631	29.784	29.784	29.756	29.848	29.832	29.717	29.739	29.611	29.685	29.652	29.722
Chincoteague, Va	18.5	....	....	....	....	....	....	....	....	....	h30.042	30.083	30.005	....
Cairo, Ill	377.3	29.619	29.621	29.755	29.785	29.782	29.754	29.721	29.747	29.716	29.648	29.657	29.661	29.705
Campo, Cal	2,527.1	27.349	i27.306	j27.363	k27.387	l27.456	m27.427	n27.424	o27.408	a27.412	27.444	o27.345	27.303	27.385
Cape Hatteras, N. C	8.4	30.039	30.002	30.116	30.165	30.202	30.181	30.157	30.163	30.055	30.095	30.131	30.042	30.112
Cape Henry, Va	16.0	29.994	29.970	30.115	30.161	30.183	30.173	30.161	30.131	30.042	30.042	30.081	30.004	30.088
Cape Lookout, N. C	15.0	30.024	29.986	30.098	30.151	30.197	30.171	30.151	30.167	30.058	30.113	30.129	30.043	30.107
Cape May, N. J	27.0	29.967	29.936	30.103	30.139	30.140	30.153	30.156	30.094	30.022	29.997	30.042	29.961	30.059
Castroville, Tex	777.8	29.150	29.130	29.237	29.275	p29.294	29.264	29.248	29.308	29.215	29.181	29.120	o29.157	29.215
Cedar Keys, Fla	22.5	....	....	....	....	....	q30.156	30.106	30.151	30.092	30.120	30.032	30.058	....
Charleston, S. C	52.5	29.969	29.939	30.028	30.079	30.165	30.131	30.098	30.116	30.020	30.039	30.060	30.001	30.054
Charlotte, N. C	837.8	29.191	29.170	29.286	29.329	29.345	29.309	29.311	29.287	29.212	29.220	29.263	29.215	29.261
Chattanooga, Tenn	783.2	29.227	29.211	29.318	29.355	29.386	29.344	29.334	29.333	29.259	29.265	29.277	29.269	29.298
Cheyenne, Wyo	6,089.4	24.108	24.119	24.154	24.091	24.003	23.839	23.890	23.889	23.908	23.953	23.966	24.038	23.995
Chicago, Ill	660.9	29.262	29.273	29.372	29.407	29.341	29.346	29.292	29.314	29.349	29.217	29.275	29.256	29.309
Cincinnati, Ohio	620.4	29.350	29.359	29.473	29.516	29.490	29.466	29.449	29.444	29.437	29.369	29.320	29.393	29.422
Cleveland, Ohio	689.7	29.255	29.261	29.366	29.408	29.347	29.352	29.329	29.297	29.331	29.224	29.305	29.280	29.313

Columbus, Ohio	804.6	29.143	29.148	29.257	29.303	29.261	29.241	29.230	29.213	29.212	29.112	29.207	29.176	29.209
Coleman City, Tex	1,735.0	28.127	*l*28.131	28.238	28.269	28.267	*r*28.232	28.236	*s*28.262	*j*28.231	28.218	*g*28.122	28.157	28.207
Concho, Tex	1,888.5	28.026	28.045	28.153	28.200	28.153	28.142	28.122	28.176	28.086	*j*28.053	27.989	28.032	28.096
Corsicana, Tex	445.0	29.490	29.465	29.576	29.612	29.633	29.558	29.580	29.637	29.560	29.531	29.491	29.526	29.555
Delaware Breakwater, Del	20.0								*t*30.113	30.038	30.019	30.063	29.989	
Davenport, Iowa	603.8	29.313	29.326	29.442	29.460	29.404	29.421	29.338	29.358	29.401	29.269	29.307	29.294	29.361
Deadwood, Dak	4,630.0	25.402	25.405	25.473	25.382	25.315	*g*25.188	25.165	25.204	25.247	25.276	25.271	25.352	25.307
Decatur, Tex	1,160.0	*r*28.784	*j*28.809	*l*29.003	*l*28.939	28.915	*g*28.895	*n*28.833	*p*28.931	*r*28.850	*u*28.967	*o*28.768	*r*28.796	28.874
Denison, Tex	767.4	29.146	29.155	29.251	29.293	29.287	29.261	29.232	29.316	29.226	29.167	29.145	29.181	29.222
Denver, Colo	5,271.1	24.811	24.832	24.883	24.833	24.767	24.626	24.671	24.680	24.676	24.702	24.693	24.753	24.744
Des Moines, Iowa	849.0	29.063	29.068	29.189	29.201	29.159	29.183	29.088	29.110	29.152	29.034	29.047	29.043	29.111
Detroit, Mich	645.3	29.279	29.290	29.390	29.432	29.365	29.376	29.344	29.312	29.371	29.244	29.320	29.298	29.335
Dodge City, Kans	2,512.5	27.357	27.384	27.473	27.488	27.445	27.389	27.374	27.395	27.365	27.310	27.287	27.306	27.381
Dubuque, Iowa	665.1	29.244	29.256	29.358	29.379	29.328	29.351	29.259	29.278	29.332	29.197	29.237	29.227	29.287
Duluth, Minn	644.1	29.204	29.228	29.311	29.288	29.309	29.380	29.238	29.244	29.352	29.206	29.196	29.214	29.264
Eagle Pass, Tex	800.0	29.118	29.127	29.241	29.278	29.315	29.280	29.269	29.393	29.231	29.197	29.115	29.109	29.223
Eastport, Me	61.2	29.840	29.812	30.022	29.932	29.950	30.074	30.042	29.905	29.885	29.829	29.909	29.850	29.921
El Paso, Tex	3,956.0	26.189	26.204	26.268	26.296	26.301	26.235	26.255	*k*26.252	26.183	(*v*)	*f*26.145	*j*26.148	
Erie, Pa	681.1	29.248	29.251	29.371	29.411	29.330	29.358	29.349	29.296	29.308	29.216	29.309	29.274	29.310
Escanaba, Mich	611.6	29.263	29.287	29.364	29.380	29.328	29.372	29.296	29.271	29.393	29.237	29.271	29.271	29.311
Florence, Ariz	1,552.8	28.343	28.299	28.333	28.442	28.500	28.505	28.497	28.556	28.444	28.452	28.331	*n*28.303	28.417
Fort Apache, Ariz	5,004.5								(*w*)	25.022	25.058	24.966	25.005	
Fort Buford, Dak	1,876.0	27.872	27.882	27.986	27.916	27.919	27.990	27.778	27.861	27.916	27.907	27.772	*a*27.831	27.886
Fort Custer, Mont	3,086.0		(*x*)	26.883	26.847	26.804	26.770	26.645	26.736	26.766	26.766	26.718	26.752	
Fort Davis, Tex	4,918.0	25.215	25.222	25.286	25.292	25.248	25.172	25.183	25.204	25.133	25.199	25.148	25.201	25.209
Fort Elliott, Tex	3,025.0					(*y*)	26.949	26.951	26.968	26.948	26.902	26.860	26.880	
Fort Gibson, Ind. T	510.0	29.391	29.407	29.505	29.556	29.533	29.524	29.482	29.523	29.485	29.411	29.389	29.420	29.469
Fort Grant, Ariz	4,737.0	25.233	25.207	25.272	25.284	25.253	25.205	25.208	25.252	25.139	25.202	25.148	25.183	25.215
Fort Griffin, Tex	1,243.0	28.659	28.677	*r*28.771	28.698	28.802	28.768	28.759	28.796	28.724	28.698	28.629	28.666	28.721
Fort Keogh, Mont	2,413.0	27.346	27.354	27.458	27.408	27.392	27.322	27.104	27.208	27.219	27.215	27.126	27.158	27.276
Fort McKavett, Tex	1,217.0	*g*27.710	27.712	27.799	27.812	27.832	27.746	27.743	27.777	27.711	27.720	27.659	27.704	27.745
Fort Sill, Ind. T	1,190.0	28.709	28.732	28.823	28.864	28.832	28.818	28.792	28.833	28.791	28.723	28.688	28.723	28.777
Fort Stevenson, Dak	1,734.0	28.068	28.085	28.185	28.092	*o*28.113	*u*28.231	*z*28.012	*z*28.026	28.129	28.101	*r*27.944	28.039	28.085
Fredericksburg, Tex	1,742.0	28.211	28.123	28.168	*i*28.213	28.217	28.194	28.169	28.228	28.159	28.148	28.084	(*aa*)	
Galveston, Tex	39.6	29.959	29.887	29.985	30.019	30.095	30.064	30.039	30.088	29.993	29.979	29.902	29.941	29.996
Graham, Tex	1,012.0	28.853	28.852	28.960	28.978	28.962	28.950	(*bb*)	(*cc*)					
Grand Haven, Mich	620.2	29.300	29.314	29.399	29.435	29.377	29.376	29.330	29.311	29.386	29.252	29.321	29.297	29.341
Henrietta, Tex	915.0	28.955	28.973	29.070	*l*29.115	*j*29.114	*p*29.060	*l*29.051	*j*29.121	*dd*2.037	*c*28.951	*ee*28.950	28.980	29.032
Indianapolis, Ind	746.6	29.199	29.235	29.313	29.342	29.290	29,270	29.239	29.249	29.262	29.173	29.230	29.209	29.251
Indianola, Tex	25.9	29.970	29.908	30.001	30.037	30.107	30.075	30.047	30.110	30.003	29.984	29.913	29.948	30.009

a One observation missed.
b Two observations missed.
c Seven observations missed.
d Four observations missed.
e Eleven observations missed.
f Six observations missed.
g Thirty days only.
h Station opened March **16**, 1880.
i Twenty-three days only.
j Twenty-seven days only.
k Eighteen days only.

l Twenty-eight days only.
m Nineteen days only.
n Seventeen days only.
o Twenty-five days only.
p Twenty-two days only.
q Station opened November 7, 1879.
r Twenty-nine days only.
s Twenty-one days only.
t Observations commenced January 28, 1880.
u Twenty-four days only.

v Observer sick with small-pox.
w Barometer readings commenced February 21, 1880.
x Observations commenced August 12, 1879.
y Observations commenced November 8, 1879.
z Twenty-six days only.
aa Barometer unserviceable.
bb Data incomplete.
cc Station closed February 18, 1880.
dd Fifteen days only.
ee Eight observations missed.

Monthly and annual mean barometer, July, 1879, *to June,* 1880, *inclusive*—Continued.

Station.	Elevation of cistern of barometer above mean sea-level.	1879.						1880.						Annual mean.
	Feet.	July.	August.	September.	October.	November.	December,	January.	February.	March.	April.	May.	June.	
Jacksboro', Tex	1,132.8	28.864	28.812	28.906	28.946	28.942	28.911	28.869	28.876	28.854	28.809	28.788	*a*28.829	28.867
Jacksonville, Fla	22.9	30.023	29.958	30.039	30.064	30.176	30.171	30.122	30.161	30.080	30.106	30.061	30.056	30.085
Keokuk, Iowa	616.7	29.295	29.307	29.423	29.451	29.406	29.404	29.327	29.353	29.391	29.283	29.288	29.290	29.351
Key West, Fla	31.7	30.022	29.928	29.957	29.914	30.071	30.099	30.040	30.103	30.071	30.102	29.977	30.048	30.028
Kittyhawk, N. C	22.0	29.976	29.922	30.113	30.178	30.206	30.180	30.172	30.150	30.060	30.086	30.121	30.034	30.099
Knoxville, Tenn	980.0	29.043	29.028	29.133	29.174	29.188	29.141	29.128	29.128	29.070	29.062	29.090	29.075	29.105
La Crosse, Wis	701.9	29.177	29.194	29.290	29.298	29.263	29.297	29.193	29.211	29.286	29.136	29.164	29.159	29.222
La Mesilla, N. Mex	4,124.0	26.032	26.003	26.139	26.139	26.143	26.077	26.085	26.114	26.025	26.067	25.992	26.026	26.070
Laredo, Tex	401.0	29.477	29.494	29.559	29.629	29.660	29.617	29.634	29.676	29.550	29.498	*b*29.422	29.449	29.555
Leavenworth, Kans	841.9	29.080	29.085	29.201	29.230	29.182	29.202	29.122	29.156	29.166	29.062	29.058	29.071	29.135
Little Rock, Ark	298.1	29.648	29.647	29.765	29.791	29.806	29.760	29.742	29.783	29.735	29.680	29.657	29.688	29.725
Los Angeles, Cal	350.1	29.569	29.501	29.577	29.643	29.716	29.728	29.721	29.802	29.724	29.733	29.615	29.581	29.659
Louisville, Ky	530.0	29.425	29.428	29.549	29.590	29.579	29.544	29.507	29.514	29.475	29.433	29.468	29.449	29.497
Lynchburg, Va	646.0	29.341	29.326	29.473	29.515	29.507	29.480	29.497	29.443	29.386	29.368	29.417	29.361	29.426
Marquette, Mich	673.0	29.187	29.211	29.274	29.272	29.263	29.300	29.213	29.332	29.335	29.188	29.202	29.196	29.248
Madison, Wis	949.2	28.948	28.953	29.046	29.069	28.994	29.005	28.937	28.936	29.007	28.878	28.937	28.924	28.969
Mason, Tex	1,620.0	28.321	28.317	28.417	28.445	28.446	28.400	28.390	28.433	*c*28.354	28.329	28.275	28.018	28.345
Memphis, Tenn	320.8	29.658	29.658	29.781	29.811	29.839	29.777	29.754	29.785	29.738	29.684	29.638	29.670	29.733
Milwaukee, Wis	697.1	29.210	29.231	29.311	29.344	29.272	29.287	29.223	29.216	29.295	29.157	29.217	29.197	29.247
Mobile, Ala	39.5	29.982	29.922	30.008	30.025	30.148	30.128	30.097	30.131	30.043	30.055	29.984	30.015	30.045
Montgomery, Ala	219.0	29.805	29.764	29.858	29.884	29.976	29.954	29.927	29.948	29.813	29.871	29.834	29.849	29.874
Morgantown, W. Va	962.6	29.008	29.006	29.132	29.167	29.130	29.106	29.108	29.072	29.048	28.991	29.073	29.034	29.073
Mount Washington, N. H	6,285.6	23.854	23.829	23.890	23.795	23.549	23.538	23.601	23.409	23.416	23.521	23.798	23.848	23.671
Nashville, Tenn	507.0	29.485	29.469	29.588	29.629	29.647	29.610	29.588	29.590	29.550	29.511	29.527	29.519	29.559
New Haven, Conn	103.0	29.855	29.836	30.015	30.026	30.002	30.061	30.066	29.973	29.923	29.879	29.933	29.866	29.953
New London, Conn	46.6	29.927	29.898	30.089	30.081	30.079	30.134	30.132	30.034	29.981	29.950	30.010	29.936	30.021
New Orleans, La	52.5	29.958	29.882	29.962	29.996	30.117	30.093	30.066	30.131	30.010	30.017	29.934	29.979	30.012
Newport, R. I	44.4	29.927	29.891	30.081	30.069	30.066	30.125	30.120	30.014	29.960	29.938	29.996	29.992	30.015
New York, N. Y	164.3	29.814	29.791	29.967	29.984	29.969	30.000	30.013	29.923	29.874	29.831	29.883	29.821	29.906
Norfolk, Va	54.5	29.962	29.933	30.081	30.130	30.152	30.127	30.125	30.099	30.011	30.007	30.049	29.971	30.054
North Platte, Nebr	2,841.0	27.053	27.053	27.154	27.121	27.093	27.040	27.002	27.022	27.041	26.995	26.967	26.998	27.045
Olympia, Wash	36.0	29.946	29.903	29.976	30.001	29.979	29.948	29.860	30.109	30.002	29.873	30.015	29.980	29.966
Omaha, Nebr	1,113.3	28.780	28.774	28.900	28.909	28.876	28.905	28.800	28.828	28.859	28.745	28.734	28.746	28.821
Oswego, N. Y	304.2	29.630	29.633	29.774	29.794	29.742	29.604	29.789	29.707	29.743	29.653	29.697	29.665	29.703
Pembina, Dak	791.0	28.977	29.002	29.094	29.007	29.108	29.242	28.989	29.039	29.129	29.054	28.899	28.995	29.045
Pensacola, Fla	29.7	....	....	....	(*d*)	30.186	30.161	30.131	30.164	30.071	30.087	30.009	29.035	....
Philadelphia, Pa	52.4	29.934	29.921	30.092	30.116	30.108	30.130	30.138	30.065	30.012	29.971	30.014	29.984	30.040
Phœnix, Ariz	1,068.0	28.635	28.601	28.665	28.793	28.863	28.876	28.857	28.932	28.803	28.798	28.675	28.655	28.763

Pike's Peak, Colo	14, 150. 6	18. 056	18. 026	18. 028	17. 871	17. 667	17. 440	17. 543	17. 446	17. 477	17. 619	17. 748	17. 919	17. 737
Pilot Point, Tex	800. 0	e29. 179	f29. 172	29. 147	f29. 253	29. 307	29. 311	f29. 254	g29. 299	h29. 261	c29. 171	i29. 096	c29. 192	29. 220
Pioche, Nev	6, 220. 0	(j)	k24. 025	24. 114	24. 097	(j)	(j)	(j)	24. 021	23. 951	23. 961	23. 985	24. 012	......
Pittsburgh, Pa	776. 1	29. 178	29. 178	29. 302	29. 341	29. 298	29. 287	29. 284	29. 244	29. 235	29. 161	29. 247	29. 206	29. 247
Port Huron, Mich	632. 9	29. 276	29. 290	29. 384	29. 423	29. 349	29. 372	29. 340	29. 298	29. 368	29. 233	29. 312	29. 287	29. 328
Portland, Me	45. 4	29. 878	29. 863	30. 048	30. 006	30. 007	30. 104	30. 086	29. 953	29. 942	29. 868	29. 937	29. 896	29. 966
Portland, Oreg	67. 0	29. 940	29. 889	29. 946	30. 011	30. 011	30. 002	29. 918	30. 141	30. 040	29. 881	30. 031	30. 003	29. 984
Prescott, Ariz	5, 339. 0	24. 673	24. 765	24. 815	24. 811	24. 796	24. 742	24. 754	24. 769	24. 688	24. 735	24. 702	24. 746	24. 750
Punta Rassa, Fla	13. 1	30. 042	29. 948	29. 981	29. 956	30. 115	30. 130	30. 068	30. 121	30. 077	30. 109	29. 995	30. 044	30. 049
Red Bluff, Cal	338. 0	29. 484	29. 437	29. 548	29. 649	29. 756	29. 767	29. 775	29. 829	29. 725	29. 622	29. 663	29. 554	29. 651
Rio Grande City, Tex	179. 4	29. 730	29. 697	29. 802	29. 853	29. 897	29. 854	29. 820	29. 893	29. 777	29. 748	29. 679	e29. 727	29. 790
Rochester, N. Y	588. 9	29. 340	29. 342	29. 460	29. 499	29. 430	29. 444	29. 439	29. 366	29. 407	29. 285	29. 368	29. 339	29. 393
Roseburg, Oreg	537. 0	29. 445	29. 404	29. 458	29. 532	29. 544	29. 549	29. 515	29. 668	29. 561	29. 391	29. 555	29. 524	29. 512
Sacramento, Cal	69. 6	29. 773	29. 718	29. 827	29. 924	30. 019	30. 054	30. 062	30. 093	30. 005	29. 943	29. 935	29. 828	29. 932
Saint Louis, Mo	567. 7	29. 401	29. 409	29. 532	29. 563	29. 525	29. 513	29. 465	29. 486	29. 490	29. 392	29. 417	29. 421	29. 468
Saint Mark's, Fla	15. 0	30. 029	29. 966	30. 038	l30. 047	......	......	......	......	......	......	......	......	......
Saint Paul, Minn	810. 9	29. 036	29. 060	29. 155	29. 136	29. 134	29. 179	29. 054	29. 064	29. 138	29. 002	29. 037	29. 021	29. 085
Salt Lake City, Utah	4, 354. 5	25. 574	25. 601	25. 671	25. 695	25. 726	25. 608	25. 657	25. 682	25. 604	25. 573	25. 578	25. 579	25. 629
San Antonio, Tex	676. 7	29. 261	29. 237	29. 340	29. 371	29. 402	29. 377	29. 359	29. 477	29. 324	29. 296	29. 264	29. 264	29. 331
San Diego, Cal	67. 1	29. 861	29. 789	29. 863	29. 933	30. 013	30. 030	30. 018	30. 106	30. 033	30. 044	29. 922	29. 885	29. 958
Sandusky, Ohio	638. 5	29. 307	29. 316	29. 417	29. 459	29. 402	29. 406	29. 381	29. 354	29. 391	29. 273	29. 348	29. 322	29. 365
Sandy Hook, N. J	29. 2	29. 947	29. 921	30. 104	30. 121	30. 113	30. 150	30. 156	30. 074	30. 014	29. 973	30. 021	29. 953	30. 046
San Francisco, Cal	60. 4	29. 864	29. 804	29. 898	29. 974	30. 044	30. 068	30. 080	30. 133	30. 046	29. 987	29. 998	29. 926	29. 985
Santa Fé, N. Mex	6, 970. 4	23. 376	23. 367	23. 420	23. 373	23. 303	23. 207	23. 245	23. 261	23. 173	23. 254	23. 236	23. 274	23. 291
Savannah, Ga	86. 9	29. 953	29. 915	30. 006	30. 044	30. 124	30. 104	30. 066	30. 108	30. 004	30. 033	30. 030	29. 992	30. 032
Shreveport, La	205. 3	29. 766	29. 721	29. 837	29. 871	29. 917	29. 872	29. 851	29. 900	29. 861	29. 786	29. 751	29. 781	29. 826
Silver City, N. Mex	5, 796. 0	24. 350	24. 331	24. 388	24. 376	24. 320	24. 242	24. 296	24. 300	24. 238	24. 301	24. 222	24. 269	24. 303
Smithville, N. C	32. 7	30. 029	29. 995	30. 101	30. 151	30. 205	30. 171	30. 141	30. 162	30. 066	30. 100	30. 123	30. 057	30. 108
Socorro, N. Mex	4, 564. 8	m25. 400	25. 399	25. 472	25. 492	25. 463	25. 389	25. 417	25. 424	25. 335	25. 363	25. 314	25. 356	25. 407
Springfield, Ill	644. 3	29. 316	29. 319	29. 433	29. 467	29. 412	29. 403	29. 357	29. 398	29. 376	29. 253	29. 341	29. 317	29. 366
Springfield, Mass	120. 5	29. 832	29. 822	29. 998	29. 995	29. 984	30. 053	30. 054	29. 946	29. 910	29. 848	29. 908	29. 851	29. 933
Stockton, Tex	3, 063. 0	26. 900	26. 931	27. 017	27. 068	27. 054	26. 996	27. 013	27. 035	26. 967	26. 965	26. 849	26. 891	26. 974
Thatcher's Island, Mass	48. 1	29. 919	29. 899	30. 078	30. 045	30. 043	30. 117	30. 121	29. 994	29. 964	29. 912	29. 977	29. 920	29. 999
Toledo, Ohio	651. 2	29. 277	29. 289	29. 380	29. 430	29. 365	29. 372	29. 339	29. 315	29. 358	29. 241	29. 299	29. 294	29. 330
Tucson, Ariz	2, 359. 6	27. 444	27. 419	27. 470	27. 541	27. 582	27. 569	27. 558	27. 588	27. 521	27. 561	27. 424	27. 409	27. 507
Umatilla, Oreg	384. 0	29. 538	29. 502	29. 648	29. 743	29. 801	29. 744	c29. 588	29. 859	29. 718	29. 591	29. 682	29. 623	29. 669
Uvalde, Tex	891. 0	f29. 017	f28. 977	29. 084	29. 145	c29. 163	f29. 110	m29. 121	29. 166	f29. 075	f29. 041	f28. 947	f28. 986	29. 069
Vicksburg, Miss	243. 5	29. 769	29. 724	29. 827	29. 855	29. 920	29. 889	29. 867	29. 907	29. 826	29. 846	29. 762	29. 796	29. 832
Virginia City, Mont	5, 810. 0	24. 269	24. 281	24. 310	24. 262	24. 211	24. 056	24. 064	24. 127	24. 112	24. 144	24. 178	24. 240	24. 188
Visalia, Cal	348. 1	29. 448	29. 406	29. 516	29. 612	29. 697	29. 732	29. 736	29. 762	29. 676	29. 645	29. 580	29. 482	29. 608
Washington, D. C	105. 6	29. 882	29. 865	30. 035	30. 071	30. 069	30. 072	30. 082	30. 026	29. 976	29. 933	29. 974	29. 915	29. 992
Wilmington, N. C	73. 5	29. 956	29. 927	30. 034	30. 080	30. 137	30. 105	30. 081	30. 096	29. 996	30. 012	30. 055	29. 982	30. 038
Winnemucca, Nev	4, 345. 2	25. 593	25. 591	25. 647	25. 682	25. 704	25. 628	25. 645	25. 686	25. 606	25. 559	25. 613	25. 610	25. 630
Wood's Holl, Mass	34. 4	29. 932	29. 892	30. 086	30. 070	30. 061	30. 127	30. 121	30. 018	29. 957	29. 943	30. 002	29. 930	30. 012
Yankton, Dak	1, 228. 4	28. 637	28. 635	28. 763	28. 725	28. 744	n28. 738	28. 651	o28. 715	28. 728	28. 610	28. 571	28. 596	28. 676
Yuma, Ariz	138. 0	29. 614	29. 584	29. 644	29. 778	29. 887	29. 912	29. 895	29. 962	29. 834	29. 779	29. 658	29. 598	29. 762

a Station closed June 19, 1880.
b Nineteen days only.
c Twenty-eight days only.
d Observations commenced October 27, 1879.
e Twenty-one days only.
f Twenty-nine days only.
g Twenty-three days only.
h Twenty-five days only.
i Twenty-two days only.
Barometer unserviceable.
k Fifteen days only.
l Station closed October 30, 1879.
m Twenty-seven days only.
n Eighteen days only.
o Twenty-four days only.

PAPER 10.

Mean normal barometer, deduced from the three telegraphic observations (corrected for temperature and instrumental error only), from January 1, 1873, to December 31, 1879, except for stations opened subsequent to the former date.

[The daily means are obtained by dividing the sum of the three telegraphic observations by three; the monthly means by dividing the sum of the daily means by the number of days in the month.]

Station.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Mean.
Albany, N. Y	30.006	29.962	29.916	29.853	29.882	29.867	29.870	29.879	29.959	29.940	29.965	29.965	29.922
Alpena, Mich	29.361	29.356	29.317	29.304	29.322	29.278	29.310	29.328	29.356	29.321	29.324	29.326	29.325
Atlanta, Ga	28.988	28.940	28.952	28.834	28.902	28.878	28.883	28.853	28.953	28.979	29.031	28.989	28.932
Atlantic City, N. J	30.123	30.077	30.026	29.937	30.001	29.984	29.985	29.982	30.064	30.056	30.073	30.084	30.033
Augusta, Ga	30.010	29.954	29.917	29.825	29.845	29.860	29.871	29.852	29.887	29.939	29.944	30.000	29.909
Baltimore, Md	30.118	30.058	30.005	29.928	29.969	29.954	29.956	29.965	30.045	30.046	30.054	30.095	30.016
Barnegat, N. J	30.106	30.052	30.009	29.932	29.976	29.961	29.957	29.954	30.044	30.030	30.048	30.059	30.011
Bismarck, Dak	28.204	28.215	28.165	28.108	28.090	28.059	28.128	28.135	28.185	28.138	28.177	28.188	28.149
Boise City, Idaho	27.232	27.127	27.135	27.069	27.084	27.086	27.065	27.085	27.148	27.235	27.280	27.266	27.151
Boston, Mass	29.905	29.845	29.825	29.763	29.819	29.810	29.814	29.832	29.921	29.872	29.874	29.883	29.847
Brownsville, Tex	30.073	29.972	29.943	29.797	29.847	29.842	29.876	29.835	29.920	29.950	30.007	30.041	29.925
Breckinridge, Minn	29.030	29.012	28.991	28.928	28.889	28.851	28.912	28.921	28.969	28.944	28.994	29.016	28.955
Buffalo, N. Y	29.330	29.306	29.262	29.235	29.269	29.250	29.267	29.286	29.335	29.301	29.292	29.309	29.287
Burlington, Vt	29.805	29.757	29.711	29.671	29.696	29.667	29.679	29.719	29.788	29.752	29.762	29.777	29.732
Cairo, Ill	29.778	29.732	29.658	29.576	29.599	29.603	29.634	29.626	29.680	29.707	29.713	29.765	29.673
Cape Hatteras, N. C	30.138	30.077	30.043	29.939	30.019	30.023	30.010	29.981	30.031	30.059	30.072	30.109	30.042
Cape Henry, Va	30.128	30.074	30.020	29.941	29.994	29.986	29.979	29.982	30.032	30.051	30.064	30.101	30.029
Cape Lookout, N. C	30.132	30.059	30.053	29.930	30.040	30.030	30.028	30.008	30.038	30.074	30.075	30.129	30.050
Cape May, N. J	30.116	30.060	30.001	29.933	29.984	29.975	29.981	29.981	30.053	30.043	30.050	30.088	30.022
Charleston, S. C	30.139	30.071	30.046	29.950	29.975	29.998	30.003	29.973	29.995	30.043	30.060	30.117	30.031
Charlotte, N. C	29.272	29.244	29.240	29.134	29.210	29.193	29.191	29.170	29.286	29.329	29.345	29.309	29.244
Chattanooga, Tenn	29.424	29.414	29.371	29.199	29.236	29.239	29.226	29.211	29.318	29.355	29.386	29.344	29.310
Cheyenne, Wyo	23.923	23.912	23.917	23.954	23.962	24.058	24.134	24.138	24.120	24.073	24.002	23.961	24.013
Chicago, Ill	29.334	29.345	29.295	29.244	29.268	29.251	29.289	29.295	29.332	29.343	29.318	29.338	29.304
Cincinnati, Ohio	29.471	29.428	29.374	29.302	29.342	29.323	29.337	29.338	29.406	29.423	29.414	29.450	29.384
Columbus, Ohio	29.249	29.224	29.224	29.130	29.200	29.160	29.143	29.148	29.257	29.303	29.261	29.241	29.212
Cleveland, Ohio	29.344	29.315	29.263	29.228	29.264	29.249	29.268	29.275	29.325	29.303	29.298	29.315	29.287
Corsicana, Tex	29.697	29.628	29.536	29.462	29.478	29.500	29.520	29.498	29.555	29.593	29.614	29.642	29.560
Davenport, Iowa	29.467	29.428	29.370	29.302	29.316	29.299	29.344	29.353	29.401	29.395	29.410	29.439	29.377
Deadwood, Dak	25.274	25.259	25.318	25.316	25.334	25.323	25.402	25.405	25.473	25.382	25.315	25.188	25.332
Denison, Tex	29.342	29.280	29.194	29.098	29.146	29.159	29.189	29.203	29.230	29.249	29.266	29.297	29.221
Denver, Colo	24.724	24.704	24.693	24.722	24.717	24.794	24.864	24.864	24.863	24.834	24.770	24.754	24.775
Des Moines, Iowa	29.242	29.188	29.170	29.095	29.063	29.063	29.063	29.081	29.202	29.214	29.172	29.196	29.146
Detroit, Mich	29.369	29.345	29.303	29.264	29.305	29.274	29.302	29.312	29.345	29.338	29.331	29.344	29.319
Dodge City, Kans	27.451	27.405	27.339	27.299	27.298	27.346	27.386	27.394	27.437	27.413	27.425	27.443	27.386

Dubuque, Iowa	29.396	29.363	29.299	29.243	29.268	29.223	29.274	29.283	29.324	29.310	29.326	29.338	29.304
Duluth, Minn	29.351	29.350	29.312	29.282	29.275	29.214	29.248	29.264	29.290	29.266	29.310	29.323	29.290
Eagle Pass, Tex	29.298	29.267	29.197	29.066	29.113	29.108	29.128	29.122	29.237	29.262	29.284	29.313	29.200
Eastport, Me	29.902	29.845	29.861	29.811	29.863	29.861	29.865	29.901	29.970	29.899	29.876	29.888	29.878
Erie, Pa	29.346	29.319	29.263	29.236	29.274	29.249	29.270	29.281	29.331	29.302	29.294	29.308	29.289
Escanaba, Mich	29.350	29.358	29.325	29.314	29.309	29.262	29.306	29.314	29.345	29.308	29.339	29.328	29.322
Fort Gibson, Ind. T	29.596	29.523	29.436	29.362	29.370	29.388	29.425	29.421	29.468	29.510	29.509	29.560	29.464
Fort Grant, Ariz	25.214	25.204	25.210	25.156	25.213	25.195	25.234	25.204	25.272	25.284	25.282	25.234	25.225
Fort Griffin, Tex	28.800	28.721	28.685	28.588	28.622	28.651	28.672	28.677	28.755	28.776	28.787	28.826	28.713
Fort Keogh, Mont*		27.443	27.430	27.361	27.351	27.290	27.346	27.354	27.435	27.408	27.392	27.322	
Fort Sill, Ind. T	28.898	28.897	28.749	28.665	28.686	28.708	28.753	28.754	28.788	28.805	28.832	28.846	28.784
Galveston, Tex	30.132	30.063	30.006	29.932	29.936	29.958	29.987	29.951	29.963	30.034	30.055	30.098	30.000
Grand Haven, Mich	29.381	29.375	29.330	29.290	29.315	29.285	29.326	29.332	29.371	29.341	29.353	29.363	29.338
Indianapolis, Ind	29.313	29.281	29.221	29.158	29.191	29.191	29.220	29.223	29.273	29.271	29.257	29.287	29.240
Indianola, Tex	30.128	30.086	30.020	29.958	29.949	29.969	30.001	29.974	29.983	30.054	30.088	30.122	30.028
Jacksonville, Fla	30.164	30.093	30.075	29.991	29.987	30.020	30.029	29.992	29.988	30.036	30.071	30.141	30.049
Keokuk, Iowa	29.466	29.428	29.368	29.289	29.297	29.281	29.326	29.327	29.382	29.389	29.410	29.430	29.366
Key West, Fla	30.119	30.076	30.072	30.008	29.973	30.017	30.029	29.992	29.944	29.957	30.029	30.100	30.026
Kittyhawk, N. C	30.135	30.090	30.047	29.944	30.027	30.021	30.003	29.975	30.047	30.066	30.071	30.101	30.044
Knoxville, Tenn	29.134	29.104	29.041	28.966	29.012	29.029	29.054	29.031	29.082	29.109	29.088	29.131	29.065
La Crosse, Wis	29.343	29.311	29.261	29.198	29.210	29.178	29.228	29.237	29.273	29.255	29.285	29.305	29.257
La Mesilla, N. Mex	26.126	26.041	26.060	25.989	25.997	25.992	26.055	26.037	26.085	26.115	26.131	26.097	26.059
Leavenworth, Kans	29.268	29.199	29.135	29.060	29.048	29.060	29.108	29.110	29.177	29.174	29.189	29.234	29.147
Los Angeles, Cal	29.738	29.688	29.697	29.620	29.624	29.578	29.553	29.512	29.576	29.622	29.697	29.722	29.636
Louisville, Ky	29.560	29.526	29.476	29.391	29.423	29.415	29.441	29.436	29.499	29.519	29.510	29.553	29.479
Lynchburg, Va	29.438	29.379	29.333	29.263	29.318	29.318	29.327	29.330	29.416	29.418	29.409	29.445	29.366
Madison, Wis	29.055	29.042	29.022	28.982	29.000	28.972	28.948	28.953	29.046	29.069	28.994	29.005	29.007
Marquette, Mich	29.274	29.282	29.253	29.257	29.261	29.204	29.239	29.259	29.279	29.237	29.263	29.255	29.255
Mason, Tex	28.453	28.366	28.343	28.342	28.292	28.306	28.319	28.314	28.394	28.418	28.426	28.441	28.359
Memphis, Tenn	29.869	29.808	29.751	29.666	29.680	29.682	29.711	29.696	29.754	29.794	29.793	29.842	29.754
Milwaukee, Wis	29.311	29.289	29.244	29.207	29.240	29.209	29.261	29.272	29.304	29.278	29.284	29.297	29.266
Mobile, Ala	30.166	30.101	30.065	29.986	29.980	29.997	30.016	29.975	29.983	30.053	30.084	30.140	30.045
Montgomery, Ala	29.975	29.906	29.870	29.782	29.793	29.809	29.827	29.792	29.824	29.881	29.900	29.959	29.860
Morgantown, W. Va	29.044	28.963	28.926	28.880	28.922	28.952	28.961	28.967	29.023	29.017	28.983	29.020	28.971
Mount Washington, N. H	23.382	23.354	23.425	23.525	23.719	23.823	23.885	23.906	23.871	23.706	23.510	23.423	23.627
Nashville, Tenn	29.634	29.572	29.535	29.441	29.467	29.480	29.494	29.477	29.541	29.574	29.565	29.613	29.533
New Haven, Conn	29.974	29.929	29.927	29.827	29.882	29.867	29.873	29.889	29.969	29.934	29.936	29.965	29.914
New London, Conn	30.059	30.003	29.963	29.899	29.962	29.949	29.951	29.970	30.045	30.007	30.010	30.036	29.988
New Orleans, La	30.116	30.069	30.000	29.939	29.945	29.961	29.980	29.943	29.952	30.021	30.048	30.099	30.006
New York City, N. Y	29.944	29.890	29.847	29.784	29.838	29.822	29.833	29.848	29.919	29.892	29.903	29.920	29.870
Newport, R. I	29.993	29.958	29.950	29.857	29.949	29.928	29.919	29.943	30.039	29.974	29.984	29.990	29.957
Norfolk, Va	30.114	30.052	30.008	29.923	29.981	29.977	29.981	29.955	30.030	30.046	30.046	30.089	30.017
North Platte, Nebr	27.100	27.073	27.019	27.014	26.979	27.026	27.074	27.076	27.121	27.105	27.098	27.096	27.065
Olympia, Wash	29.894	29.790	29.839	29.959	29.964	30.012	29.947	29.925	29.962	30.023	29.993	30.061	29.947
Omaha, Nebr	28.973	28.939	28.885	28.816	28.803	28.808	28.862	28.865	28.910	28.915	28.918	28.955	28.887
Oswego, N. Y	29.740	29.724	29.678	29.638	29.683	29.646	29.653	29.677	29.731	29.703	29.705	29.722	29.692
Pembina, Dak	29.225	29.239	29.193	29.133	29.092	29.021	29.063	29.081	29.115	29.109	29.168	29.189	29.136
Philadelphia, Pa	30.106	30.048	29.991	29.911	29.977	29.955	29.951	29.974	30.040	30.034	30.036	30.075	30.008
Pike's Peak, Colo	17.505	17.524	17.540	17.621	17.773	17.938	18.074	18.059	17.964	17.710	17.656	17.559	17.744
Pioche, Nev	24.037	23.996	24.020	23.948	23.963	24.055	24.069	24.072	24.097	24.106	24.113	24.062	24.045
Pittsburgh, Pa	29.277	29.222	29.178	29.127	29.177	29.168	29.185	29.193	29.248	29.241	29.224	29.246	29.207

*Normal for January not determined.

Mean normal barometer, deduced from the three telegraphic observations, &c.—Continued.

Station.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Mean.
Port Huron, Mich	29. 377	29. 345	29. 309	29. 257	29. 314	29. 273	29. 299	29. 307	29. 365	29. 340	29. 329	29. 329	29. 320
Portland, Me	29. 993	29. 930	29. 901	29. 860	29. 906	29. 896	29. 897	29. 935	30. 009	29. 955	29. 954	29. 965	29. 933
Portland, Oreg	29. 953	29. 854	29. 879	29. 980	29. 992	30. 016	29. 951	29. 914	29. 955	30. 042	30. 031	30. 094	29. 972
Prescott, Ariz	24. 759	24. 737	24. 744	24. 672	24. 706	24. 735	24. 789	24. 790	24. 817	24. 813	24. 766	24. 721	24. 754
Punta Rassa, Fla	30. 165	30. 112	30. 112	30. 042	30. 009	30. 048	30. 061	30. 024	29. 981	30. 006	30. 074	30. 144	30. 065
Red Bluff, Cal	29. 722	29. 649	29. 664	29. 593	29. 609	29. 482	29. 474	29. 479	29. 555	29. 645	29. 746	29. 768	29. 616
Rochester, N. Y	29. 409	29. 388	29. 349	29. 321	29. 359	29. 335	29. 351	29. 372	29. 423	29. 391	29. 378	29. 385	29. 372
Roseburg, Oreg	29. 475	29. 408	29. 422	29. 494	29. 515	29. 520	29. 457	29. 426	29. 470	29. 562	29. 561	29. 607	29. 493
Sacramento, Cal	30. 015	29. 951	29. 973	29. 880	29. 900	29. 762	29. 766	29. 730	29. 832	29. 912	30. 012	30. 047	29. 899
Saint Louis, Mo	29. 566	29. 517	29. 460	29. 376	29. 393	29. 392	29. 432	29. 436	29. 494	29. 505	29. 505	29. 543	29. 468
Saint Mark's, Fla	30. 192	30. 126	30. 085	29. 998	30. 014	30. 029	30. 035	30. 000	30. 005	30. 048	30. 081	30. 160	30. 064
Saint Paul, Minn	29. 183	29. 167	29. 124	29. 063	29. 057	29. 026	29. 081	29. 092	29. 124	29. 100	29. 132	29. 154	29. 109
Salt Lake City, Utah	25. 683	25. 679	25. 598	25. 578	25. 552	25. 603	25. 605	25. 620	25. 651	25. 688	25. 701	25. 727	25. 640
San Antonio, Tex	29. 434	29. 347	29. 306	29. 183	29. 232	29. 233	29. 257	29. 234	29. 327	29. 356	29. 405	29. 414	29. 311
San Diego, Cal	30. 046	29. 998	30. 004	29. 931	29. 932	29. 877	29. 849	29. 811	29. 869	29. 916	29. 996	30. 018	29. 937
Sandusky, Ohio	29. 392	29. 340	29. 330	29. 227	29. 331	29. 304	29. 316	29. 289	29. 403	29. 388	29. 369	29. 376	29. 339
Sandy Hook, N. J	30. 102	30. 056	30. 004	29. 930	29. 974	29. 956	29. 959	29. 967	30. 054	30. 040	30. 054	30. 062	30. 013
San Francisco, Cal	30. 029	29. 999	30. 004	29. 930	29. 939	29. 848	29. 854	29. 818	29. 899	29. 955	30. 036	30. 059	29. 948
Santa Fé, N. Mex	23. 199	23. 163	23. 180	23. 170	23. 214	23. 295	23, 372	23. 374	23. 363	23. 321	23. 270	23. 228	23. 262
Savannah, Ga	30. 114	30. 049	30. 020	29. 930	29. 947	29. 968	29. 980	29. 950	29. 967	30. 013	30. 033	30. 100	30. 006
Shreveport, La	29. 966	29. 898	29. 834	29. 759	29. 778	29. 799	29. 805	29. 781	29. 812	29. 872	29. 882	29. 936	29. 844
Smithville, N. C	30. 166	30. 087	30. 055	29. 964	30. 037	30. 029	30. 029	29. 993	30. 032	30. 078	30. 061	30. 118	30. 054
Springfield, Mass	29. 934	29. 889	29. 881	29. 785	29. 847	29. 832	29. 820	29. 829	29. 930	29. 930	29. 917	29. 918	29. 876
Stockton, Tex	27. 022	26. 941	26. 938	26. 833	26. 880	26. 889	26. 910	26. 930	26. 995	27. 035	27. 029	27. 018	26. 952
Thatcher's Island, Mass	29. 979	29. 937	29. 932	29. 851	29. 924	29. 907	29. 899	29. 912	30. 034	29. 968	29. 965	29. 972	29. 940
Toledo, Ohio	29. 397	29. 360	29. 299	29. 264	29. 302	29. 277	29. 308	29. 308	29. 358	29. 341	29. 341	29. 359	29. 326
*Tucson, Ariz	....	27. 582	27. 542	27. 484	27. 465	27. 422	27. 444	27. 419	27. 470	27. 541	27. 582	27. 569	....
Tybee Island, Ga	30. 175	30. 102	30. 044	29. 963	30. 009	30. 015	30. 024	29. 989	29. 999	30. 050	30. 069	30. 134	30. 048
Umatilla, Oreg	29. 750	29. 594	29. 607	29. 626	29. 629	29. 604	29. 537	29. 518	29. 634	29. 735	29. 790	29. 871	29. 658
Vicksburg, Miss	29. 948	29. 871	29. 824	29. 746	29. 762	29. 778	29. 799	29. 774	29. 809	29. 867	29. 882	29. 924	29. 832
Virginia City, Mont	24. 174	24. 096	24. 177	24. 143	24. 193	24. 254	24. 273	24. 305	24. 293	24. 255	24. 252	24. 177	24. 216
Visalia, Cal	29. 755	29. 699	29. 700	29. 595	29. 600	29. 466	29. 467	29. 443	29. 548	29. 632	29. 722	29. 752	29. 615
Washington, D. C	30. 047	29. 992	29. 939	29. 865	29. 915	29. 895	29. 903	29. 906	29. 981	29. 983	29. 992	30. 025	29. 954
Wilmington, N. C	30. 110	30. 043	30. 007	29. 922	29. 958	29. 975	29. 996	29. 958	29. 986	30. 030	30. 031	30. 094	30. 009
Winnemucca, Nev	25. 662	25. 595	25. 614	25. 558	25. 590	25. 603	25. 596	25. 592	25. 646	25. 705	25. 725	25. 698	25. 632
Wood's Holl, Mass	30. 029	29. 980	29. 944	29. 881	29. 931	29. 953	29. 949	29. 971	30. 044	30. 002	29. 977	30. 015	29. 973
Yankton, Dak	28. 807	28. 780	28. 724	28. 663	28, 629	28. 626	28. 674	28. 685	28. 746	28. 715	28. 755	28. 783	28. 716
Yuma, Ariz	29. 942	29. 837	29. 802	29. 717	29. 678	29. 598	29. 595	29. 584	29. 658	29. 750	29. 862	29. 912	29. 745

* Normal for January not determined.

PAPER 11.

Monthly and annual mean pressure, reduced to sea-level, from observations taken at 7 a. m., 2 p. m., and 9 p. m. (local time), from July, 1879, to June, 1880, inclusive.

[The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m., and twice the 9 p. m. observations by four; the monthly means by dividing the sum of the daily means by the number of days in the month.]

Station.	Elevation of cistern of barometer above mean sea-level.	1879.						1880.						Annual mean.
		July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	
	Feet.													
Albany, N. Y	75.3	29.950	29.942	30.099	30.119	30.110	30.178	30.192	30.078	30.067	29.970	30.025	29.970	30.058
Alpena, Mich	608.2	29.896	29.922	30.014	30.043	30.000	30.064	30.000	29.975	30.087	29.893	29.958	29.905	29.980
Atlantic City, N. J	12.9	30.000	29.972	30.150	30.175	30.177	30.189	30.189	30.129	30.061	30.045	30.088	30.013	30.099
Atlanta, Ga	1,131.3	29.968	29.949	30.070	30.109	30.177	30.150	30.126	30.128	30.044	30.049	30.032	30.012	30.068
Augusta, Ga	185.3	30.035	30.026	30.134	30.185	30.244	30.231	30.202	30.205	30.117	30.134	30.132	30.088	30.144
Baltimore, Md	45.2	30.004	29.986	30.158	30.192	30.193	30.200	30.212	30.148	30.096	30.042	30.082	30.019	30.111
Barnegat, N. J	20.0	29.989	29.957	30.136	30.161	30.159	30.180	30.176	30.118	30.046	30.021	30.065	29.992	30.083
Bismarck, Dak	1,704.3	29.960	29.976	30.067	29.980	30.008	30.085	29.906	29.951	30.015	29.978	29.841	29.925	29.974
Boise City, Idaho	2,768.0	30.002	30.011	30.114	30.190	30.231	30.134	30.124	30.208	30.136	30.058	30.107	30.068	30.115
Boston, Mass	142.2	29.957	29.936	30.122	30.096	30.096	30.179	30.177	30.057	30.018	29.974	30.029	29.970	30.051
Brackettville, Tex	1,136.7	29.729	29.747	29.869	29.933	a29.981	29.932	29.912	29.984	29.856	29.808	(b)	c29.768	....
Breckinridge, Minn	966.5	29.805	29.838	29.977	29.896	30.027	30.189	29.955	29.980	30.065	29.892	29.755	29.803	29.932
Buffalo, N. Y	664.5	29.912	29.921	30.050	30.085	30.037	30.084	30.057	30.013	30.056	29.917	29.979	29.933	30.004
Burlington, Vt	286.0	29.907	29.911	30.069	30.068	30.055	30.157	30.137	30.025	30.045	29.906	29.968	29.929	30.015
Cairo, Ill	377.3	29.989	29.997	30.138	30.172	30.180	30.160	30.120	30.145	30.115	30.022	30.028	30.030	30.091
Cape Hatteras, N. C	8.4	30.050	30.014	30.126	30.177	30.218	30.192	30.168	30.177	30.071	30.107	30.139	30.047	30.124
Cape Henry, Va	16.0	30.016	30.037	30.135	30.179	30.204	30.175	30.181	30.150	30.063	30.059	30.100	30.023	30.110
Cape Lookout, N. C	15.0	30.047	30.006	30.116	30.167	30.215	30.190	30.169	30.187	30.082	30.118	30.146	30.058	30.125
Cape May, N. J	27.0	30.000	29.966	30.133	30.169	30.170	30.181	d30.185	....	....	....	....	....	....
Cedar Keys, Fla	22.5	....	....	....	....	....	e30.186	30.132	30.178	30.120	30.145	30.057	30.083	....
Charleston, S. C	52.5	30.029	29.993	30.086	30.133	30.214	30.190	30.158	30.177	30.083	30.111	30.119	30.056	30.112
Charlotte, N. C	837.8	29.966	29.951	30.081	30.133	30.171	30.142	30.134	30.114	30.029	30.023	30.042	29.989	30.065
Chattanooga, Tenn	783.2	29.985	29.982	30.100	30.149	30.200	30.161	30.144	30.151	30.063	30.055	30.050	30.034	30.089
Cheyenne, Wyo	6,089.4	30.050	30.063	30.096	30.034	29.950	29.787	29.837	29.832	29.851	29.898	29.905	29.979	29.940
Chicago, Ill	660.9	29.913	29.928	30.048	30.086	30.048	30.068	30.001	30.028	30.057	29.910	29.940	29.912	29.995
Chincoteague, Va	18.5	....	....	....	....	....	....	....	....	....	f30.081	30.104	30.026	....
Cincinnati, Ohio	620.4	29.963	29.983	30.114	30.158	30.155	30.138	30.109	30.111	30.105	30.019	30.045	30.013	30.076
Cleveland, Ohio	689.7	29.945	29.957	30.077	30.123	30.091	30.106	30.073	30.054	30.087	29.952	30.004	29.974	30.037

a Nine observations missed.
b Local observations discontinued May 4, 1880.
c Local observations recommenced June 14, 1880.
d Local observations discontinued January 31, 1880.
e Station opened November 7, 1879.
f Station opened March 16, 1880.

Monthly and annual mean pressure, &c.—Continued.

Station.	Elevation of cistern of barometer above mean sea-level.	1879.						1880.						Annual mean.
		July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	
	Feet.													
Columbus, Ohio	804. 6	29. 927	29. 943	30. 078	30. 121	30. 113	30. 105	30. 079	30. 069	30. 070	29. 968	30. 011	29. 975	30. 038
Corsicana, Tex	445. 0	29. 927	29. 904	30. 021	30. 068	30. 097	30. 086	30. 049	30. 112	30. 025	29. 982	29. 933	29. 966	30. 014
Davenport, Iowa	603. 8	29. 911	29. 935	30. 068	30. 090	30. 058	30. 098	29. 992	30. 005	30. 058	29. 904	29. 913	29. 895	29. 994
Delaware Breakwater, Del	20. 0								*a*30. 143	30. 103	30. 041	30. 085	30. 007	
Denison, Tex	767. 4	29. 887	29. 898	30. 013	30. 074	30. 083	30. 068	30. 026	30. 073	30. 019	29. 935	29. 896	29. 926	29. 991
Denver, Colo	5, 271. 1	30. 035	30. 059	30. 106	30. 055	29. 994	29. 855	29. 897	29. 901	29. 902	29. 928	29. 915	29. 974	29. 968
Des Moines, Iowa	849. 0	29. 891	29. 911	30. 054	30. 071	30. 065	30. 128	29. 987	30. 024	30. 057	29. 910	29. 882	29. 872	29. 988
Detroit, Mich	645. 3	29. 914	29. 929	30. 045	30. 092	30. 051	30. 081	30. 032	30. 009	30. 071	29. 917	29. 964	29. 937	30. 003
Dodge City, Kans	2, 512. 5	29. 494	29. 544	29. 689	29. 744	29. 760	29. 749	29. 974	29. 731	29. 687	29. 551	29. 454	29. 439	29. 651
Dubuque, Iowa	665. 1	29. 899	29. 920	30. 047	30. 068	30. 048	30. 093	29. 999	30. 001	30. 048	29. 893	29. 899	29. 884	29. 983
Duluth, Minn	644. 1	29. 850	29. 876	29. 985	29. 960	30. 016	30. 127	29. 951	29. 965	30. 069	29. 900	29. 864	29. 871	29. 953
Eastport, Me	61. 2	29. 909	29. 881	30. 087	29. 997	30. 021	30. 145	30. 114	29. 971	29. 956	29. 903	29. 977	29. 918	29. 990
Erie, Pa	681. 1	29. 926	29. 937	30. 062	30. 106	30. 056	30. 090	30. 070	30. 037	30. 042	29. 932	30. 002	29. 955	30. 018
Escanaba, Mich	611. 6	29. 885	29. 914	30. 011	30. 029	29. 997	30. 080	29. 980	29. 962	30. 085	29. 908	29. 902	29. 862	29. 968
Fort Gibson, Ind. T	510. 0	29. 892	29. 919	30. 024	30. 054	30. 076	30. 083	30. 022	30. 070	30. 026	29. 933	29. 931	29. 928	29. 996
Galveston, Tex	39. 6	30. 003	29. 929	30. 034	30. 067	30. 141	30. 113	30. 086	30. 136	30. 039	30. 025	29. 945	29. 983	30. 042
Grand Haven, Mich	620. 2	29. 934	29. 935	30. 039	30. 078	30. 031	30. 063	29. 995	29. 977	30. 055	29. 906	29. 952	29. 918	29. 900
Indianapolis, Ind	746. 6	29. 927	29. 951	30. 081	30. 108	30. 078	30. 080	30. 026	30. 049	30. 059	29. 946	29. 974	29. 947	30. 019
Indianola, Tex	25. 9	29. 997	29. 938	30. 036	30. 077	30. 139	30. 109	30. 082	30. 143	30. 065	30. 014	29. 940	29. 973	30. 043
Jacksonville, Fla	22. 9	30. 047	29. 995	30. 067	30. 091	30. 202	30. 197	30. 147	30. 186	30. 107	30. 133	30. 085	30. 083	30. 112
Keokuk, Iowa	616. 7	29. 867	29. 887	30. 022	30. 056	30. 025	30. 058	29. 956	29. 984	30. 010	29. 871	29. 873	29. 859	29. 956
Key West, Fla	31. 7	30. 060	29. 966	29. 995	29. 951	30. 108	30. 135	30. 077	30. 143	30. 108	30. 138	30. 013	30. 084	30. 065
Kittyhawk, N. C	22. 0	30. 002	29. 948	30. 135	30. 200	30. 234	30. 202	30. 202	30. 192	30. 091	30. 115	30. 146	30. 063	30. 127
Knoxville, Tenn	980. 0	29. 996	29. 989	30. 114	30. 165	30. 214	30. 163	30. 155	30. 153	30. 073	30. 052	30. 058	30. 030	30. 097
La Crosse, Wis	701. 9	29. 870	29. 893	30. 014	30. 021	30. 027	30. 090	29. 960	30. 019	30. 044	29. 875	29. 863	29. 857	29. 961
La Mesilla, N. Mex	4, 124. 0	30. 187	30. 188	30. 257	30. 259	30. 285	30. 231	30. 243	30. 262	30. 173	30. 206	30. 138	30. 172	30. 217
Leavenworth, Kans	841. 9	29. 871	29. 879	30. 020	30. 060	30. 038	30. 096	29. 985	30. 025	30. 024	29. 890	29. 856	29. 863	29. 967
Little Rock, Ark	298. 1	29. 990	29. 991	30. 118	30. 156	30. 171	30. 137	30. 107	30. 153	30. 069	29. 989	29. 954	29. 986	30. 068
Los Angeles, Cal	350. 1	29. 906	29. 839	29. 915	29. 989	30. 062	30. 077	30. 065	30. 149	30. 068	30. 076	29. 951	29. 914	30. 001
Louisville, Ky	530. 0	29. 950	29. 962	30. 098	30. 139	30. 145	30. 121	30. 069	30. 080	30. 063	29. 986	30. 002	29. 980	30. 050
Lynchburg, Va	646. 0	29. 987	29. 978	30. 144	30. 189	30. 202	30. 177	30. 198	30. 142	30. 075	30. 040	30. 070	30. 006	30. 101
Madison, Wis	949. 2	29. 879	29. 895	30. 015	30. 042	30. 008	30. 056	29. 953	29. 988	30. 021	29. 864	29. 877	29. 862	29. 952
Marquette, Mich	673. 0	29. 853	29. 883	29. 964	29. 961	29. 988	30. 050	29. 942	29. 903	30. 073	29. 901	29. 885	29. 877	29. 940
Memphis, Tenn	220. 8	29. 983	29. 988	30. 122	30. 150	30. 173	30. 123	30. 095	30. 136	30. 082	30. 011	29. 962	29. 992	30. 068
Milwaukee, Wis	697. 1	29. 899	29. 919	30. 027	30. 065	30. 025	30. 064	29. 977	29. 973	30. 051	29. 894	29. 921	29. 893	29. 976
Mobile, Ala	39. 5	30. 028	29. 968	30. 056	30. 072	30. 200	30. 171	30. 143	30. 179	30. 089	30. 100	30. 026	30. 059	30. 091

Montgomery, Ala	219.0	30.024	29.993	30.091	30.118	30.215	30.191	30.162	30.180	30.090	30.105	30.059	30.064	30.108
Morgantown, W. Va	962.6	29.948	29.954	30.103	30.143	30.134	30.114	30.109	30.080	30.059	29.974	30.027	29.980	30.052
Mount Washington, N. H	6,285.6	30.219	30.194	30.253	30.159	29.910	29.901	29.963	29.770	29.780	29.889	30.167	30.211	30.035
Nashville, Tenn	507.0	29.985	29.980	30.114	30.157	30.184	30.146	30.125	30.136	30.058	30.032	30.038	30.029	30.082
New Haven, Conn	103.0	29.968	29.949	30.131	30.133	30.126	30.180	30.191	30.096	30.047	30.001	30.051	29.982	30.071
New London, Conn	46.6	29.984	29.944	30.137	30.134	30.131	30.188	30.185	30.092	30.040	30.012	30.063	29.988	30.075
New Orleans, La	52.5	30.019	29.945	30.025	30.059	30.179	30.156	30.126	30.168	30.069	30.075	29.992	30.036	30.071
Newport, R. I	44.4	29.980	29.944	30.134	30.122	30.124	30.179	30.176	30.076	30.020	29.998	30.051	29.977	30.065
New York, N. Y	164.3	29.986	29.961	30.136	30.164	30.148	30.197	30.201	30.112	30.065	30.015	30.059	29.993	30.086
Norfolk, Va	54.5	30.021	29.992	30.138	30.189	30.215	30.181	30.191	30.168	30.075	30.070	30.104	30.041	30.115
North Platte, Nebr	2,841.0	29.479	29.489	29.658	29.665	29.701	29.798	29.647	29.681	29.685	29.535	29.420	29.426	29.599
Olympia, Wash	36.0	29.986	29.937	30.001	30.044	30.020	29.984	29.902	30.146	30.044	29.914	30.049	30.041	30.006
Omaha, Nebr	1,113.3	29.816	29.807	29.971	29.984	29.980	30.090	29.917	29.966	29.980	29.809	29.772	29.781	29.906
Oswego, N. Y	304.2	29.940	29.945	30.084	30.114	30.071	30.139	30.121	30.043	30.080	29.947	30.010	29.972	30.039
Pembina, Dak	791.0	29.763	29.801	29.915	29.838	29.984	30.192	29.911	29.960	30.036	29.908	29.706	29.780	29.899
Pensacola, Fla	29.7	....	....	....	(b)	c30.214	30.198	30.169	30.198	30.106	30.121	30.043	30.067	....
Philadelphia, Pa	52.4	29.986	29.961	30.144	30.168	30.165	30.184	30.190	30.120	30.067	30.022	30.063	29.999	30.089
Pike's Peak, Colo	14,150.6	30.270	30.237	30.239	30.086	29.876	29.650	29.742	29.655	29.691	29.835	29.963	30.136	29.948
Pioche, Nev	6,220.0	....	d29.802	29.884	29.873	(e)	(e)	(e)	29.792	29.723	29.739	29.743	29.780	....
Pittsburgh, Pa	776.1	29.942	29.951	30.097	30.141	30.126	30.122	30.107	30.079	30.066	29.965	30.020	29.974	30.049
Port Huron, Mich	632.9	29.905	29.924	30.036	30.078	30.030	30.069	30.023	29.987	30.060	29.897	29.957	29.924	29.991
Portland, Me	45.4	29.929	29.913	30.095	30.055	30.055	30.122	30.143	30.007	29.994	29.920	29.986	29.944	30.014
Portland, Oreg	67.0	30.015	29.960	30.018	30.090	30.084	30.073	29.989	30.209	30.113	29.950	30.107	30.075	30.057
Prescott, Ariz	5,339.0	30.145	30.131	30.182	30.181	30.160	30.108	30.116	30.129	30.048	30.101	30.064	30.103	30.122
Punta Rassa, Fla	13.1	30.063	29.970	30.004	29.980	30.138	30.153	30.090	30.144	30.100	30.131	30.016	30.067	30.071
Red Bluff, Cal	338.0	29.818	29.774	29.893	30.009	30.116	30.130	30.140	30.181	30.085	29.979	30.013	29.890	30.002
Rochester, N. Y	588.9	29.926	29.932	30.077	30.109	30.063	30.090	30.072	30.010	30.051	29.900	29.961	29.927	30.010
Roseburg, Oreg	537.0	30.007	29.955	30.018	30.111	30.123	30.135	30.092	30.255	30.143	29.960	30.127	30.087	30.084
Sacramento, Cal	69.6	29.854	29.800	29.912	30.011	30.102	30.130	30.135	30.162	30.077	30.023	30.009	29.901	30.010
Saint Louis, Mo	567.7	29.941	29.959	30.095	30.130	30.108	30.111	30.054	30.073	30.074	29.959	29.965	29.962	30.036
Saint Paul, Minn	810.9	29.807	29.842	29.965	29.945	29.992	30.078	29.919	29.939	30.002	29.824	29.791	29.805	29.909
Salt Lake City, Utah	4,354.5	29.904	29.935	30.003	30.029	30.057	29.943	29.990	30.008	29.931	29.906	29.905	29.900	29.959
San Antonio, Tex	676.7	29.806	29.781	29.901	29.944	29.981	29.961	29.939	30.021	29.966	29.971	29.893	29.921	29.924
San Diego, Cal	67.1	29.934	29.865	29.939	30.015	30.088	30.106	30.092	30.182	30.109	30.121	30.001	29.962	30.034
Sandusky, Ohio	638.5	29.945	29.958	30.074	30.121	30.088	30.108	30.070	30.049	30.086	29.948	29.992	29.961	30.033
Sandy Hook, N. J	29.2	29.986	29.954	30.139	30.153	30.149	30.189	30.188	30.107	30.048	30.009	30.054	29.985	30.080
San Francisco, Cal	60.4	29.934	29.876	29.967	30.045	30.110	30.133	30.143	30.179	30.111	30.061	30.067	29.995	30.052
Santa Fé, N. Mex	6,970.4	29.917	29.911	29.965	29.920	29.846	29.752	29.792	29.774	29.713	29.775	29.772	29.813	29.829
Savannah, Ga	86.9	30.046	30.009	30.100	30.139	30.222	30.203	30.164	30.206	30.101	30.130	30.125	30.083	30.127
Shreveport, La	205.3	29.973	29.936	30.051	30.089	30.129	30.095	30.072	30.134	30.040	29.992	29.954	29.985	30.037
Smithville, N. C	32.7	30.066	30.032	30.139	30.182	30.244	30.208	30.179	30.197	30.107	30.137	30.159	30.091	30.145
Springfield, Ill	644.3	29.968	29.963	30.094	30.129	30.100	30.118	30.043	30.066	30.119	29.953	29.971	29.952	30.040
Springfield, Mass	120.5	29.958	29.948	30.128	30.120	30.122	30.169	30.195	30.084	30.050	29.984	30.039	29.977	30.064
Thatcher's Island, Mass	48.1	30.000	29.949	30.130	30.100	30.090	30.173	30.179	30.044	30.019	29.970	30.028	29.972	30.054
Toledo, Ohio	651.2	29.924	29.943	30.049	30.111	30.047	30.086	30.039	30.017	30.050	29.925	29.955	29.938	30.007
Umatilla, Oreg	384.0	30.004	29.955	30.104	30.244	30.311	30.257	f30.088	30.330	30.220	30.077	30.164	30.090	30.154
Vicksburg, Miss	243.5	30.019	29.976	30.085	30.118	30.183	30.150	30.126	30.170	30.090	30.065	30.008	30.042	30.086
Virginia City, Mont	5,810.0	29.747	29.762	29.806	29.752	29.701	29.542	29.537	29.600	29.587	29.628	29.659	29.708	29.669
Visalia, Cal	348.1	29.796	29.754	29.875	29.985	30.070	30.113	30.112	30.135	30.046	30.015	29.938	29.830	29.972

a Observations commenced January 28, 1880.
b Observations commenced October 27, 1879.
c Twenty-seven days only.
d Fifteen days only.
e Barometer unserviceable.
f Twenty-eight days only.

Monthly and annual mean pressure, &c.—Continued.

Station.	Elevation of cistern of barometer above mean sea-level.	1879.						1880.						Annual mean.
		July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	
	Feet.													
Washington, D. C	105. 6	29. 995	29. 977	30. 150	30. 185	30. 188	30. 190	30. 203	30. 148	30. 094	30. 043	30. 083	30. 025	30. 107
Wilmington, N. C	73. 5	30. 036	30. 004	30. 013	30. 161	30. 220	30. 186	30. 163	30. 178	30. 082	30. 103	30. 132	30. 061	30. 120
Winnemucca, Nev	4, 345. 2	29. 952	29. 953	30. 007	30. 047	30. 059	29. 988	30. 002	30. 039	29. 965	29. 919	29. 960	29. 947	29. 986
Wood's Holl, Mass	34. 4	29. 978	29. 927	30. 126	30. 106	30. 101	30. 164	30. 157	30. 088	30. 014	29. 986	30. 043	29. 970	30. 055
Yankton. Dak	1, 228. 4	29. 844	29. 860	30. 031	29. 979	30. 084	*a*30. 154	30. 003	*b*30. 096	30. 075	29. 899	29. 799	29. 818	29. 970

a Eighteen days only.

b Twenty-four days only.

PAPER 12.

Annual and mean annual pressures, reduced to sea-level, at stations of the Signal Service, United States Army, in operation June 30, 1880, deduced from observations taken at 7 a. m., 2 p. m., and 9 p. m., local time.

[The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m., and twice the 9 p. m. observations by four; the monthly means by divining the sum of the daily means by the number of days in the month.]

Stations.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	Mean.
Albany, N. Y				29.996	30.005	30.079	30.004	29.945	30.034	30.010
Alpena, Mich			29.969	30.017	29.952	29.940	30.000	29.906	30.013	29.971
Atlanta, Ga									30.061	30.061
Atlantic City, N. J				30.076	30.049	30.030	30.042	29.979	30.081	30.043
Augusta, Ga		30.096	30.092	30.112	30.078	30.079	30.068	30.027	30.119	30.084
Baltimore, Md		30.058	30.044	30.077	30.057	30.056	30.061	29.990	30.096	30.055
Barnegat, N. J				30.023	30.024	30.020	30.033	29.979	30.063	30.024
Bismarck, Dak					29.883	29.844	29.843	29.953	30.001	29.905
Boise City, Idaho								30.053	30.103	30.078
Boston, Mass	29.982	29.975	29.987	30.029	29.996	29.973	29.997	29.944	30.022	29.989
Breckenridge, Minn			29.977	29.983	29.989	29.972	29.962	29.899	29.977	29.966
Buffalo, N. Y		29.947	29.946	30.018	29.983	29.962	29.996	29.929	30.011	29.974
Burlington, Vt		29.940	29.971	30.009	29.997	29.968	30.006	29.938	30.001	29.979
Cairo, Ill		30.120	30.023	30.079	30.058	30.057	30.054	29.997	30.109	30.062
Cape Hatteras, N. C					30.049	30.005	29.997	30.020	30.109	30.036
Cape Henry, Va				30.021	30.071	30.046	30.046	29.989	30.094	30.044
Cape Lookout, N. C							30.062	30.017	30.105	30.061
Cape May, N. J		30.051	30.033	30.078	30.054	30.041	30.042	29.993	30.069	30.045
Charleston, S. C		30.078	30.083	30.104	30.095	30.090	30.076	30.057	30.100	30.085
Charlotte, N. C									30.050	30.050
Cheyenne, Wyo		29.981	29.954	29.956	29.943	29.933	29.946	29.943	29.962	29.952
Chicago, Ill		30.041	29.998	30.020	29.983	29.965	29.988	29.928	30.022	29.993
Cincinnati, Ohio		30.119	30.040	30.083	30.010	29.976	29.980	29.959	30.083	30.031
Cleveland, Ohio		30.033	29.970	30.007	29.991	30.002	30.034	29.965	30.051	30.007
Columbus, Ohio									30.043	30.043
Corsicana, Tex					30.003	30.021	30.019	29.971	30.022	30.007
Davenport, Iowa		30.067	29.996	30.040	30.018	29.995	30.024	29.959	30.034	30.017
Denison, Tex								29.962	30.007	29.984
Denver, Colo		30.019	30.004	30.001	29.993	29.993	29.987	29.972	29.985	29.994
Des Moines, Iowa									30.011	30.011
Detroit, Mich		29.999	29.971	30.013	29.983	29.968	29.991	29.932	30.020	29.985
Dodge City, Kans					29.656	29.636	29.641	29.608	29.663	29.641
Dubuque, Iowa				30.040	30.009	29.995	29.996	29.937	30.023	30.000
Duluth, Minn		29.980	29.949	29.988	29.981	29.971	29.974	29.920	29.995	29.970
Eastport, Me				29.951	29.938	29.914	29.955	29.900	29.956	29.936
Erie, Pa				30.010	29.979	29.965	29.995	29.934	30.028	29.985
Escanaba, Mich		29.956	29.929	29.992	29.974	29.954	29.990	29.941	30.009	29.968
Fort Gibson, Ind. T				29.991	29.985	29.984	29.989	29.945	30.013	29.984

Annual and mean annual pressure, &c.—Continued.

Stations.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	Mean.
Fort Saint Michaels, Alaska								29.632	(*)	29.632
Galveston, Tex		30.077	30.060	30.051	30.051	30.067	30.048	29.997	30.055	30.051
Grand Haven, Mich		29.971	29.950	30.046	29.985	29.959	29.991	29.936	30.020	29.982
Indianapolis, Ind		30.043	30.004	30.038	30.005	29.997	30.008	29.946	30.038	30.010
Indianola, Tex			30.051	30.072	30.055	30.061	30.045	29.996	30.054	30.048
Jacksonville, Fla		30.101	30.085	30.097	30.097	30.079	30.066	30.028	30.103	30.082
Keokuk, Iowa		29.987	29.973	30.006	29.975	29.961	29.972	29.917	30.080	29.984
Key West, Fla		30.050	30.060	30.065	30.085	30.064	30.031	30.006	30.060	30.053
Kittykawk, N. C						30.072	30.058	30.010	30.096	30.059
Knoxville, Tenn		30.086	30.061	30.080	30.055	30.068	30.056	30.017	30.101	30.065
La Crosse, Wis			30.011	30.038	29.994	29.967	29.982	29.918	29.997	29.987
Leavenworth, Kans		30.042	29.975	29.995	29.982	29.970	29.977	29.922	29.998	29.983
Los Angeles, Cal								29.955	30.000	29.977
Louisville, Ky		30.058	30.018	30.050	30.027	30.025	30.022	29.965	30.068	30.029
Lynchburg, Va		30.078	30.042	30.094	30.057	30.038	30.043	29.982	30.071	30.051
Madison, Wis									29.997	29.997
Marquette, Mich			29.952	29.988	29.966	29.952	29.965	29.916	29.973	29.959
Memphis, Tenn		30.117	30.061	30.088	30.063	30.071	30.060	30.008	30.092	30.070
Milwaukee, Wis		29.986	29.961	30.054	30.019	29.991	30.025	29.937	30.013	29.998
Mobile, Ala		30.109	30.102	30.096	30.088	30.089	30.066	30.032	30.093	30.084
Montgomery, Ala			30.091	30.103	30.095	30.099	30.072	30.028	30.094	30.083
Morgantown, W. Va				30.042	30.017	30.010	30.027	29.963	30.049	30.018
Mount Washington, N. H		29.909	29.926	29.964	29.945	29.958	30.018	29.972	29.988	29.960
Nashville, Tenn		30.134	30.056	30.076	30.041	30.041	30.049	30.004	30.093	30.062
New Haven, Conn			30.009	30.068	30.037	30.005	30.019	29.966	30.045	30.021
New London, Conn		29.994	30.020	30.061	30.037	30.009	30.025	29.971	30.051	30.021
New Orleans, La		30.075	30.068	30.077	30.071	30.075	30.049	30.006	30.072	30.062
Newport, R. I						29.993	30.013	29.955	30.040	30.000
New York, N. Y		29.999	30.033	30.070	30.047	30.024	30.041	29.986	30.068	30.033
Norfolk, Va		30.058	30.054	30.100	30.070	30.059	30.061	30.012	30.097	30.064
North Platte, Nebr					29.616	29.604	29.611	29.597	29.636	29.613
Olympia, Wash								29.977	29.995	29.986
Omaha, Nebr		29.943	29.970	29.983	29.981	29.956	29.945	29.883	29.943	29.950
Oswego, N. Y		29.950	29.992	30.032	30.008	29.989	30.021	29.952	30.035	29.997
Pembina, Dak				29.980	(*)	29.976	29.980	29.922	29.966	29.965
Philadelphia, Pa		30.046	30.041	30.089	30.059	30.037	30.048	29.987	30.075	30.048
Pike's Peak, Colo				29.958	29.939	29.953	29.956	29.951	29.988	29.957
Pioche, Nev								29.803	(*)	29.803
Pittsburgh, Pa		30.003	29.994	30.039	30.005	29.993	30.005	29.949	30.052	30.005
Port Huron, Mich					29.990	29.968	29.992	29.922	30.004	29.975
Portland, Me		29.970	29.920	29.959	30.077	29.964	29.976	29.922	29.986	29.972
Portland, Oreg		30.102	30.107	30.076	30.117	30.032	30.079	30.065	30.064	30.080
Punta Rassa, Fla		30.076	30.079	30.092	30.110	30.083	30.052	30.027	30.077	30.074
Red Bluff, Cal								29.943	29.991	29.967
Rochester, N. Y		29.948	29.960	30.011	29.990	29.960	29.992	29.923	30.020	29.975

Roseburg, Oreg	....	....	....	....	....	....	....	30.041	30.081	30.061
Sacramento, Cal	....	....	....	....	....	....	....	29.956	30.006	29.981
Saint Louis, Mo	....	30.034	30.016	30.063	30.040	30.027	30.029	29.976	30.063	30.031
Saint Mark's, Fla	....	....	....	....	30.094	30.089	30.062	30.026	(*)	30.068
Saint Paul, Minn	....	....	29.955	29.958	29.942	29.936	29.937	29.876	29.956	29.937
Salt Lake City, Utah	....	....	....	29.977	29.971	29.959	29.959	29.962	29.963	29.965
San Antonio, Tex	....	....	....	....	....	....	....	....	29.865	29.865
San Diego, Cal	....	30.020	29.990	30.010	30.030	30.017	29.999	30.001	30.027	30.012
Sandusky, Ohio	....	....	....	....	....	....	....	29.965	30.052	30.008
Sandy Hook, N. J	....	....	....	30.060	30.028	29.999	30.033	29.978	30.059	30.026
San Francisco, Cal	....	30.047	30.040	30.028	30.037	30.017	30.005	29.987	30.043	30.025
Santa Fé, N. Mex	....	29.833	29.814	29.756	29.753	29.796	29.809	29.799	29.843	29.800
Savannah, Ga	....	30.090	30.097	30.116	30.094	30.092	30.075	30.035	30.114	30.089
Shreveport, La	....	30.057	30.055	30.033	30.067	30.098	30.065	29.998	30.053	30.053
Smithville, N. C	....	....	....	....	....	30.086	30.077	30.050	30.130	30.086
Springfield, Mass	....	....	....	....	30.016	29.989	29.987	29.913	30.037	29.988
Thatcher's Island, Mass	....	....	....	....	....	29.974	29.999	29.944	30.053	29.992
Toledo, Ohio	....	30.004	29.980	30.038	29.986	29.960	30.005	29.931	30.023	29.991
Umatilla, Oreg	....	....	....	....	....	....	....	30.135	30.151	30.143
Vicksburg, Miss	....	....	30.110	30.125	30.128	30.102	30.081	30.035	30.102	30.098
Virginia City, Mont	....	29.753	(*)	29.694	29.702	29.697	29.719	29.706	29.688	29.708
Visalia, Cal	....	....	....	....	....	....	....	29.982	29.981	29.981
Washington, D. C	30.059	30.052	30.044	30.091	30.066	30.052	30.060	30.006	30.090	30.058
Wilmington, N. C	....	30.090	30.073	30.108	30.084	30.078	30.064	30.022	30.102	30.078
Winnemucca, Nev	....	....	....	....	....	....	....	29.985	29.999	29.992
Wood's Holl, Mass	....	....	30.020	30.056	30.027	30.003	30.024	29.956	29.955	30.006
Yankton, Dak	....	....	....	30.022	30.027	30.009	30.002	29.953	(*)	30.003

* Data incomplete.

PAPER 13.

Monthly and annual mean temperature, July, 1879, *to June,* 1880, *inclusive, deduced from observations taken at* 7 *a. m.,* 2 *p. m., and* 9 *p. m.* (*local time*).

[The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m., and twice the 9 p. m. observations by four; the monthly means by dividing the sum of the daily means by the number of days in the month.]

Stations.	Elevation of thermometer above ground.	1879.						1880.						Annual mean.
		July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	
	Feet.	°	°	°	°	°	°	°	°	°	°	°	°	°
Albany, N. Y	51	71.2	68.0	59.8	56.1	37.5	28.4	31.0	28.6	32.9	49.8	66.4	71.9	50.1
Alpena, Mich	54	69.3	64.9	55.4	53.9	32.9	22.2	29.2	22.6	25.3	38.3	55.5	62.4	44.3
Atlanta, Ga	77	80.1	73.7	69.3	64.0	50.5	51.6	54.4	50.6	56.1	63.0	71.9	76.9	63.5
Atlantic City, N. J	10	69.7	70.9	64.2	60.3	44.4	41.4	41.1	38.2	40.1	49.3	63.1	69.3	54.3
Augusta, Ga	18	82.7	78.7	73.3	69.2	57.0	55.3	56.5	55.1	59.9	66.1	73.4	81.0	67.3
Baltimore, Md	33	78.6	76.3	64.9	63.1	46.4	41.8	43.1	41.7	43.2	55.4	71.1	75.3	58.4
Barnegat, N. J	5	69.2	70.4	63.9	59.2	42.8	39.7	40.6	37.0	39.2	47.9	62.0	68.7	53.4
Bismarck, Dak	16	70.6	67.1	55.1	48.7	28.2	—1.2	14.8	14.7	19.7	36.4	59.5	64.1	39.8
Boise City, Idaho	19	75.5	76.4	67.5	49.8	37.5	31.6	38.3	32.8	38.0	49.7	55.0	66.5	51.5
Boston, Mass	156	69.9	67.7	60.8	56.6	39.2	32.6	35.0	32.2	33.1	45.9	62.7	67.7	50.3
Brackettville, Tex	6	86.3	82.2	77.5	70.0	*a*61.1	56.3	58.1	54.3	60.4	71.8	(*b*)	*c*84.2	
Breckenridge, Minn	6	70.8	66.5	52.9	53.3	26.3	—3.0	11.6	9.3	15.4	37.5	60.3	65.5	38.9
Buffalo, N. Y	72	71.9	68.4	59.8	58.3	39.0	30.9	36.9	30.1	30.8	43.1	59.7	66.7	49.6
Burlington, Vt	55	70.3	67.0	59.1	54.7	35.0	23.6	30.0	25.4	27.5	43.6	61.5	68.1	47.1
Cairo, Ill	44	82.5	75.8	67.0	65.3	52.6	40.8	51.6	45.7	50.1	63.0	73.4	77.0	62.1
Cape Hatteras, N. C	7	77.5	76.4	70.6	68.0	55.4	56.3	53.4	51.4	52.7	59.1	69.2	74.3	63.7
Cape Henry, Va	16	76.6	75.1	69.8	66.0	52.5	51.7	49.5	48.0	49.2	58.5	70.2	74.8	61.8
Cape Lookout, N. C	18	78.9	77.5	72.4	69.2	55.1	56.0	54.0	53.0	55.4	60.8	70.6	75.7	64.9
Cape May, N. J	19	72.8	72.5	67.1	63.9	48.3	44.8	*d*43.6						
Cedar Keys, Fla	20						*e*63.6	63.6	60.7	69.0	71.4	76.2	80.8	
Charleston, S. C	40	84.1	80.6	75.0	70.6	58.7	58.3	58.2	56.4	61.2	67.0	73.7	80.6	68.7
Charlotte, N. C	35	79.1	74.0	68.2	65.1	52.1	49.7	50.7	49.1	51.5	61.8	71.7	76.6	62.5
Chattanooga, Tenn	42	81.2	73.2	68.0	64.0	52.2	49.6	52.0	48.4	54.2	62.4	71.5	75.7	62.7
Cheyenne, Wyo	15	69.9	65.8	58.0	46.1	35.4	25.8	30.5	24.0	27.6	41.4	53.8	62.5	45.1
Chicago, Ill	69	76.0	73.0	61.5	60.5	42.1	30.4	40.1	35.1	38.8	49.0	64.5	70.2	53.4
Chincoteague, Va	29										*f*51.6	64.6	70.6	
Cincinnati, Ohio	67	81.3	73.3	64.1	64.8	48.4	41.5	48.7	42.9	45.7	58.0	70.8	74.8	59.5
Cleveland, Ohio	78	73.7	70.2	60.7	59.6	41.3	33.1	39.4	34.2	34.5	49.1	66.7	69.4	52.7
Columbus, Ohio	52	79.6	72.0	62.1	62.9	44.4	37.2	44.1	39.1	41.1	54.2	69.6	73.4	56.6
Corsicana, Tex	18	88.1	83.1	79.9	70.1	62.0	50.6	59.2	53.6	58.3	69.6	76.6	80.5	69.3
Davenport, Iowa	46	76.9	72.0	60.7	59.9	40.1	24.1	37.6	34.0	37.2	50.4	68.2	72.9	52.9
Deadwood, Dak	16	67.9	66.0	53.1	(*g*)	32.9	*h*16.3	30.6	24.7	26.1	38.2	53.0	60.1	

Delaware Breakwater, Del	13								*i*41.8	43.1	52.0	65.8	70.7	
Denison, Tex	17	85.6	80.3	77.8	67.7	57.3	44.2	54.9	50.5	54.1	68.0	75.3	76.8	66.0
Denver, Colo	45	74.0	70.2	62.6	52.1	38.4	28.4	36.2	28.2	35.3	48.6	58.9	68.7	50.1
Des Moines, Iowa	33	77.7	73.4	60.4	59.7	39.3	21.4	38.2	32.3	38.0	50.5	68.5	71.8	52.6
Detroit, Mich	76	73.2	69.6	58.4	58.9	39.0	29.4	37.0	32.3	33.2	46.1	64.2	69.1	50.9
Dodge City, Kans	15	80.4	75.6	66.2	59.5	40.8	25.3	38.2	34.4	40.2	54.8	68.2	74.7	54.9
Dubuque, Iowa	32	76.2	71.8	59.8	59.0	37.7	20.8	34.4	29.2	35.6	49.3	67.4	71.1	51.0
Duluth, Minn	19	67.8	67.1	54.1	50.8	29.9	8.2	22.4	15.3	21.4	38.3	51.2	59.7	40.5
Eastport, Me	32	60.2	59.4	55.1	49.2	34.9	23.9	27.4	24.7	25.6	38.1	48.1	56.4	41.9
Erie, Pa	31	73.3	69.7	60.6	59.5	42.1	34.9	40.0	34.3	33.9	47.5	64.8	69.9	52.5
Escanaba, Mich	25	69.0	65.8	54.6	52.2	30.9	17.4	25.8	19.9	22.6	37.1	55.0	63.7	42.8
Fort Gibson, Ind. T	19	85.3	78.3	74.4	65.0	52.9	38.0	50.4	45.2	50.3	63.9	73.9	75.2	62.7
Galveston, Tex	36	84.4	81.3	79.3	73.2	66.4	59.7	64.6	58.2	63.7	71.4	77.7	81.5	71.7
Grand Haven, Mich	23	72.9	68.5	58.2	57.8	39.4	28.9	37.3	32.2	34.2	44.8	61.2	67.0	50.2
Indianapolis, Ind	47	80.0	70.3	62.7	62.6	45.8	35.9	45.7	39.0	42.0	55.5	69.1	74.1	56.9
Indianola, Tex	29	85.2	82.2	79.7	73.2	66.9	59.8	65.1	57.7	62.3	72.7	78.0	82.9	72.1
Jacksonville, Fla	37	83.4	81.3	76.8	73.4	63.5	62.6	62.1	61.3	68.3	71.9	73.9	81.0	71.6
Keokuk, Iowa	46	80.8	75.4	64.2	62.1	42.9	27.1	41.4	36.7	40.1	54.8	69.6	74.7	55.8
Key West, Fla	42	84.4	84.7	82.5	79.8	74.0	74.2	73.1	73.1	76.3	76.8	79.1	83.4	78.4
Kittyhawk, N. C	4	76.4	75.5	70.0	66.7	52.4	53.5	50.4	49.5	50.0	57.9	66.1	74.1	61.9
Knoxville, Tenn	72	79.5	73.2	68.0	64.4	49.7	47.5	49.9	45.9	64.7	60.9	71.6	75.6	61.5
La Crosse, Wis	37	74.9	71.3	58.6	58.6	35.2	17.7	33.1	25.9	33.1	47.1	65.8	70.4	49.3
La Mesilla, N. Mex	5	79.0	78.1	74.6	61.6	48.6	44.4	45.5	42.8	52.2	61.1	71.5	79.6	61.6
Leavenworth, Kans	34	79.8	77.6	65.9	62.1	44.6	26.7	41.4	37.9	42.9	56.4	71.0	74.7	56.7
Little Rock, Ark	26	83.4	75.3	70.8	65.4	56.5	48.3	55.1	49.7	54.2	65.4	74.7	76.7	64.6
Los Angeles, Cal	37	66.6	69.0	66.8	63.4	54.9	51.5	50.5	49.1	50.5	55.2	61.3	62.9	58.5
Louisville, Ky	89	81.7	74.1	64.4	64.9	49.7	41.8	50.1	44.7	46.5	59.6	71.8	75.5	60.4
Lynchburg, Va	30	80.9	75.7	65.3	62.9	47.7	45.9	45.6	44.7	47.7	60.3	72.7	75.7	60.4
Madison, Wis	32	74.3	70.6	59.0	58.0	37.0	21.1	34.5	28.2	33.6	46.6	65.5	69.6	49.8
Marquette, Mich	34	68.7	66.7	56.2	56.2	31.9	18.5	28.5	21.5	25.4	38.6	57.2	62.0	44.3
Memphis, Tenn	53	83.6	75.4	69.7	65.6	54.4	46.4	54.6	47.4	52.5	64.8	75.0	77.0	63.9
Milwaukee, Wis	105	71.8	69.4	58.6	55.6	36.8	23.5	34.7	28.6	33.0	44.9	61.5	67.8	48.8
Mobile, Ala	31	81.7	78.6	75.8	69.7	60.5	56.4	59.4	56.5	64.5	69.2	75.3	80.2	69.0
Montgomery, Ala	34	82.4	77.6	73.8	68.1	58.6	54.4	58.0	54.2	62.0	67.5	76.7	80.1	67.8
Morgantown, W. Va	10	76.3	70.3	62.4	60.8	47.0	45.0	47.9	41.8	43.4	56.0	68.2	71.1	57.5
Mount Washington, N. H	*j*28	47.6	45.4	38.3	35.4	17.1	13.3	18.2	10.1	8.6	22.7	39.0	44.9	28.4
Nashville, Tenn	34	83.5	75.9	68.2	66.7	52.4	47.8	53.1	45.6	51.7	63.5	74.2	77.9	63.4
New Haven, Conn	105	73.2	69.6	62.0	59.0	42.3	36.1	37.7	35.8	36.7	49.3	64.3	70.5	53.0
New London, Conn	28	70.6	68.9	62.0	58.4	41.5	36.4	37.7	34.4	35.9	46.7	61.3	68.1	51.8
New Orleans, La	45	83.0	81.0	78.5	72.4	64.9	59.8	63.2	60.4	65.7	71.2	76.6	80.1	71.4
Newport, R. I	19	69.5	68.0	62.4	58.4	42.3	37.1	38.3	35.8	36.7	45.5	58.4	66.9	51.6
New York, N. Y	148	73.5	71.1	63.4	60.4	43.3	37.5	39.9	36.6	37.3	49.0	65.5	70.9	54.0
Norfolk, Va	44	78.9	75.7	69.0	65.0	50.6	50.2	49.0	48.9	48.5	60.0	73.4	76.6	62.1
North Platte, Nebr	19	73.7	71.9	60.1	54.7	35.4	14.9	31.9	29.6	32.6	48.8	63.6	69.6	48.9
Olympia, Wash	23	60.7	62.7	57.0	47.9	42.0	37.6	36.6	36.7	39.7	46.9	50.7	57.9	48.0
Omaha, Nebr	59	78.7	75.5	62.9	62.0	40.5	17.8	34.9	31.4	36.5	52.3	70.1	73.4	53.0
Oswego, N. Y	35	70.6	67.6	59.2	57.3	40.4	32.4	36.2	31.9	32.8	45.7	61.9	67.0	50.2

a Twenty-one days only.
b Local observations discontinued May 4, 1880.
c Local observations recommenced June 14, 1880.
d Local observations discontinued January 31, 1880.
e Station opened November 7, 1879.
f Station opened March 16, 1880.
g Data incomplete.
h Twenty-nine days only.
i Observations commenced January 28, 1880.
j Twenty-eight feet below summit of Mt. Washington.

Monthly and annual mean temperature, July, 1879, to June, 1880, inclusive, &c.—Continued.

Stations.	Elevation of thermometer above ground.	1879.						1880.						Annual mean.
		July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	
	Feet.	°	°	°	°	°	°	°	°	°	°	°	°	°
Pembina, Dak	4	67.0	62.8	49.9	44.7	20.8	—14.5	0.6	—1.0	8.5	31.2	56.1	62.6	32.4
Pensacola, Fla	20	......	......	......	(a)	b60.9	57.9	60.4	58.2	65.8	69.6	74.5	80.2	......
Philadelphia, Pa	99	75.6	72.7	64.4	61.7	44.7	38.3	41.0	39.1	39.6	52.4	68.8	73.8	56.0
Pike's Peak, Colo	5	43.1	39.2	35.8	26.3	12.5	3.5	6.4	—0.3	5.3	13.1	24.3	37.3	20.5
Pioche, Nev	5	75.4	74.1	69.2	51.4	38.9	30.2	30.2	27.0	34.6	45.5	57.4	68.8	50.2
Pittsburgh, Pa	88	75.6	71.2	61.7	60.7	43.2	38.9	44.1	38.2	39.9	54.0	69.6	71.9	55.7
Port Huron, Mich	80	71.3	68.0	57.1	56.9	36.8	27.4	34.9	30.2	31.0	44.5	60.4	66.3	48.7
Portland, Oreg	45	66.1	68.0	63.7	51.9	43.6	38.9	41.9	38.1	41.4	50.3	53.9	60.4	51.5
Portland, Me	28	68.0	63.9	59.9	55.6	38.5	29.2	32.3	30.1	33.7	45.4	59.5	65.6	48.5
Prescott, Ariz	4	76.6	75.3	71.4	55.5	42.4	35.5	34.3	28.5	42.0	51.0	62.0	70.7	53.8
Punta Rassa, Fla	14	81.2	81.3	79.3	77.0	69.5	70.4	68.3	68.6	73.0	74.2	76.1	80.1	74.9
Red Bluff, Cal	21	82.6	83.8	77.2	63.1	50.8	44.6	44.8	46.6	50.3	56.4	65.2	76.0	61.8
Rochester, N. Y	100	72.0	68.7	59.6	57.9	38.6	30.8	36.4	30.5	31.2	45.5	64.7	68.5	50.4
Roseburg, Oreg	20	66.5	67.9	62.8	51.0	42.2	39.1	41.4	37.2	40.3	49.2	53.7	60.6	51.0
Sacramento, Cal	38	72.8	74.9	70.4	61.0	50.8	43.7	43.3	46.1	49.2	55.4	63.4	68.8	58.3
Saint Louis, Mo	104	80.9	75.0	65.0	62.5	47.1	32.8	45.9	39.9	43.6	58.2	70.3	74.3	58.0
Saint Paul, Minn	32	73.5	70.2	57.1	57.2	32.6	11.9	26.1	20.9	29.2	45.2	63.1	68.0	46.2
Salt Lake City, Utah	53	78.4	76.2	68.8	51.8	36.6	29.8	28.8	26.9	33.7	47.1	55.1	67.5	50.1
San Antonio, Tex	19	87.2	83.1	78.6	71.8	66.1	59.2	62.4	56.7	61.6	71.9	77.8	83.5	71.7
San Diego, Cal	19	65.6	68.9	66.3	62.3	55.7	53.3	51.7	50.4	52.2	57.0	61.3	63.1	59.0
Sandusky, Ohio	54	75.1	71.7	61.0	60.4	42.7	34.5	40.9	36.3	37.3	49.2	67.6	71.6	54.0
Sandy Hook, N. J	28	72.7	71.9	64.4	60.6	44.3	38.3	39.9	36.8	38.0	49.5	65.0	71.3	54.4
San Francisco, Cal	48	58.0	59.6	60.5	60.1	54.6	49.6	47.8	48.5	48.8	52.8	57.5	56.1	54.5
Santa Fé, N. Mex	21	69.7	68.3	62.7	49.9	37.2	28.7	30.7	26.4	34.6	45.8	58.6	67.7	48.4
Savannah, Ga	41	83.6	79.8	74.2	70.5	59.8	58.6	59.0	57.7	64.2	68.9	73.7	81.9	69.3
Shreveport, La	24	85.2	78.8	75.2	68.9	61.0	54.8	60.4	53.2	59.1	69.8	77.1	79.3	68.6
Smithville, N. C	27	80.2	77.8	71.6	68.8	54.9	55.4	55.4	53.4	57.7	63.7	72.8	78.4	65.8
Springfield, Ill	39	81.6	74.7	60.9	61.9	44.7	31.7	43.8	38.2	42.3	56.8	68.6	74.4	56.6
Springfield, Mass	54	72.6	68.4	60.9	57.7	40.5	32.5	34.1	31.9	34.7	48.9	64.9	70.2	51.4
Thatcher's Island, Mass	7	64.9	65.5	59.8	55.3	40.6	35.1	36.8	32.4	34.1	44.0	57.1	64.7	49.2
Toledo, Ohio	63	75.7	71.4	60.5	61.0	42.5	33.6	40.5	36.5	38.4	50.9	68.1	72.3	54.3
Umatilla, Oreg	7	73.3	75.5	68.6	51.7	37.6	30.5	c40.6	34.3	41.8	52.8	57.9	67.5	52.7
Unalaska, Alaska	15	......	......	d41.8	37.9	31.3	30.3	29.2	31.4	33.2	33.8	(e)	......	......
Vicksburg, Miss	32	83.1	78.0	74.3	68.4	60.3	55.6	59.8	54.5	60.5	68.5	76.2	78.4	68.1
Virginia City, Mont	24	66.0	66.8	58.1	42.4	28.8	13.9	24.1	17.8	21.4	35.3	43.1	54.7	39.4
Visalia, Cal	22	81.2	83.5	74.7	60.2	49.5	44.9	42.4	45.8	49.4	57.3	65.8	74.8	60.8

Washington, D. C.	....	78.4	74.2	64.6	62.5	45.8	41.5	42.0	41.3	42.2	55.7	70.9	74.8	57.8
Wilmington, N. C.	52	79.2	76.8	71.2	67.5	55.1	55.9	55.3	53.3	56.2	63.5	70.9	76.6	65.1
Winnemucca, Nev	19	73.7	73.7	66.8	48.1	34.0	29.8	32.2	29.6	32.8	44.4	52.4	65.8	48.6
Wood's Holl, Mass	6	68.2	67.7	62.9	58.1	43.7	39.1	39.0	36.1	36.8	45.2	56.9	65.1	51.6
Yankton, Dak	20	75.9	73.4	60.7	59.0	34.3	*f* 11.8	28.3	*g* 24.6	31.2	47.4	67.4	71.1	48.8

[a] Observations commenced October 27, 1879.
[b] Twenty-seven days only.
[c] Twenty-eight days only.
[d] Observations recommenced September 17, 1879.
[e] Reports not yet received.
[f] Eighteen days only.
[g] Twenty-four days only.

PAPER 14.

Annual and mean annual temperature at stations of observation of the Signal Service, United States Army, in operation on June 30, 1880, *deduced from observations taken at 7 a. m., 2 p. m., and 9 p. m., local time.*

[The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m., and twice the 9 p. m. observations by four; the monthly means by dividing the daily means by the number of days in the month.]

Stations.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	Mean.
	°	°	°	°	°	°	°	°	°	°
Albany, N. Y	......	......	......	46.4	43.8	47.2	48.3	48.8	47.0	46.9
Alpena, Mich	......	......	39.9	41.4	37.6	40.9	43.6	48.4	42.2	42.0
Atlanta, Ga	......	......	......	......	......	......	......	......	61.8	61.8
Atlantic City, N. J	......	......	......	51.7	49.3	51.1	52.6	53.2	51.5	51.6
Augusta, Ga	......	62.0	63.0	64.8	63.5	63.9	64.7	65.2	65.3	64.0
Baltimore, Md	......	55.9	54.8	55.6	53.3	55.1	56.6	57.1	55.9	55.5
Barnegat, N. J	......	......	......	50.5	49.1	50.9	52.0	52.4	50.7	50.9
Bismarck, Dak	......	......	......	......	35.3	36.8	42.3	45.1	39.6	39.8
Boise City, Idaho	......	......	......	......	......	......	......	53.1	52.3	52.7
Boston, Mass	49.6	48.4	48.3	48.8	46.3	47.3	49.5	49.5	48.0	48.4
Breckenridge, Minn	......	......	36.5	38.0	36.2	35.7	40.5	43.5	38.9	38.5
Buffalo, N. Y	48.7	47.6	46.1	46.2	42.9	46.1	48.0	48.8	46.6	46.8
Burlington, Vt	......	43.1	43.7	44.3	41.9	45.1	48.0	47.8	44.5	44.8
Cairo, Ill	......	56.4	56.7	59.0	55.3	57.2	58.8	60.4	59.7	57.9
Cape Hatteras, N. C	......	......	......	......	60.8	61.5	61.3	61.9	60.6	61.2
Cape Henry, Va	......	......	......	59.9	57.6	57.6	58.6	59.7	58.9	58.7
Cape Lookout, N. C	......	......	......	......	......	......	63.0	63.8	62.4	63.1
Cape May, N. J	......	51.6	51.9	52.6	50.5	53.6	54.9	56.0	54.3	53.2
Charleston, S. C	......	64.4	64.9	66.4	65.0	65.7	66.4	66.9	66.9	65.8
Charlotte, N. C	......	......	......	......	......	......	......	......	60.7	60.7
Chattanooga, Tenn	......	......	......	......	......	......	......	......	61.0	61.0
Cheyenne, Wyo	......	43.7	45.3	45.8	42.7	44.5	44.5	44.6	46.7	44.7
Chicago, Ill	......	46.9	48.4	50.4	45.4	49.1	50.5	51.7	50.2	49.1
Cincinnati, Ohio	......	54.6	52.6	57.6	53.2	55.5	56.7	57.2	56.7	55.5
Cleveland, Ohio	50.4	48.1	48.8	50.3	46.0	48.2	50.3	50.9	49.3	49.1
Columbus, Ohio	......	......	......	......	......	......	......	......	53.7	53.7
Corsicana, Tex	......	......	......	......	64.0	64.9	64.5	66.1	68.4	65.6
Davenport, Iowa	......	49.1	49.2	49.9	45.7	49.0	51.0	52.4	50.2	49.6
Denison, Tex	......	......	......	......	......	......	......	63.7	64.9	64.3
Denver, Colo	......	47.9	48.0	50.0	48.8	49.7	48.8	49.5	51.0	49.2
Des Moines, Iowa	......	......	......	......	......	......	......	......	50.1	50.1
Detroit, Mich	47.7	46.0	46.4	48.4	44.5	47.4	49.3	49.8	48.1	47.5
Dodge City, Kans	......	......	......	......	52.2	53.4	53.2	54.7	54.3	53.6
Dubuque, Iowa	......	......	......	49.0	44.6	47.8	49.9	50.7	48.9	48.5
Duluth, Minn	42.[illegible]	38.5	38.3	39.8	36.4	38.2	43.5	45.3	39.8	40.2
Eastport, Me	......	......	......	41.3	38.8	40.7	42.8	43.2	40.9	41.3
Erie, Pa	......	......	......	49.9	46.0	48.8	50.3	51.7	49.4	49.3
Escanaba, Mich	......	39.9	40.6	40.5	36.3	39.8	42.6	44.6	41.1	40.7
Fort Gibson, Ind. T	......	......	......	60.9	58.3	59.3	59.0	60.7	62.3	60.1
Fort Saint Michaels, Alaska	......	......	......	......	......	......	......	26.0	(*a*)	26.0
Galveston, Tex	......	69.4	69.5	70.4	68.0	69.9	69.0	70.1	70.6	69.6
Grand Haven, Mich	......	44.4	45.3	47.5	43.5	47.2	49.0	50.3	48.0	46.9
Indianapolis, Ind	......	51.3	52.1	55.0	50.5	53.2	54.6	55.4	54.0	53.3
Indianola, Tex	......	......	69.8	70.6	69.4	70.0	69.6	70.9	71.4	70.2
Jacksonville, Fla	......	68.2	68.1	69.8	69.1	68.8	69.3	69.4	69.6	69.0
Keokuk, Iowa	......	51.6	50.2	53.0	49.0	51.3	53.1	55.0	53.3	52.1
Key West, Fla	......	77.0	77.0	77.8	77.9	77.2	77.1	77.0	76.9	77.2
Kittyhawk, N. C	......	......	......	......	......	59.1	59.4	60.0	59.2	59.4
Knoxville, Tenn	......	55.5	56.6	57.9	55.6	55.9	57.4	57.8	51.1	56.0
La Crosse, Wis	......	......	43.6	47.7	43.4	45.7	48.9	51.2	47.7	46.9
Leavenworth, Kans	......	52.4	52.6	54.3	44.4	53.2	54.1	55.6	54.8	52.7
Los Angeles, Cal	......	......	......	......	......	......	......	60.8	60.1	60.4
Louisville, Ky	......	54.9	56.0	57.7	54.4	56.2	57.8	58.0	57.6	56.6
Lynchburg, Va	......	55.1	54.9	56.9	55.3	57.3	59.5	59.3	58.8	57.1
Madison, Wis	......	......	......	......	......	......	......	......	47.9	47.9
Marquette, Mich	......	38.6	40.7	41.0	36.9	40.6	44.3	46.3	42.9	41.4
Memphis, Tenn	......	59.2	59.0	62.4	59.6	60.3	61.1	62.2	61.9	60.7
Milwaukee, Wis	46.1	43.7	44.2	46.0	40.8	44.1	45.9	48.6	46.4	45.1
Mobile, Ala	......	65.1	66.1	68.0	66.7	66.1	67.1	67.6	67.1	66.7
Montgomery, Ala	......	......	63.8	66.3	65.5	64.9	65.6	65.9	66.0	65.4
Morgantown, W. Va	......	......	......	53.8	51.4	52.9	53.9	54.4	55.2	53.6
Mount Washington, N. H	......	29.0	25.5	25.9	23.4	26.0	27.7	28.1	25.8	26.4
Nashville, Tenn	......	58.4	59.5	61.7	58.5	59.1	59.9	60.2	61.1	59.8
New Haven, Conn	......	......	47.8	49.4	48.4	51.0	52.8	52.8	51.0	50.5
New London, Conn	......	48.1	47.5	48.4	47.3	49.7	51.4	51.5	49.6	49.2
New Orleans, La	......	67.6	68.3	70.5	68.9	68.6	68.6	69.2	69.9	68.9
Newport, R. I	......	......	......	......	......	49.0	50.6	51.2	49.5	50.1
New York, N. Y	51.7	51.4	50.0	51.0	48.9	51.0	52.8	52.6	51.5	51.2
Norfolk, Va	......	57.3	58.4	57.9	57.6	60.3	59.0	60.0	59.4	58.7
North Platte, Nebr	......	......	......	......	46.7	48.1	48.0	49.4	48.1	48.1
Olympia, Wash	......	......	......	......	......	......	......	50.5	49.0	49.7
Omaha, Nebr	......	48.3	48.8	50.3	46.5	48.6	51.2	52.9	51.8	49.8
Oswego, N. Y	45.7	46.3	46.1	46.8	44.2	47.0	48.8	51.2	48.0	47.1

a No reports received.

Annual and mean annual temperature at stations of observation, &c.—Continued.

Stations.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	Mean.
	°	°	°	°	°	°	°	°	°	°
Pembina, Dak	......	......	......	36.7	(*b*)	31.6	37.2	40.8	33.2	35.9
Philadelphia, Pa	53.8	52.0	54.4	52.6	50.3	52.6	54.2	54.7	53.6	53.1
Pike's Peak, Colo	......	......	......	19.0	18.2	19.0	18.4	18.7	22.4	19.3
Pioche, Nev	......	......	......	......	......	......	......	51.4	52.5	51.9
Pittsburgh, Pa	......	50.7	51.2	52.5	49.5	51.9	53.5	53.5	52.4	51.9
Port Huron, Mich	......	......	......	......	41.9	45.0	46.7	48.1	45.6	45.5
Portland, Me	......	43.6	43.9	45.0	43.9	46.3	50.0	49.1	46.7	46.1
Portland, Oreg	......	52.1	52.8	53.7	53.6	53.1	54.3	53.8	52.5	53.2
Punta Rassa, Fla	......	73.4	72.6	74.0	74.0	73.4	74.0	73.5	73.3	73.5
Red Bluff, Cal	......	......	......	......	......	......	......	63.9	63.3	63.6
Rochester, N. Y	47.3	44.7	45.5	46.9	44.1	46.9	48.9	50.0	47.6	46.9
Roseburg, Oreg	......	......	......	......	......	......	......	52.8	52.0	52.4
Sacramento, Cal	......	......	......	......	......	......	......	61.3	60.5	60.9
Saint Louis, Mo	......	54.3	54.1	56.8	53.2	55.4	56.6	57.6	55.9	55.5
Saint Mark's, Fla	......	......	......	......	66.8	65.8	66.4	66.1	(*c*)	66.3
Saint Paul, Minn	45.2	(*b*)	41.6	43.6	39.3	39.6	46.7	48.5	45.7	43.8
Salt Lake City, Utah	......	......	......	......	52.9	51.5	51.9	52.2	53.3	52.4
San Diego, Cal	......	60.2	60.6	59.5	61.6	60.8	62.1	60.3	60.0	60.6
Sandusky, Ohio	......	......	......	......	......	......	......	52.2	51.0	51.6
San Francisco, Cal	......	56.0	55.7	55.4	55.5	56.2	57.0	56.4	56.1	56.0
Sandy Hook, N. J	......	......	......	50.0	49.2	52.0	53.4	53.5	51.7	51.6
Santa Fé, N. Mex	......	48.3	48.9	49.0	48.6	48.1	48.3	47.6	50.6	48.7
Savannah, Ga	......	65.0	65.5	66.7	66.0	66.7	67.2	67.9	67.5	66.6
Shreveport, La	......	64.2	64.9	66.9	65.2	65.3	65.1	66.1	67.4	65.6
Smithville, N. C	......	......	......	......	......	63.2	63.1	63.6	63.7	63.4
Springfield, Mass	......	......	......	......	46.4	49.8	51.5	51.7	49.1	49.7
Thatcher's Island, Mass	......	......	......	......	......	46.1	48.1	48.5	47.0	47.4
Toledo, Ohio	49.2	48.7	49.5	51.3	47.9	50.3	52.2	53.1	51.6	50.4
Umatilla, Oreg	......	......	......	......	......	......	......	55.1	52.4	53.7
Vicksburg, Miss	......	65.5	66.0	66.9	64.9	64.8	65.1	66.2	66.7	65.8
Virginia City, Mont	......	39.3	(*b*)	40.0	39.4	40.7	40.5	42.5	41.9	40.6
Visalia, Cal	......	......	......	......	......	......	......	62.1	63.1	62.6
Washington, D. C	54.8	55.2	55.1	56.1	52.5	54.6	55.8	56.1	55.4	55.1
Wilmington, N. C	......	62.3	63.2	64.2	61.8	62.0	62.7	63.1	62.9	62.8
Winnemucca, Nev	......	......	......	......	......	......	......	50.1	49.6	49.8
Wood's Holl, Mass	......	......	47.0	47.8	46.4	49.0	50.4	50.8	48.9	48.6
Yankton, Dak	......	......	......	47.0	40.7	43.5	47.5	48.4	(*b*)	45.4

b Data incomplete.

c Station closed.

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Monthly and annual mean relative humidity; from observations taken at 7 a. m., 2 p. m., and 9 p. m. (local time), July, 1879, to June, 1880, inclusive.

[The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m., and 9 p. m. observations by three; the monthly means by dividing the sum of the daily means by the number of days in the months.]

Station.	1879.						1880.						Annual mean.
	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	
Albany, N. Y	69.6	72.4	74.2	69.4	72.9	73.8	78.6	73.6	69.5	54.9	56.4	57.4	68.6
Alpena, Mich	69.6	70.6	73.0	74.6	82.2	80.6	79.8	77.3	75.6	68.4	66.2	71.8	74.1
Atlanta, Ga	63.2	73.2	64.8	71.3	68.0	70.6	70.7	58.0	62.7	63.9	64.3	60.6	65.9
Atlantic City, N. J	80.2	79.9	82.7	80.5	75.7	79.5	79.3	74.4	71.9	74.2	77.4	80.8	78.0
Augusta, Ga	63.3	69.1	64.6	68.9	64.1	71.4	79.4	63.1	71.4	66.4	65.6	57.4	67.1
Baltimore, Md	60.6	70.6	70.9	67.1	62.4	70.1	71.9	65.0	63.6	54.5	56.6	61.3	64.5
Barnegat, N. J	80.3	82.9	76.3	77.8	74.5	84.8	84.9	76.8	73.3	73.1	74.4	76.6	78.0
Bismarck, Dak	66.6	62.7	56.2	59.4	73.8	93.9	83.4	84.6	81.7	68.4	56.3	68.6	71.3
Boise City, Idaho	33.7	32.6	36.6	53.7	64.1	75.0	65.6	69.1	61.9	55.4	49.7	36.3	52.8
Boston, Mass	69.2	73.1	73.2	64.7	71.5	68.3	70.2	68.4	65.9	57.6	59.6	66.5	67.3
Brackettville, Tex	45.4	63.0	62.4	57.0	*a*54.5	63.9	75.3	62.4	70.3	55.9	(*b*)	*c*56.2	
Breckinridge, Minn	71.7	73.8	66.5	61.5	77.3	98.6	95.7	94.9	90.8	75.0	65.2	75.3	78.9
Buffalo, N. Y	67.7	68.6	68.7	66.4	70.1	72.2	71.3	71.0	68.0	66.6	66.1	72.6	69.1
Burlington, Vt	63.3	63.9	66.9	64.7	73.7	74.6	71.8	71.6	68.7	58.4	60.9	62.3	66.7
Cairo, Ill	69.9	71.1	71.4	70.5	64.9	75.8	72.8	64.0	63.2	56.0	65.7	66.3	67.6
Cape Hatteras, N. C	77.3	80.7	79.1	79.9	73.6	84.0	85.7	75.2	78.4	79.2	77.5	80.5	79.3
Cape Henry, Va	72.2	74.4	72.5	73.3	59.7	71.4	79.0	68.7	72.2	61.0	63.1	68.0	69.6
Cape Lookout, N. C	76.1	78.1	79.7	81.3	74.6	86.1	87.1	76.7	76.1	75.6	74.9	76.2	78.5
Cape May, N. J	76.8	79.6	74.9	72.4	64.9	75.4	*d*78.6						
Cedar Keys, Fla						*e*83.2	81.5	79.1	75.0	73.9	72.6	74.8	
Charleston, S. C	68.3	72.8	72.8	77.5	69.0	76.9	79.1	69.5	68.8	71.2	70.4	66.8	71.9
Charlotte, N. C	64.6	72.8	66.1	67.6	61.9	76.1	74.3	60.6	66.9	60.4	58.2	58.4	65.7
Chattanooga, Tenn	64.4	75.6	73.0	73.6	65.6	75.8	74.5	61.2	65.2	63.1	67.9	67.5	68.9
Cheyenne, Wyo	41.4	39.5	29.3	33.0	39.7	47.9	38.7	50.7	42.0	33.3	28.4	37.5	38.4
Chicago, Ill	66.9	62.3	62.7	65.6	67.0	69.4	72.4	62.3	61.4	62.9	65.2	67.7	65.5
Chincoteague, Va										*f*84.1	86.8	87.5	
Cincinnati, Ohio	58.8	68.6	68.2	61.9	62.6	69.9	69.4	60.5	57.0	53.6	56.0	64.9	62.6
Cleveland, Ohio	68.8	68.8	69.9	70.2	73.6	79.7	76.2	70.7	68.8	61.9	55.4	68.1	69.3
Columbus, Ohio	57.1	66.5	67.4	59.4	66.4	74.9	73.1	64.2	59.1	55.6	55.1	62.1	63.4
Corsicana, Tex	56.8	57.0	54.3	57.4	58.5	62.4	67.0	62.5	69.3	59.3	68.9	67.6	61.7
Davenport, Iowa	66.0	67.8	66.5	64.0	67.1	71.0	74.5	66.2	62.8	60.0	56.2	67.8	65.8
Deadwood, Dak	56.0	49.4	45.6	68.8	56.3	*g*55.1	49.2	51.0	52.7	54.6	44.2	55.0	53.2

Delaware Breakwater, Del	....	....	....	....	....	....	....	h72.8	76.5	66.3	72.4	79.9	....
Denison, Tex	64.8	65.7	58.5	59.7	62.0	69.4	65.9	62.7	70.7	58.2	68.8	74.7	65.1
Denver, Colo	45.6	41.8	34.6	35.6	49.3	58.8	39.8	50.7	40.4	37.0	34.7	36.2	42.0
Des Moines, Iowa	65.5	64.9	65.0	64.7	68.3	69.8	71.0	64.1	59.7	54.3	54.9	67.8	64.2
Detroit, Mich	68.1	67.7	72.6	72.6	77.0	82.1	79.8	75.1	69.6	65.9	62.7	67.6	71.7
Dodge City, Kans	58.3	57.1	45.4	45.5	51.5	52.0	52.1	48.5	45.8	26.6	48.3	49.6	48.4
Dubuque, Iowa	65.1	63.4	64.3	61.6	69.8	71.6	72.8	66.4	61.6	55.3	54.3	65.9	64.3
Duluth, Minn	72.1	69.8	71.8	73.8	74.0	74.1	76.4	72.3	70.7	71.2	75.5	80.6	73.5
Eastport, Me	76.1	77.5	81.2	69.1	75.3	76.7	75.5	75.0	72.3	68.2	75.4	73.5	74.6
Erie, Pa	68.8	71.1	70.4	67.4	70.9	74.3	70.4	69.8	70.1	64.5	58.2	65.2	68.4
Escanaba, Mich	71.9	70.1	70.5	70.3	73.4	71.9	66.2	62.2	62.5	63.4	63.8	73.2	68.3
Fort Gibson, Ind. T	57.6	62.0	53.6	57.0	60.7	68.8	63.2	56.1	64.5	48.1	62.2	67.9	60.1
Galveston, Tex	73.1	74.7	73.7	69.7	75.6	81.3	80.4	78.1	82.3	79.5	77.7	73.5	76.6
Grand Haven, Mich	70.3	70.1	74.0	76.6	79.5	81.5	78.8	77.8	72.5	72.6	69.7	72.5	74.7
Indianapolis, Ind	59.5	69.1	70.6	67.2	64.5	72.4	71.2	64.5	61.6	57.3	59.7	69.4	65.6
Indianola, Tex	69.2	74.2	74.5	70.1	73.8	79.7	80.8	78.3	83.9	78.2	78.3	71.3	76.0
Jacksonville, Fla	68.9	72.1	80.3	79.2	70.5	74.6	77.1	69.4	63.7	63.0	71.1	66.9	71.4
Keokuk, Iowa	63.4	65.7	65.1	63.4	66.6	72.2	74.0	64.9	62.8	55.9	60.1	66.0	65.0
Key West, Fla	70.1	72.5	80.3	80.4	75.7	78.2	77.1	75.4	68.8	68.3	74.9	70.6	74.4
Kittyhawk, N. C	77.5	80.4	79.1	80.5	69.3	83.7	86.4	72.3	75.3	72.8	69.8	74.1	76.8
Knoxville, Tenn	63.2	71.6	61.6	66.1	61.5	77.6	73.3	64.7	64.7	55.5	59.1	62.5	65.1
La Crosse, Wis	72.7	68.4	68.0	65.5	69.7	69.7	66.4	71.4	65.9	60.2	58.9	69.3	67.2
La Mesilla, N. Mex	46.0	38.4	34.4	48.3	36.1	38.1	44.3	45.5	33.7	19.0	23.9	28.0	36.3
Leavenworth, Kans	70.9	59.7	58.8	64.8	69.4	66.8	69.7	62.0	61.3	51.6	56.4	61.6	62.7
Little Rock, Ark	69.9	77.4	74.9	71.8	69.2	74.9	70.6	65.3	71.2	63.6	70.7	73.2	71.1
Los Angeles, Cal	69.0	67.5	64.4	55.1	61.8	67.9	65.0	67.0	72.6	77.4	72.0	72.4	67.7
Louisville, Ky	56.9	65.0	68.1	64.2	59.6	71.4	71.2	61.7	60.4	53.7	55.1	62.3	62.5
Lynchburg, Va	60.9	71.3	70.5	69.1	65.3	72.8	74.0	60.3	60.4	47.2	53.9	63.5	64.1
Madison, Wis	71.3	66.8	70.3	67.0	73.1	73.9	73.1	70.0	67.8	64.6	62.0	71.4	69.3
Marquette, Mich	67.0	63.2	66.2	65.0	78.3	78.8	72.2	72.0	63.3	65.2	59.8	68.1	68.3
Memphis, Tenn	68.3	72.0	68.2	68.0	62.8	74.3	69.9	64.1	67.3	58.3	65.6	67.2	67.2
Milwaukee, Wis	71.0	68.4	71.4	71.8	74.5	80.1	79.7	72.6	71.8	66.2	62.3	68.6	71.5
Mobile, Ala	77.2	85.2	74.6	80.2	78.6	86.7	80.4	76.5	74.7	77.2	77.5	77.4	78.8
Montgomery, Ala	70.6	74.6	69.0	78.6	66.3	79.2	74.0	68.9	69.3	67.6	72.2	64.8	71.3
Morgantown, W. Va	68.0	76.9	69.1	67.7	61.9	66.8	67.1	62.4	65.4	57.9	60.7	71.6	66.3
Mount Washington, N. H	86.3	83.9	90.8	88.3	90.4	86.4	86.5	86.6	87.8	85.0	83.3	82.3	86.5
Nashville, Tenn	62.2	69.9	74.4	67.2	64.1	76.3	60.4	68.6	74.4	70.0	60.5	61.1	67.4
New Haven, Conn	71.0	75.1	76.6	70.3	72.2	74.4	78.5	75.6	70.2	65.5	67.6	68.3	72.1
New London, Conn	74.0	75.6	78.5	69.7	70.7	76.0	74.8	71.6	67.1	68.0	70.2	72.5	72.4
New Orleans, La	70.1	70.9	70.6	72.1	68.9	76.3	72.6	69.1	70.9	72.8	74.8	71.9	71.7
Newport, R. I	73.4	77.2	77.6	74.3	76.1	80.3	76.5	74.0	70.2	70.4	73.4	73.0	74.7
New York, N. Y	66.0	73.3	72.1	67.3	64.5	73.4	73.3	73.0	70.2	61.0	63.4	64.8	68.5
Norfolk, Va	67.4	74.3	66.9	74.4	63.7	76.2	78.8	69.1	72.9	58.1	55.9	61.8	68.3
North Platte, Nebr	72.1	62.2	52.8	52.6	53.6	68.6	55.6	48.2	53.0	41.8	46.9	58.7	55.5
Olympia, Wash	77.7	74.7	83.1	85.8	88.7	87.5	89.6	84.2	79.7	75.9	73.0	69.5	80.8
Omaha, Nebr	68.7	64.7	60.1	56.7	62.2	73.7	70.2	63.0	60.3	45.9	51.1	62.8	61.6
Oswego, N. Y	70.4	72.5	72.1	71.6	75.3	74.6	73.9	72.6	72.4	66.5	66.5	70.0	71.5
Pembina, Dak	74.7	75.5	73.5	75.1	84.2	99.5	95.1	90.3	90.1	72.8	67.6	74.7	81.1

a Twenty-one days only.
b Local observation discontinued May 4, 1880.
c Local observations recommenced June 14, 1880.
d Local observations discontinued January 31, 1880.
e Station opened November 7, 1879.
f Station opened March 16, 1880.
g Twenty-nine days only.
h Observations commenced January 28, 1880.

Monthly and annual mean relative humidity, &c.—Continued.

Station.	1879.						1880.						Annual mean.
	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	
Pensacola, Fla	......	......	......	(*a*)	*b*79.7	83.6	80.3	74.7	74.4	77.6	77.5	72.3	......
Philadelphia, Pa	65.6	73.2	71.1	66.9	68.0	76.3	75.0	68.4	67.3	57.1	59.0	62.6	67.5
Pike's Peak, Colo	50.7	52.3	46.5	42.7	52.7	70.1	52.4	64.9	65.4	68.9	63.5	48.2	56.5
Pioche, Nev	13.0	17.3	13.1	30.0	40.2	58.4	55.8	55.5	45.4	41.9	16.6	15.6	33.6
Pittsburgh, Pa	66.6	70.4	71.1	68.0	69.7	76.3	71.7	70.7	66.4	60.1	55.1	66.4	67.7
Port Huron, Mich	68.8	66.0	70.3	71.5	77.9	80.9	79.2	74.4	69.8	64.2	65.0	68.5	71.4
Portland, Me	70.3	70.2	76.3	64.2	70.7	68.0	71.5	66.8	65.4	58.0	61.8	66.8	67.5
Portland, Oreg	64.7	63.5	70.4	74.0	77.7	78.3	82.5	79.4	72.0	67.6	65.2	64.4	71.6
Prescott, Ariz	32.7	36.0	27.8	32.0	45.1	59.1	59.8	60.0	42.1	31.9	19.1	16.2	38.5
Punta Rassa, Fla	73.6	76.6	79.3	77.0	70.2	78.1	76.0	76.6	69.9	69.0	72.6	73.7	74.4
Red Bluff, Cal	31.1	31.6	34.4	48.2	63.1	73.4	67.8	58.2	46.5	67.5	54.1	37.5	51.1
Rochester, N. Y	64.1	64.3	67.2	65.4	76.0	77.6	74.5	72.6	71.0	62.9	58.9	62.8	68.1
Roseburg, Oreg	60.6	59.5	68.6	80.2	85.6	86.2	82.1	83.0	72.9	70.5	66.4	64.2	73.3
Sacramento, Cal	51.5	49.2	54.4	63.1	73.5	84.0	78.0	68.5	60.1	73.0	60.8	52.3	64.0
Saint Louis, Mo	60.9	61.6	59.7	61.9	63.0	74.5	67.5	62.8	61.0	53.7	60.4	66.7	62.8
Saint Mark's, Fla	79.3	83.4	89.9	*c*83.8	......	......	......	......	......	......	......	......	......
Saint Paul, Minn	68.4	67.9	65.5	61.4	66.5	66.8	71.4	65.1	63.6	59.3	61.6	67.7	65.4
Salt Lake City, Utah	20.8	21.9	17.8	39.9	47.6	56.1	45.5	49.4	42.4	44.1	37.6	24.7	37.3
San Antonio, Tex	51.9	60.2	59.2	59.4	59.4	66.3	73.7	69.1	74.5	64.0	69.7	62.3	64.1
San Diego, Cal	77.4	78.2	77.3	67.1	68.4	71.3	69.4	67.9	72.8	74.4	70.2	74.5	72.4
Sandusky, Ohio	68.7	66.9	70.5	69.6	71.3	78.4	75.1	71.7	69.5	66.5	59.5	64.2	69.3
Sandy Hook, N. J	71.9	74.9	71.9	71.6	68.8	78.9	79.5	76.2	72.2	66.4	68.7	68.2	72.4
San Francisco, Cal	78.2	78.1	78.8	68.9	70.9	76.0	74.8	72.2	69.8	78.9	67.4	75.7	74.1
Santa Fé, N. Mex	38.1	35.3	27.2	41.5	46.7	49.9	44.6	47.5	41.6	40.1	21.8	20.0	37.9
Savannah, Ga	69.5	74.6	76.6	79.8	69.0	74.7	75.9	67.4	66.4	66.8	71.4	66.6	71.6
Shreveport, La	63.6	69.2	69.3	64.2	63.4	68.5	72.2	70.8	67.0	65.4	69.4	72.4	67.9
Smithville, N. C	82.5	83.7	76.9	82.2	77.0	87.0	84.7	80.2	74.4	78.6	74.1	72.2	79.5
Springfield, Ill	54.3	61.1	59.4	59.6	63.2	65.8	70.3	58.9	59.9	54.2	61.0	62.6	60.9
Springfield, Mass	71.3	74.4	75.6	69.2	69.6	66.9	70.2	66.8	62.8	61.9	61.8	64.9	67.9
Thatcher's Island, Mass	81.5	86.8	88.4	81.2	83.4	82.8	84.0	80.4	84.2	85.5	86.7	85.8	84.2
Toledo, Ohio	66.7	66.6	70.8	74.1	77.5	79.2	76.0	68.1	66.7	64.0	60.3	66.2	69.7
Umatilla, Oreg	44.0	35.8	40.9	57.6	74.3	78.8	*d*68.7	69.3	55.0	52.1	48.4	39.3	55.8
Unalashka, Alaska	......	......	*e*91.0	95.6	94.4	90.2	92.9	94.3	94.1	84.3	(*f*)	......	......
Vicksburg, Miss	69.3	73.1	71.0	71.3	67.4	75.3	72.1	68.7	69.5	67.3	69.4	71.7	70.5
Virginia City, Mont	31.1	22.4	36.0	48.4	56.8	62.8	53.3	57.5	57.6	54.8	52.2	43.2	48.0
Visalia, Cal	33.5	31.0	42.9	59.1	71.8	80.8	80.5	70.3	63.3	70.9	50.6	36.4	57.6
Washington, D. C	60.4	71.7	71.3	67.4	64.3	71.9	74.1	65.3	65.8	55.5	58.5	63.0	65.8

Wilmington, N. C	71.4	76.2	73.7	76.5	66.4	76.1	74.9	65.9	65.1	67.0	69.7	69.7	71.0
Winnemucca, Nev	18.6	19.1	17.1	43.4	60.1	70.2	58.2	64.4	55.2	52.1	33.4	17.5	42.4
Wood's Holl, Mass	79.2	82.2	77.4	74.0	71.0	73.3	76.5	76.1	71.8	71.5	77.3	79.2	75.8
Yankton, Dak	69.3	63.5	51.0	52.0	52.5	*g*64.1	61.6	*h*61.8	62.3	48.7	54.0	67.4	59.0

a Observations commenced October 27, 1879.
b Twenty-seven days only.
c Station closed October 30, 1879.
d Twenty-eight days only.
e Observations recommenced September 17, 1879.
f Reports not yet received.
g Eighteen days only.
h Twenty-four days only.

PAPER 16.

Monthly and annual amounts of precipitation (in inches and hundredths) from July, 1879, to June, 1880, inclusive, at stations of observation of the Signal Service, United States Army, in operation on June 30, 1880.

Station.	Elevation of rain gauge above ground.	1879.						1880.						Annual amount.
		July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	
	Feet.													
Albany, N. Y	70	5.10	4.25	3.47	1.24	2.56	4.23	2.96	2.67	2.17	2.75	3.35	2.21	36.96
Alpena, Mich	52	3.77	3.71	8.00	1.92	5.35	3.74	2.84	1.85	2.31	3.44	7.36	8.48	52.77
Atlantic City, N. J	37	2.25	14.67	1.85	1.11	2.42	5.89	1.70	2.85	5.97	1.83	.54	3.15	44.23
Atlanta, Ga	92	5.75	4.76	1.43	5.44	3.88	7.86	2.86	3.11	11.87	7.07	4.52	3.57	61.12
Augusta, Ga	40	6.48	4.75	4.46	2.76	3.85	4.12	4.28	3.37	6.43	5.72	2.98	1.54	50.74
Baltimore, Md	69	3.16	6.71	2.72	.75	1.30	5.23	2.26	1.96	4.82	3.07	1.23	5.48	38.69
Barnegat, N. J	8	3.57	12.33	2.15	1.05	2.10	6.68	1.75	3.29	6.51	3.29	.88	3.67	47.27
Bismarck Dak	1	4.27	2.69	.07	1.35	.16	1.28	.30	.16	.69	3.65	2.76	2.32	19.70
Boerne, Tex	4	.68	2.50	1.20	1.35	.05	.39	4.19	2.54	1.81	2.43	8.29	2.14	27.57
Boise City, Idaho	32	(*a*)	.03	.14	.76	1.20	3.65	.90	.94	.50	1.50	1.57	.11	11.30
Boston, Mass	162	3.09	6.71	1.84	.91	2.97	5.36	3.72	4.11	3.25	2.85	1.63	.75	37.19
Brackettville, Tex	3	(*a*)	3.17	1.29	.21	.05	.60	6.39	1.22	.77	4.01	13.11	1.40	32.22
Breckenridge, Minn	2	3.78	2.04	2.36	.79	.29	.66	.01	.00	1.49	2.23	5.84	7.90	27.39
Brownsville, Tex	40	1.59	9.48	11.64	4.70	.14	.62	3.87	1.06	.58	.01	1.56	1.03	36.28
Buffalo, N. Y	67	2.68	3.62	2.52	.74	4.28	3.31	1.68	3.51	2.11	2.53	3.05	2.97	33.00
Burkes, Ariz	12	(*a*)	.72	1.03	.05	1.22	1.10	.29	.00	.00	.15	.00	(*a*)	4.56
Burlington, Vt	72	2.71	2.39	2.82	1.36	3.56	2.22	1.87	.62	.97	1.73	1.46	1.33	23.04
Chincoteague, Va	30	....	....	....	....	....	....	....	....	....	*b*2.70	.96	3.10	....
Cairo, Ill	78	1.37	7.05	.93	3.87	3.25	6.63	4.56	5.01	4.52	3.25	4.64	2.92	48.00
Campo, Cal	2	(*a*)	(*a*)	.00	.00	3.00	2.23	3.00	2.15	3.56	4.00	.00	.00	17.94
Cape Hatteras, N. C	1	2.21	5.95	11.64	5.86	4.60	3.78	3.37	7.13	8.05	2.32	5.03	8.59	68.53
Cape Henry, Va	14	7.96	9.36	5.54	.88	.62	4.13	3.48	2.43	10.72	2.92	.18	4.71	52.93
Cape Lookout, N. C	1	1.34	11.90	8.82	2.40	4.60	3.07	5.01	5.77	4.44	2.81	3.47	6.94	60.57
Cape May, N. J	6	4.94	16.58	1.89	.97	1.09	6.19	2.17	2.41	7.94	1.68	1.27	3.79	50.92
Castroville, Tex	8	1.88	5.39	1.17	.55	.18	.23	3.20	2.63	2.68	2.22	2.76	1.18	24.07
Cedar Keys, Fla	35	....	....	....	....	....	1.51	3.02	7.35	2.83	.73	4.94	8.76	....
Charleston, S. C	57	7.77	4.50	5.90	6.74	3.70	1.00	2.15	3.97	2.01	3.65	.90	2.18	44.47
Charlotte, N. C	47	8.64	7.89	.53	1.92	1.79	5.26	2.43	3.10	9.57	5.64	1.15	4.36	52.28
Chattanooga, Tenn	59	5.17	4.78	2.54	4.36	2.89	8.47	4.48	2.75	12.16	10.37	6.21	2.37	66.55
Cheyenne, Wyo	24	1.04	1.26	.00	.65	.23	.17	.20	.09	.06	.17	.44	1.06	5.37
Chicago, Ill	92	5.58	.45	1.18	2.72	4.93	2.47	3.53	2.91	2.23	5.20	4.97	3.50	39.67
Cincinnati, Ohio	76	2.75	11.72	4.01	.65	4.05	7.11	4.84	4.50	4.15	5.82	5.70	9.86	65.16
Cleveland, Ohio	74	5.72	4.20	3.60	1.32	5.22	4.19	2.67	3.12	2.33	3.95	3.12	4.47	43.91
Columbus, Ohio	70	3.67	4.64	2.33	.26	3.52	4.29	4.49	1.70	2.42	5.08	3.21	3.30	38.91

Coleman City, Tex	2	.87	3.21	.37	.96	.08	.34	2.03	c2.01	3.69	2.18	4.46	4.36	24.56
Concho, Tex	2	.08	5.80	1.34	.20	.00	.18	4.36	1.02	1.35	.72	2.34	3.55	20.94
Corsicana, Tex	30	1.70	.34	.88	2.25	1.33	1.15	3.34	3.25	4.08	5.90	3.15	2.75	30.12
Delaware Breakwater, Del	27								d.86	4.70	.68	1.38	1.80	
Davenport, Iowa	77	5.87	4.33	1.43	.92	4.70	1.02	3.13	1.72	2.68	4.50	5.09	7.21	42.60
Dayton, Wash	2						e4.55	3.37	2.19	1.89	3.81	2.78	1.00	
Deadwood, Dak	24	1.82	1.49	.32	4.26	.27	1.14	.56	1.14	.75	1.57	2.43	3.33	19.08
Decatur, Tex	5	.70	3.30	1.15	.70	.45	.60	.95	1.45	2.45	1.80	3.70	3.27	20.52
Denison, Tex	28	1.98	2.33	.24	.50	1.29	1.00	.86	2.20	5.05	1.95	4.92	10.00	32.32
Denver, Colo	56	.64	1.38	.02	.19	.21	.33	.38	.32	.21	.31	1.11	1.22	6.32
Des Moines, Iowa	44	.29	1.98	2.79	3.15	6.49	1.39	.70	.17	.70	1.56	5.84	4.11	29.17
Detroit, Mich	80	6.22	1.31	6.14	.83	4.71	4.62	2.81	1.51	2.75	6.17	4.86	4.38	46.31
Dodge City, Kans	30	8.90	3.75	.80	(a)	.04	.12	(a)	(a)	.04	.11	3.01	1.59	13.36
Dubuque, Iowa	43	6.78	2.43	2.98	.93	5.41	1.28	1.95	1.01	2.55	3.51	3.72	6.02	38.57
Duluth, Minn	28	10.42	1.58	5.24	3.95	1.65	3.89	1.21	1.57	2.43	3.17	4.31	10.40	49.82
Eagle Pass, Tex	1	.14	3.10	3.08	.69	.03	.29	3.72	.56	1.14	.68	2.50	.12	16.05
Eastport, Me	55	5.57	3.66	3.42	3.28	4.52	3.67	4.29	3.99	4.08	2.97	2.55	1.64	43.64
Edinburg, Tex	28	.20	7.52	5.49	5.04	.00	.04	1.48	.76	1.42	.19	2.05	f.00	24.19
El Paso, Tex	14	2.47	.35	.04	.95	.01	.26	1.01	(a)	.30	(g)	.00	(a)	
Erie, Pa	60	2.04	4.17	2.91	1.18	8.35	4.74	2.86	3.73	2.32	3.86	3.02	3.78	42.96
Escanaba, Mich	38	4.89	3.52	2.75	1.91	2.76	2.92	3.42	1.04	1.95	1.86	2.29	4.83	34.14
Florence, Ariz	4	1.32	2.52	.21	.49	.76	1.41	.76	.49	.21	.20	.00	h.05	8.43
Fort Apache, Ariz	1	3.92	3.06	1.52	2.64	1.77	2.41	1.31	.95	.80	.46	.00	.46	19.30
Fort Buford, Dak	2	3.63	.18	.00	1.55	.37	1.68	.10	.51	.21	.74	4.02	5.46	18.45
Fort Custer, Mont	32		(i)	.03	2.04	.18	1.53	.32	.60	.36	1.31	5.63	3.17	15.17
Fort Davis, Tex	2	1.67	5.19	1.13	6.18	.00	.00	1.29	(a)	.46	.14	.15	1.35	17.56
Fort Elliott, Tex	2						j.10	(a)	.05	.40	.16	4.48	4.50	
Fort Gibson, Ind. T	35	1.65	4.75	.86	1.48	3.67	4.06	.30	1.94	4.40	2.44	2.64	4.26	32.45
Fort Grant, Ariz	33	2.59	1.12	2.18	1.83	.87	1.38	.60	.48	.85	.08	.00	1.32	13.30
Fort Griffin, Tex	3	.47	2.24	1.43	1.36	.30	.51	2.01	1.22	1.35	2.41	6.42	4.49	24.21
Fort Keogh, Mont	37	5.90	1.84	.44	2.47	.11	.58	.32	.17	.51	.48	3.51	3.05	19.44
Fort McKavett, Tex	21	(a)	7.54	.52	.83	.55	.50	2.67	1.29	1.59	.87	2.92	.44	19.72
Fort Sill, Ind. T	2	1.53	2.36	.47	.28	.27	.55	.58	.59	3.03	1.58	9.74	5.76	26.74
Fort Stevenson, Dak	4	3.68	1.00	.06	1.53	.06	1.07	.27	.11	.49	.66	2.48	1.60	13.01
Fort St. Michaels, Alaska	1	.65	.83	.64	.25	.03	.07	.00	.12	.06	.10	.21	(*)	
Fort Verde, Ariz	4	.97	.53	1.40	.23	2.40	3.03	1.08	.13	.30	.27	.00	.16	10.50
Fredericksburg, Tex	24	.55	2.90	1.45	1.50	.38	.21	1.15	2.27	1.08	3.33	5.46		
Galveston, Tex	51	3.09	7.18	1.47	.60	1.95	2.07	.66	2.13	6.54	1.71	4.09	8.33	39.82
Graham, Tex	7	.62	3.73	.09	.78	.25	.64	(k)	(l)					
Grand Haven, Mich	76	2.61	2.47	6.01	2.58	7.23	3.25	2.64	2.05	1.92	6.48	4.19	3.65	45.08
Helena, Mont	29										m2.22	1.24	.46	
Henrietta, Tex	3	.36	6.24	.60	.38	.34	.69	1.18	.65	2.60	1.78	3.30	5.24	23.36
Indianapolis, Ind	74	2.40	5.71	6.94	1.34	5.82	5.10	6.32	3.16	4.03	6.43	8.22	8.48	63.95
Indianola, Tex	40	.79	7.14	7.27	6.54	.13	.76	4.61	1.66	2.43	.55	3.66	3.48	39.02
Jacksboro', Tex	17	4.47	3.70	1.21	1.45	.45	1.82	1.06	1.84	1.42	2.00	6.09	n2.50	28.01
Jacksonville, Fla	57	5.44	8.39	8.24	9.45	1.24	.46	3.17	6.17	1.69	1.50	6.24	3.00	54.99
Keokuk, Iowa	60	1.98	4.57	1.12	.28	3.91	1.45	3.91	1.94	1.83	4.79	5.92	3.06	34.76

a Too small to measure.
b Observations commenced March 16, 1880.
c Observations commenced November 7, 1879.
d Observations commenced January 28, 1880.
e Observations commenced December 1, 1879.
f Twenty-two days only.
g Observer sick with small-pox.
h Seventeen days only.
i Observations commenced August 12, 1879.
j Observations commenced November 28, 1879.
k Data incomplete.
l Station closed February 18, 1880.
m No reports received prior to April 1, 1880.
n Station closed June 19, 1880.
* Reports for June not yet received.

Monthly and annual amounts of precipitation, &c.—Continued.

Station.	Elevation of rain gauge above ground.	1879.						1880.						Annual amount.
		July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	
	Feet.													
Key West, Fla	52	1.46	5.61	9.71	14.20	2.24	4.50	1.20	.33	.93	.33	7.84	1.81	50.16
Kittyhawk, N. C	1	6.62	6.88	4.36	.79	3.96	3.20	2.97	3.56	7.26	4.85	.60	1.72	46.77
Knoxville, Tenn	77	3.28	2.89	.22	3.14	3.11	8.28	2.16	4.43	8.59	6.20	2.50	3.38	48.18
Lewiston, Idaho	35	....	....	....	....	(*a*)	1.20	.33	.20	.29	.59	1.59	1.07	....
La Crosse, Wis	65	6.80	1.31	5.72	2.45	4.63	2.68	1.36	.90	2.89	2.90	4.33	6.60	42.57
La Mesilla, N. Mex	16	1.87	1.02	.18	.78	.00	1.26	.14	.43	.52	.45	.00	.00	6.65
Laredo, Tex	5	.00	12.59	2.18	.27	.00	.06	.77	2.67	3.82	1.20	*b*.92	.09	24.57
Leavenworth, Kans	48	4.99	.18	3.41	4.25	7.85	2.34	2.00	1.40	2.22	1.38	5.01	1.69	36.72
Little Rock, Ark	57	2.65	7.43	.39	.98	3.93	3.50	4.64	7.95	7.60	4.69	2.44	3.23	49.43
Los Angeles, Cal	50	.00	.00	.00	.93	3.44	6.53	1.33	1.56	1.45	5.06	.04	.00	20.34
Louisville, Ky	102	1.18	10.02	5.88	.59	4.90	7.93	4.61	5.40	5.14	7.32	6.09	4.11	63.17
Lynchburg, Va	50	3.44	7.79	1.91	2.66	1.83	6.25	2.16	2.73	6.71	4.10	2.17	4.17	45.92
Madison, Wis	57	5.91	.99	2.79	2.50	6.02	2.29	2.75	1.75	2.11	5.48	4.45	9.31	46.35
Marquette, Mich	56	4.29	2.43	3.62	4.28	5.43	6.25	2.94	1.08	1.00	2.62	4.83	5.52	44.29
Mason, Tex	2	.60	1.71	1.62	1.67	.24	.47	1.73	1.99	1.20	1.58	7.01	.86	20.68
Memphis, Tenn	51	3.01	4.57	.62	1.39	6.01	8.51	6.87	9.44	8.82	3.91	3.82	4.96	61.93
Milwaukee, Wis	135	3.59	1.87	2.00	2.01	3.65	1.76	2.17	1.69	1.16	4.22	3.13	6.93	34.18
Mobile, Ala	53	11.17	10.54	1.33	5.15	4.72	3.38	1.18	5.73	9.41	2.99	5.62	5.08	66.30
Montgomery, Ala	58	5.21	4.54	1.12	10.20	1.47	7.42	1.65	6.11	9.26	6.42	7.07	.90	61.37
Morgantown, W. Va	1	7.10	6.62	1.27	1.62	2.24	6.70	5.77	4.53	5.10	4.30	2.24	6.66	54.15
Mount Washington, N. H	*c*36	10.23	9.55	6.53	5.03	9.53	5.56	4.24	2.56	4.87	3.47	5.51	5.86	72.94
Nashville, Tenn	49	8.47	4.62	5.18	2.90	5.85	9.15	3.74	12.37	8.16	5.26	4.13	3.95	73.78
New Haven, Conn	108	9.50	9.40	2.13	1.41	2.33	4.41	3.75	3.80	5.68	3.69	1.24	1.21	48.55
New London, Conn	57	6.04	7.75	4.70	1.16	2.22	4.38	2.44	3.43	4.97	3.44	1.39	2.16	44.08
New Orleans, La	77	7.04	10.44	3.15	1.36	3.79	2.90	1.02	4.62	6.66	6.88	6.55	6.43	60.84
Newport, R. I	43	3.97	5.39	2.60	1.03	3.54	4.74	2.14	3.65	5.93	4.69	1.12	1.95	40.75
New York, N. Y	144	3.39	5.17	1.45	.58	2.21	5.79	2.19	2.11	4.66	3.18	.82	1.69	33.24
Norfolk, Va	59	3.90	7.70	3.77	.25	.42	2.34	1.42	1.69	5.34	1.83	.54	5.34	34.54
North Platte, Nebr	7	8.47	.16	.40	.21	.10	.37	.03	.03	.18	.16	2.28	3.12	15.51
Olympia, Wash	38	2.62	2.11	2.38	6.17	5.49	11.43	19.69	5.16	5.57	2.47	4.10	1.44	68.63
Omaha, Nebr	75	3.17	1.51	1.43	3.64	4.25	1.75	.90	.14	.50	.55	3.40	3.14	24.38
Oswego, N. Y	62	3.56	3.51	2.95	1.67	5.64	5.98	3.09	4.81	4.17	2.28	4.06	3.27	44.06
Pensacola, Fla	36	....	....	....	(*d*)	*e*1.53	2.17	.95	3.19	5.99	3.78	5.85	2.75	....
Pembina, Dak	15	3.01	.90	1.18	3.38	.34	2.22	.43	.20	.32	.59	7.98	4.98	25.53
Philadelphia, Pa	95	3.62	7.13	1.12	.41	1.38	4.69	1.51	2.43	3.53	2.43	.54	1.67	30.46
Phœnix, Ariz	19	.54	.67	.65	.27	1.66	1.35	1.16	.38	.26	.15	.00	.49	7.58
Pike's Peak, Colo	1	4.21	4.40	.68	.76	2.40	2.71	4.26	3.34	2.79	2.04	2.17	.79	30.55
Pilot Point, Tex	36	.03	2.14	.03	.11	.14	.13	.14	.01	.04	.08	*f*5.01	6.32	14.18

Pioche, Nev	23	.17	.46	(*g*)	.66	.38	1.75	.21	.36	.12	.46	.01	.03	4.61
Pittsburgh, Pa	94	7.78	5.56	1.01	.65	3 36	5.00	3.02	2.63	2.77	2.41	1.25	3.52	38.96
Port Huron, Mich	63	2.01	.64	4.37	1.42	5.07	3.97	2.22	1.54	1.75	5.39	3.84	4.21	36.43
Portland, Me	77	3.80	3.73	2.67	1.43	4.90	3.39	5.36	4.50	1.42	2.66	1.35	3.03	38.24
Portland, Oreg	60	1.75	.97	2.18	4.23	4.56	7.36	2.27	5.67	4.48	2.92	3.13	1.59	51.11
Prescott, Ariz	4	1.87	2.20	.68	.37	1.58	4.21	.35	.16	.11	.52	.00	.04	12.09
Punta Rassa, Fla	36	6.21	12.75	13.78	4.85	.35	.52	13.22	1.26	.03	.55	5.32	2.45	51.29
Red Bluff, Cal	32	.04	.28	(*g*)	.48	6.05	9.95	2.01	1.66	1.70	7.05	1.04	.00	30.26
Rio Grande City, Tex	2	.04	11.75	5.58	2.13	.00	.91	1.34	.71	1.00	.83	1.64	1.67	27.60
Rochester, N. Y	96	4.61	3.47	2.80	.67	4.47	3.35	2.07	3.82	2.57	2.12	5.54	2.45	37.94
Roseburg, Oreg	33	.15	1.47	1.15	2.20	5.79	7.86	9.37	2.49	2.81	3.98	1.39	.68	39.34
Sacramento, Cal	54	(*g*)	(*g*)	.00	.88	2.05	3.41	1.64	1.83	1.70	14.20	.76	.06	26.47
Saint Louis, Mo	100	1.97	2.23	1.34	.68	4.30	2.84	3.83	2.65	2.51	3.31	3.44	2.46	31.56
Saint Mark's, Fla	29	9.82	18.09	9.82	*h*12.94									
Saint Paul, Minn	58	9.32	2.78	2.26	2.56	1.41	2.47	.81	.97	2.30	1.58	2.63	5.55	34.64
Salt Lake City, Utah	74	.07	.06	.01	1.62	.32	3.08	.29	1.02	.43	2.37	1.85	.01	11.13
San Antonio, Tex	32	.12	4.07	5.91	1.26	.00	.47	3.48	4.01	2.42	3.94	3.09	2.26	31.03
San Diego, Cal	30	.00	.00	.00	.29	2.77	6.30	.61	1.50	1.43	1.34	.06	.06	14.36
Sandusky, Ohio	66	4.01	3.26	5.77	.69	5.22	4.29	3.77	2.11	2.66	4.67	4.49	2.91	43.85
Sandy Hook, N. J	1	5.76	12.44	1.13	.47	2.15	8.02	1.77	1.67	5.86	2.69	2.01	2.78	46.75
San Francisco, Cal	75	.01	.02	(*g*)	.78	4.03	4.46	2.23	1.87	2.08	10.06	1.12	.00	26.66
Santa Fé, N. Mex	18	2.34	2.30	1.07	1.38	1.34	.50	.28	.94	.15	.05	.52	.65	11.52
Savannah, Ga	58	4.29	5.10	5.54	3.87	2.46	1.18	2.56	2.95	1.14	4.49	2.53	2.30	38.41
Shreveport, La	32	2.41	4.75	.95	.52	4.57	3.21	3.68	6.19	6.17	8.43	3.21	2.74	46.83
Silver City, N. Mex	2	1.37	3.85	2.41	1.06	.28	.49	.79	.85	.53	.30	.00	.99	12.92
Smithville, N. C	40	10.21	6.12	6.71	3.02	3.18	2.09	5.05	4.59	2.81	3.49	1.36	2.05	50.68
Socorro, N. Mex	13	2.24	1.46	1.95	2.10	.03	.01	.15	.03	.11	.05	.14	.80	9.07
Springfield, Ill	61	1.52	3.82	.84	1.25	5.12	2.88	2.70	2.89	2.37	3.23	5.76	2.47	34.85
Springfield, Mass	64	4.85	6.94	2.60	1.54	2.33	5.29	4.04	3.29	2.81	3.97	2.06	1.95	41.67
Stockton, Tex	1	(*g*)	.74	.10	.70	(*g*)	(*g*)	.14	.00	.15	.00	.85	1.82	4.50
Thatcher's Island, Mass	4	2.17	7.56	.99	.90	6.91	4.05	2.31	2.37	4.07	8.53	2.37	2.14	44.37
Toledo, Ohio	105	3.45	1.84	4.55	.62	4.60	4.16	3.08	.99	2.15	5.01	3.74	2.91	37.10
Tucson, Ariz	16	.84	1.76	.74	.94	.60	3.31	.56	.15	.41	.04	.00	(*g*)	9.85
Umatilla, Oreg	3	.21	.03	.83	.33	.61	.78	.56	.54	.35	.97	.57	.38	6.16
Unalashka, Alaska	1			*i*.37	6.98	6.56	2.68	4.11	3.30	3.28	1.18	(*)	(*)	
Uvalde, Tex	2	(*g*)	5.66	3.29	.89	.01	.09	2.85	1.82	1.96	2.59	1.76	2.01	22.93
Vicksburg, Miss	53	3.03	4.49	4.90	1.31	5.96	6.45	1.85	4.60	11.23	9.09	5.99	6.36	65.26
Virginia City, Mont	29	.28	.23	.51	1.23	.91	3.83	1.15	1.13	1.94	3.87	4.01	2.69	21.78
Visalia, Cal	45	.00	.00	.00	.92	1.03	2.16	.98	3.14	.48	3.82	.28	.00	12.81
Washington, D. C	68	3.36	7.36	1.56	.79	1.10	4.66	2.51	1.71	5.60	3.81	3.38	3.52	39.36
Wickenburg, Ariz	2	.62	*j*1.27	*k*1.10	.10	1.69	3.12	1.33	.25	(*g*)	.25	.17	.00	9.90
Wilmington, N. C	60	4.67	11.37	6.18	2.60	2.48	2.21	3.55	2.85	1.93	3.52	1.84	6.93	50.13
Winnemucca, Nev	40	.01	.04	.01	.56	1.03	1.97	.26	1.34	.37	1.35	.29	.00	7.23
Wood's Holl, Mass	34	3.91	4.81	2.22	1.37	3.54	2.86	1.69	2.13	3.73	2.85	.88	1.71	31.70
Yankton, Dak	28	7.54	1.68	2.84	.33	.23	.41	.62	.16	.95	.40	4.04	4.99	24.19
Yuma, Ariz	26	.00	.00	.11	.33	.15	.27	(*g*)	(*g*)	.00	.00	.00	.00	.86

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* Reports for May and June not yet received.

a Observations commenced November 23, 1879.

b Nineteen days only.

c Rain gauge 36 feet below summit of Mount Washington.

d Observations commenced October 27, 1879.

e Seventeen days only.

f Twenty-three days only.

g Two small to measure.

h Station closed October 30, 1879.

i Observations recommenced September 17, 1879.

j Seven days only.

k Fourteen days only.

PAPER 17.

Annual and mean annual amounts of precipitation in inches and hundredths at stations of observation of the Signal Service, United States Army, in operation on June 30, 1880.

Station.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	Mean.
Albany, N. Y				37.93	38.25	38.39	36.09	49.37	38.66	39.78
Alpena, Mich			31.10	25.18	37.72	37.62	41.00	38.48	39.37	35.78
Atlanta, Ga									50.30	50.30
Atlantic City, N. J				33.98	39.85	35.95	36.38	42.00	47.43	39.26
Augusta, Ga		45.07	48.50	57.19	54.68	46.16	53.97	46.34	40.99	49.11
Baltimore, Md		35.14	49.80	33.63	45.21	46.70	43.14	50.09	36.01	42.46
Barnegat, N. J				54.93	46.65	47.17	48.24	52.06	49.35	49.73
Bismarck, Dak					27.44	31.06	17.68	20.23	22.61	23.80
Boerne, Tex									17.87	17.87
Boise City, Idaho								10.21	17.63	13.92
Boston, Mass	46.89	50.65	54.53	43.53	50.15	48.96	51.49	65.53	45.67	50.82
Brackettville, Tex								25.66	16.52	21.09
Breckenridge, Minn			27.39	27.63	19.42	18.13	29.39	35.72	19.76	25.35
Brownsville, Tex							25.86	36.35	34.81	32.34
Buffalo, N. Y	32.40	31.25	44.53	30.44	31.44	38.46	34.48	60.24	30.47	37.08
Burkes, Ariz								4.03	5.51	4.77
Burlington, Vt		32.97	25.92	31.94	26.94	27.02	33.11	35.45	24.27	29.70
Cairo, Ill		26.52	50.86	48.18	52.93	55.60	39.47	41.76	45.41	45.09
Campo, Cal								17.63	11.44	14.53
Cape Hatteras, N. C					68.26	65.68	102.58	77.18	70.72	76.88
Cape Henry, Va				51.00	59.60	54.17	64.67	60.65	49.88	56.66
Cape Lookout, N. C							106.16	77.78	61.85	81.93
Cape May, N. J		36.67	48.54	44.40	53.89	45.88	47.68	45.22	43.93	45.78
Castroville, Tex								17.65	15.23	16.44
Charleston, S. C		57.06	61.96	62.51	50.97	78.42	78.11	77.44	50.29	64.59
Charlotte, N. C									44.34	44.34
Cheyenne, Wyo		13.79	10.01	9.71	12.10	5.03	11.71	12.64	7.34	10.29
Chicago, Ill		29.06	36.31	28.59	38.08	36.48	41.01	41.95	30.71	35.27
Cincinnati, Ohio		37.09	41.38	37.55	42.58	52.62	34.65	41.62	51.60	42.39
Cleveland, Ohio	30.25	34.38	41.24	33.39	36.91	41.20	34.12	53.51	41.51	38.50
Columbus, Ohio									31.26	31.26
Coleman City, Tex								29.40	17.99	23.69
Concho, Tex								24.84	18.36	21.60
Corsicana, Tex					32.11	33.72	53.69	39.07	35.18	38.75
Davenport, Iowa		35.64	28.08	36.72	31.99	46.82	35.10	31.21	33.89	34.93
Deadwood, Dak									28.50	28.50
Decatur, Tex								33.75	19.87	26.81
Denison, Tex						42.10	52.64	41.15	20.45	39.08
Denver, Colo		18.05	11.73	13.46	17.25	20.12	16.38	15.51	10.86	15.42
Des Moines, Iowa									32.82	32.82
Detroit, Mich	25.33	25.63	34.00	26.63	35.71	40.40	35.23	43.39	37.17	33.72
Dodge City, Kans					10.69	15.40	27.89	17.96	15.43	17.47
Dubuque, Iowa				30.12	35.12	50.28	38.97	38.30	32.40	37.53
Duluth, Minn	29.08	29.92	38.73	36.44	26.93	32.27	34.31	28.09	45.28	33.45
Eagle Pass, Tex								25.67	18.65	22.16
Eastport, Me				42.56	45.42	57.99	50.62	51.37	43.48	48.57
Edinburg, Tex									21.37	21.37
El Paso, Tex									6.63	6.63
Erie, Pa				37.83	41.20	44.65	38.96	54.33	36.25	42.20
Escanaba, Mich		32.59	26.92	31.10	43.54	42.44	34.61	32.56	30.76	34.31
Florence, Ariz								13.49	12.02	12.75
Fort Davis, Tex									21.41	21.41
Fort Gibson, Ind. T				38.88	44.10	31.48	46.78	13.06	33.09	34.56
Fort Griffin, Tex								29.77	18.93	24.35
Fort McKavett, Tex								21.88	16.65	19.26
Fort Sill, Ind. T								33.69	25.07	29.38
Fort Saint Michaels, Alaska								16.18	(*)	16.18
Fort Verde, Ariz							10.56	10.56	9.00	10.04
Fredericksburg, Tex								22.78	18.27	20.52
Galveston, Tex		41.72	58.91	49.58	58.48	50.92	66.87	60.90	26.90	51.78
Grand Haven, Mich		32.50	28.14	31.71	27.18	46.29	36.03	33.64	35.48	38.87
Indianapolis, Ind		34.12	52.32	43.60	54.58	57.56	39.08	37.62	42.88	45.22
Indianola, Tex			43.27	44.06	35.39	32.57	42.67	41.74	26.78	38.07
Jacksboro', Tex								31.34	23.81	27.57
Jacksonville, Fla		56.87	60.61	48.31	57.80	55.08	51.62	60.42	47.18	54.74
Keokuk, Iowa		29.37	42.35	35.30	48.42	51.61	47.49	31.80	22.51	38.61
Key West, Fla		31.83	32.71	32.66	36.35	37.95	38.15	49.03	58.54	39.65
Kittyhawk, N. C						57.11	80.70	63.10	51.25	63.04
Knoxville, Tenn		44.43	59.39	58.38	73.87	41.19	54.35	47.76	48.95	53.54
La Crosse, Wis			22.64	31.73	38.72	39.41	36.58	31.40	34.94	33.63
La Mesilla, N. Mex								8.07	7.30	7.68
Laredo, Tex							21.39	27.49	21.51	23.46
Leavenworth, Kans		43.50	35.17	33.65	31.26	44.46	52.06	35.15	41.55	39.60
Los Angeles, Cal								20.86	17.41	19.13
Louisville, Ky			45.80	43.60	53.21	53.60	44.58	47.06	50.69	48.36
Lynchburg, Va		30.55	52.70	44.20	41.88	40.04	43.70	45.04	36.81	41.86
Madison, Wis									35.23	35.23
Marquette, Mich		30.25	26.39	24.96	30.13	31.44	27.54	36.19	40.75	30.96

Annual and mean annual amounts of precipitation in inches and hundredths, &c.—Continued.

Station.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	Mean.
Mason, Tex	......	......	......	......	......	......	......	25.00	13.16	19.08
Memphis, Tenn	......	43.95	56.20	44.07	56.99	55.49	73.50	49.33	52.28	53.98
Milwaukee, Wis	30.03	26.26	30.56	31.00	35.56	50.34	46.15	38.29	24.93	34.79
Mobile, Ala	......	67.81	68.61	56 36	62.73	58.60	68.74	63.47	57.33	62.96
Montgomery, Ala	......	......	63.79	51.93	58.16	59.74	50.26	55.14	48.46	55.35
Morgantown, W. Va	......	......	......	45.11	50.26	48.16	43.45	43.13	43.34	45.57
Mount Washington, N. H	......	56.51	78.56	70.66	55.78	77.56	86.41	114.48	91.11	78.88
Nashville, Tenn	34.37	40.20	49.47	58.14	53.48	46.91	49.64	48.56	57.69	49.72
New Haven, Conn	......	......	59.16	55.82	43.52	53.98	51.36	58.72	55.50	54.01
New London, Conn	......	46.82	41.61	60.38	44.79	43.20	51.31	39.35	51.05	47.31
New Orleans, La	......	60.68	66.58	62.74	85.73	67.25	63.09	66.16	51.27	65.44
Newport, R. I	......	......	......	......	......	50.42	48.46	60.10	44.28	50.81
New York, N. Y	48.80	45.73	39.76	40.76	45.09	47.40	40.94	46.67	34.55	43.30
Norfolk, Va	......	56.95	60.12	50.21	50.97	47.53	69.13	51.87	35.88	52.83
North Platte, Nebr	......	......	......	......	15.34	11.84	25.47	18.62	20.06	18.27
Olympia, Wash	......	......	......	......	......	......	......	64.34	73.44	68.89
Omaha, Nebr	......	32.48	27.05	25.75	42.89	32.51	40.95	37.05	30.31	33.62
Oswego, N. Y	29.20	27.61	33.19	34.91	31.41	34.20	32.20	55.83	36.80	35.04
Pembina, Dak	......	......	13.17	12.49	(*)	25.75	21.67	33.82	19.31	21.03
Philadelphia, Pa	......	48.36	54.62	44.31	40.24	47.39	37.26	34.53	36.75	42.93
Phœnix, Ariz	......	......	......	......	......	......	......	6.31	6.40	6.35
Pike's Peak, Colo	......	......	......	26.80	24.74	23.87	25.58	43.30	39.82	30.68
Pilot Point, Tex	......	......	......	......	......	......	......	......	6.29	6.29
Pioche, Nev	......	......	......	......	......	......	......	8.46	6.94	7.70
Pittsburgh, Pa	......	31.05	40.69	39.34	34.06	37.01	34.72	38.76	37.02	36.58
Port Huron, Mich	......	......	......	......	29.14	37.16	31.61	39.91	27.54	33.07
Portland, Me	......	37.02	36.90	36.04	36.14	39.04	43.53	38.60	41.61	38.61
Portland, Oreg	......	46.90	50.52	46.17	60.58	55.03	58.30	47.70	62.22	53.43
Prescott, Ariz	......	......	......	......	......	15 62	10.77	15.63	12.89	13.73
Punta Rassa, Fla	......	40.74	59.20	38.16	40.71	44.34	38.99	51.81	46.29	45.03
Red Bluff, Cal	......	......	......	......	......	......	......	49.01	33.64	41.32
Rio Grande City, Tex	......	......	......	......	......	......	......	25.03	25.61	25.32
Rochester, N. Y	37.54	36.29	49.84	35.80	29.93	35.82	34.12	48.81	35.22	38.15
Roseburg, Oreg	......	......	......	......	......	......	......	36.92	45.03	40.97
Sacramento, Cal	......	......	......	......	......	......	......	23.45	22.37	22.91
Salt Lake City, Utah	......	......	......	......	23.64	21.28	16.35	19.75	13.11	18.83
San Antonio, Tex	......	......	......	......	......	......	......	39.50	22.80	31.15
San Diego, Cal	......	5.08	12.99	10.85	6.80	7.21	8.11	13.87	14.83	9.97
Sandusky, Ohio	......	......	......	......	......	......	......	42.91	37.71	40.31
Sandy Hook, N. J	......	......	......	51.20	48.31	57.26	53.65	61.66	56.50	54.76
San Francisco, Cal	......	22.45	18.55	22.52	22.63	23.54	11.93	33.26	30.76	23.20
Santa Fé, N. Mex	......	9.87	9.73	19.83	18.97	15.07	13.15	19.55	11.44	14.70
Savannah, Ga	......	63.87	48.42	57.50	49.00	64.83	59.60	52.58	45.81	55.20
Shreveport, La	......	51.03	52.37	54.80	50.98	54.49	47.71	55.80	32.59	49.97
Smithville, N. C	......	......	......	......	......	56.23	65.01	56 88	49.08	56.80
Springfield, Mass	......	......	......	......	47.26	47.15	41.51	54.74	48.02	47.74
Saint Louis, Mo	......	36.40	45.02	37.79	42.59	47.74	41.26	40.83	25.70	39.67
Saint Mark's, Fla	......	......	......	......	67.41	67.57	72.82	62.17	(†)	67.49
Saint Paul, Minn	29.37	29.19	33.74	35.50	30.66	23.67	28.81	22.78	32.39	29.57
Stockton, Tex	......	......	......	......	......	......	......	12.47	5.14	8.80
Thatcher's Island, Mass	......	......	......	......	......	47.52	42.53	58.38	45.93	48.59
Toledo, Ohio	28.09	27.56	35.38	25.81	28.03	34.55	35.17	32.67	30.27	30.84
Tucson, Ariz	......	......	......	......	......	14.02	12.75	16.66	12.01	13.86
Umatilla, Oreg	......	......	......	......	......	......	......	7.75	10.58	9.16
Uvalde, Tex	......	......	......	......	......	......	......	23.97	19.20	21.58
Vicksburg, Miss	......	58.28	41.20	66.04	70.05	51.70	52.96	60.83	52.31	56.67
Virginia City, Mont	......	9.83	(*)	16.32	17.48	17.63	17.47	19.06	17.84	16.52
Visalia, Cal	......	......	......	......	......	......	......	9.79	7.40	8.59
Washington, D. C	37.98	32.06	45.70	34.58	41.11	47.94	52.32	60.09	32.83	42.73
Wickenburg, Ariz	......	......	......	......	......	......	......	8.07	10.65	9.36
Wilmington, N. C	......	59.18	58.32	52.31	49.59	66.73	82.65	54.73	51.14	59.33
Winnemucca, Nev	......	......	......	......	......	......	......	6.77	9.36	8.06
Wood's Holl, Mass	......	......	52.10	41.23	42.58	48.26	50.90	52.09	36.88	46.29
Yankton, Dak	......	......	......	23.83	37.15	28.84	28.11	28.73	22.83	28.25
Yuma, Ariz	......	......	......	......	......	0.94	3.66	2.88	3.29	2.69

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*Data incomplete.

†Station closed.

PAPER 18.

Maximum, minimum and mean temperatures.

STATION, ALBANY, N. Y.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	76	52	87	62	85	65	81	55	40	31	38	15	35	25	33	1	39	28	56	30	52	36	72	55
2	83	56	91	69	85	72	78	59	41	28	47	31	46	24	12	− 6	38	24	64	41	57	49	68	54
3	89	67	86	73	79	70	76	60	39	31	46	32	36	16	25	6	50	29	62	51	80	51	70	53
4	86	65	83	66	80	65	68	50	36	22	45	32	43	33	28	10	51	43	67	56	81	60	70	52
5	73	54	84	66	66	53	72	46	35	20	45	31	38	20	28	7	62	40	58	44	79	60	76	59
6	77	57	84	67	71	49	75	57	36	25	51	35	40	19	30	16	42	28	50	37	72	56	76	59
7	71	62	76	53	81	62	68	56	36	29	53	43	39	26	32	6	40	31	40	31	60	48	84	66
8	81	61	74	59	71	56	73	58	50	34	45	31	34	18	28	11	34	9	43	28	76	53	75	57
9	80	61	69	55	65	53	77	61	65	50	35	25	38	18	28	1	27	5	55	34	85	62	75	61
10	83	65	71	50	64	50	81	62	62	42	51	34	41	31	26	−10	35	20	65	42	87	62	78	61
11	81	62	76	49	67	46	68	59	48	36	56	35	43	18	37	21	23	12	55	31	75	62	83	64
12	82	66	81	56	70	45	70	60	60	47	39	26	43	25	47	37	30	14	41	27	70	54	85	67
13	84	67	81	64	65	55	64	45	54	41	35	22	25	5	45	36	30	12	68	27	66	47	79	67
14	87	65	81	63	64	54	64	39	57	46	35	28	27	1	37	25	38	25	66	43	55	43	73	59
15	89	71	67	57	64	49	72	42	68	50	39	32	33	20	31	22	38	23	74	43	66	42	72	62
16	88	68	59	53	66	54	79	57	56	44	38	25	35	11	42	28	36	28	63	47	70	52	78	59
17	75	62	68	56	67	52	75	57	50	39	34	20	43	32	51	28	36	22	52	41	81	56	79	57
18	76	58	63	59	66	49	69	59	47	30	28	7	40	34	58	35	38	24	52	40	66	58	82	58
19	73	52	71	57	63	51	60	38	36	25	30	16	45	36	36	17	41	33	55	47	75	58	85	65
20	77	56	77	55	60	48	52	32	35	15	35	17	37	26	29	10	44	36	60	47	81	58	83	62
21	77	61	80	64	60	39	60	41	21	7	20	− 8	28	11	37	23	37	28	70	40	86	65	80	62
22	83	65	86	69	64	43	63	51	34	10	33	− 5	36	8	41	28	43	31	70	47	80	65	75	61
23	78	67	82	66	68	47	69	45	44	29	37	15	44	32	39	21	56	34	57	40	80	66	78	59
24	77	63	76	62	62	48	46	29	35	24	39	21	33	29	26	10	43	18	52	38	86	65	91	65
25	76	56	71	55	54	38	42	25	49	29	38	4	40	26	41	20	31	12	62	40	90	69	91	73
26	73	63	71	55	57	33	50	25	40	30	11	− 2	46	26	52	40	40	22	62	47	92	70	85	72
27	82	64	72	60	62	42	56	36	45	29	21	5	40	33	56	33	46	32	58	44	90	71	90	69
28	83	63	73	56	66	50	53	44	57	42	35	20	46	34	52	32	38	33	63	41	82	61	91	77
29	85	67	79	61	68	57	57	45	58	23	41	31	34	8	53	34	40	26	61	48	73	54	84	74
30	83	67	72	59	77	56	54	43	29	17	40	4	42	6	......	......	42	31	58	39	66	59	82	66
31	83	59	77	52	......	......	49	35	......	......	29	− 1	44	28	......	......	48	30	......	......	71	59	......	......
Range	37°		42°		52°		56°		61°		64°		45°		68°		57°		47°		56°		39°	
Monthly mean	71°.2		68°.0		59°.8		56°.1		37°.5		28°.4		31°.0		28°.6		32°.9		49.8		66°.4		71°.9	

Elevation of thermometers above ground, 51 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, ALPENA, MICH.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	72	52	88	66	83	63	66	60	33	18	40	26	40	17	15	— 5	24	11	50	34	55	27	58	39
2	87	62	89	60	73	64	72	59	28	20	34	24	40	20	20	— 8	35	17	40	35	63	40	62	39
3	87	65	72	62	66	61	66	47	23	17	25	20	40	19	22	12	47	33	42	35	86	52	53	37
4	73	59	73	53	62	48	72	40	30	15	30	20	52	25	18	5	40	30	45	39	58	42	61	48
5	68	52	85	60	72	45	75	57	33	16	40	29	35	10	19	8	31	25	42	33	80	48	64	54
6	82	58	74	56	65	52	69	56	40	24	45	37	41	30	20	zero.	37	20	35	27	51	37	70	51
7	82	66	72	52	58	45	69	60	52	35	39	25	38	20	21	5	37	5	34	17	52	40	58	46
8	80	64	63	46	54	45	66	61	62	44	26	19	35	30	42	9	13	— 5	44	16	66	40	56	40
9	87	59	70	45	56	42	68	60	60	41	37	20	40	28	19	zero.	32	5	62	30	81	47	59	50
10	82	64	68	51	60	37	83	60	45	36	55	30	34	18	35	15	14	— 8	38	27	67	50	69	53
11	76	65	65	46	61	42	65	52	57	40	30	15	52	20	37	17	30	10	34	14	67	45	74	54
12	72	59	80	62	65	50	72	56	51	41	25	10	25	10	49	25	16	— 3	47	17	69	45	78	54
13	88	63	65	58	60	45	60	55	48	39	25	15	25	8	26	20	26	— 2	65	40	50	39	72	52
14	86	68	65	55	55	40	66	58	60	44	31	16	41	8	25	15	28	5	43	30	50	37	60	48
15	88	68	57	44	60	39	79	59	46	37	29	20	30	10	35	18	32	— 8	60	30	52	40	75	48
16	80	59	64	44	60	48	69	57	45	35	19	10	42	29	35	27	27	9	40	29	80	44	77	50
17	75	53	72	42	58	44	70	60	35	28	19	5	42	32	56	32	20	— 3	52	27	68	49	80	52
18	71	50	76	47	59	44	60	40	32	27	15	3	37	30	47	5	37	10	40	35	59	48	72	50
19	67	48	75	49	55	38	55	31	35	20	17	5	39	30	20	zero.	37	23	64	36	76	52	75	56
20	82	58	74	57	56	37	65	38	20	5	17	5	30	10	27	— 1	32	12	54	31	66	52	86	59
21	80	65	74	63	57	35	64	41	26	3	15	zero.	30	8	28	20	50	zero.	66	33	55	47	86	61
22	71	63	71	61	58	52	68	41	31	15	25	12	32	24	37	18	40	25	62	36	55	49	80	61
23	69	61	73	57	60	43	44	32	32	23	28	zero.	25	15	27	19	45	19	36	32	73	51	92	64
24	65	55	70	50	49	35	38	26	31	16	30	12	32	10	44	23	19	5	41	32	64	51	85	69
25	67	51	67	49	63	30	52	25	32	28	15	3	36	21	58	35	30	zero.	41	38	78	54	77	66
26	80	62	67	48	59	42	55	36	35	20	10	— 5	42	30	40	30	35	28	50	38	87	63	72	59
27	77	56	68	52	59	51	61	41	45	33	24	zero.	40	30	34	28	42	32	44	31	76	46	75	59
28	83	60	85	59	73	55	51	41	40	20	30	20	30	10	32	25	40	30	44	32	60	42	75	58
29	75	57	85	61	76	63	53	37	25	13	33	15	25	5	22	15	40	23	46	33	62	44	70	52
30	70	52	80	61	85	60	41	30	27	zero.	15	zero.	50	22	......	......	45	21	40	27	63	47	70	55
31	87	62	84	60	......	......	35	24	......	......	28	10	25	10	......	......	40	23	......	......	68	45	......	......
Range	40°		47°		55°		59°		62°		60°		47°		66°		58°		52°		60°		55°	
Monthly mean	69°.3		64°.9		55°.4		53°.9		32°.9		22°.2		29°.2		22°.6		25°.3		38°.3		55°.5		62°.4	

Elevation of thermometers above ground, 54 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, ATLANTA, GA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	84	69	78	69	79	71	79	66	58	46	49	30	69	54	55	39	60	46	67	54	64	44	86	73
2	85	65	78	68	81	72	83	66	63	47	58	36	70	55	44	32	64	46	65	53	70	50	82	69
3	84	67	84	71	80	65	82	63	52	36	66	50	69	55	45	31	63	49	75	57	66	55	82	65
4	89	68	88	70	78	65	82	68	50	30	64	50	70	55	47	31	75	62	82	66	63	57	76	60
5	91	73	89	74	81	64	75	66	52	37	59	51	71	56	48	32	76	64	86	66	76	58	79	61
6	90	71	91	75	82	66	76	66	66	39	59	45	70	58	51	35	73	59	85	64	82	62	82	65
7	90	70	88	75	86	66	73	69	68	50	62	42	68	58	55	35	78	61	65	51	83	65	84	69
8	93	73	85	72	84	70	80	69	69	59	64	47	65	55	53	39	63	53	51	37	81	64	84	67
9	94	78	77	66	74	57	80	69	71	63	64	51	55	49	61	38	64	45	55	38	78	65	88	67
10	95	81	75	62	76	57	83	69	70	64	70	58	60	49	66	49	62	47	66	42	78	63	89	74
11	97	81	79	62	74	60	73	66	73	61	65	38	67	57	65	51	61	52	57	44	82	62	90	72
12	97	80	78	63	77	60	73	63	75	60	47	31	70	59	70	56	64	42	58	36	84	63	91	72
13	97	79	81	64	71	63	78	62	75	66	43	34	62	38	69	52	45	40	70	44	84	64	92	78
14	85	72	78	70	73	60	76	63	75	65	45	35	46	30	57	42	57	40	76	51	78	68	92	78
15	87	71	81	70	76	56	76	63	76	64	50	40	56	34	51	35	60	53	79	62	73	58	90	75
16	91	72	85	70	78	60	72	67	71	59	53	34	57	37	58	35	62	46	76	61	75	60	80	66
17	92	74	78	68	82	61	76	70	59	52	62	37	63	41	65	45	57	35	82	65	81	64	78	60
18	87	73	79	62	83	61	73	61	59	41	67	46	59	47	64	55	60	42	85	66	84	65	78	58
19	73	67	83	63	83	64	65	54	48	35	66	49	68	48	55	40	60	45	76	61	86	68	79	62
20	81	65	84	68	74	63	59	50	42	29	64	47	67	52	51	36	60	44	73	59	83	65	81	62
21	80	68	83	66	71	63	56	50	44	24	67	56	64	53	54	42	62	47	73	52	74	66	81	64
22	84	68	81	70	69	60	63	54	51	31	69	59	62	46	63	38	65	50	67	55	80	66	85	67
23	85	72	81	71	71	62	67	49	60	37	69	62	48	36	63	51	66	50	66	61	83	66	87	68
24	90	73	83	73	77	63	57	40	56	35	71	60	50	32	65	44	60	47	81	60	81	69	84	69
25	83	75	80	70	72	55	51	38	60	40	67	30	45	32	70	46	61	40	82	67	80	65	80	71
26	86	73	74	59	68	51	56	36	65	49	35	17	43	36	67	60	70	44	74	62	81	65	86	70
27	82	73	75	57	71	44	53	47	60	41	48	22	62	40	71	60	70	58	70	56	82	67	89	71
28	86	74	75	60	75	51	67	53	62	57	55	31	69	46	74	59	63	47	70	51	85	67	89	72
29	80	73	77	58	78	54	69	45	60	38	60	41	67	51	67	51	58	40	70	59	83	70	87	74
30	76	71	78	62	72	62	71	52	46	32	68	48	59	48	......	......	60	40	65	55	78	68	88	71
31	82	70	83	63	......	......	63	45	......	......	68	58	62	48	......	......	69	41	......	......	85	68	......	......
Range	32°		34°		42°		47°		52°		54°		41°		43°		43°		50°		42°		34°	
Monthly mean	80°.1		73°.7		69°.2		64°.0		50°.5		51°.6		54°.4		50°.6		56°.1		63°.0		71°.9		76°.9	

Elevation of thermometers above ground, 77 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, ATLANTIC CITY, N. J.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	76	56	81	69	78	65	78	59	47.5	31	44	21	43	31	40	20	50	35	62	32	56	33	74	62
2	73	61	86	70	75	61	71	60	48	30	50	38	47	38	32	11	47	27	57	41.5	60	50	67	51
3	74	60	85	71	74	68	76	64	48	32	54	46	45	34	48	31	50	40	53	48	63	50	68	51
4	73	59	84	71	82	66	70	60	38	22.5	60	48	51	37	39	25	71	47	58	47	66	53	69	54
5	65	55	84	69	78	60	73	55	40	21	48	42	52	42	35	18	72	47	75	51	60	52.5	71	60
6	68	54	87	70	74	64	75	61	48	35	54	47	51	40	44	31	54	41	56	46	86	52	72	61.5
7	76	58	77	70	76	67	70	68	48	31	57	47	46	41.5	48	28.5	45	40.5	48	32	65	52	86	62
8	82	63	80	72	79	58	79	64	57	37	50	45	44	39.5	38	21.5	45	36	47	26.5	62	53	71	59
9	84	67	73	61	70	52	76	66	62	52.5	48	42	45	40.5	44	20	40	34	49	30	75	56	64	57.5
10	89	63	71	53	68	53	72	66	72	53	54	46	53	39	39	14.5	42	31.5	53	43	67	59	70	55
11	81	66	77	55	68	52	67	62	57	49	55	43	47	37	40.5	25.5	40	29	49	30	68	57	72	62
12	77	65	79	64	68	52	70	61	71	56	42	30	49	38	47	38.5	35	26	44	24	74	58	93	65
13	71	60	78	64	72	58	71	60	67	53	41	25	38	24	51	44	38	26	55	39	63	49	89	68.5
14	76	59	78	70	69	58	70	57	59	52	48	40.5	37	13	56	40	46	37	67	49	55	46.5	77	66
15	78	59	75	68	70	49	81	57	64	58	50	36	41	29	42	33	39	35	58	48.5	61	42	69	60
16	88	64	78	70	72	61	78	61	62	43	43	26	42	29	43	27	46	34	58	50.5	77	45	67	60
17	88	66	75	69	77	59	76	62	51	37.5	49	36	40	25	50	38.5	42	31	64	45	89	56	77	57
18	74	61	72	62	72	52	74	66	56	39	36	21	47	36	52	45	39	27	54	37	72	56	76	56
19	74	61	79	59	68	63	69	46	39	30	41	32	51	30	53	24	43	33	56	45	61	55	74	63
20	74	62	71	62	68	58	60	39	39	25	42	35	53	42	35	16.5	51	33	65	43	70	54.5	87	64
21	79	60	77	65	65	60	64	47	34	18	39	27	50	35	43	27	45	29	58	39	69.5	60.5	90	65.5
22	78	62	77	67	62	55	69	59	38	12	51	32	48	38	45	26	52	33	60	44.5	71	60	85	65
23	78	68	83	68	69	50	67	54	53	33	44	32	47	35	50	31	50	33	59	45	70	61.5	78	65.5
24	73	67	73	69	71	55	55	35	42	22	49	41	43	32	43	22	44	24	54	42	71	61	87	70
25	71	65	70	65	57	44	43	29	51	32	49	28	42	26	50	28.5	40	18	53	43	78	62	81	70.5
26	76	68	66	62	61	44	54	30	44	30.5	29	13	44	29	52	44	43	23	64	48	84	60	90	71
27	80	67	68	58	61	51	59	42	52	29.5	34	9	52	42	54	37	50	40	63	51	81	66	83	70.5
28	79	67	67	57	67	49	64	45	56.5	46	42	33	64	44	52	42	52	38	56	42	79	64	87	71
29	82	68	81	59	70	54	63	44	56	32	46	39	44	32	71	47	47	31	57	48	68	61	84	71
30	73	69	76	65	71	57	63	42	35	25	61	32	50	34	......	......	48	31	63	40	74	62	86	71
31	78	68	76	65	......	......	52	37	......	......	41	29	53	35	......	......	54	29	......	......	81	64	......	......
Range	35°		34°		38°		52°		59°		52°		51°		60°		54°		51°		56°		42°	
Monthly mean	69°.7		70°.9		64°.2		60°.3		44°.4		41°.4		41°.1		38°.2		40°.1		49°.3		63°.1		69°.3	

Elevation of thermometers above ground, 10 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, AUGUSTA, GA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	91	71	85	73	82	73	88	67	61	53	56	32	75	48	63	51	64	55	79	45	72	50	88	70
2	89	67	84	74	88	74	86	64	68	50	68	38	67	54	55	38	68	47	75	49	76	51	90	72
3	90	66	84	73	87	74	86	66	64	41	71	45	72	45	50	36	72	47	69	61	72	62	81	63
4	92	68	89	73	87	70	82	60	51	32	71	52	76	49	51	33	82	59	82	63	75	62	82	61
5	98	71	94	76	88	68	79	70	56	31	63	45	73	49	45	36	83	67	85	62	81	61	86	63
6	92	75	95	77	88	68	83	70	69	43	73	56	75	54	49	34	79	61	90	64	87	60	87	67
7	90	72	95	79	90	68	81	74	75	46	72	40	73	59	59	30	84	59	72	58	89	63	86	73
8	96	72	94	74	91	70	82	72	78	62	64	42	65	57	58	43	72	58	62	41	85	62	91	70
9	101	72	82	74	83	67	82	70	78	63	71	47	61	56	65	36	58	51	60	39	85	66	96	70
10	102	81	81	65	82	61	89	68	80	59	77	55	70	56	70	38	58	50	70	39	83	68	90	75
11	102	82	82	65	81	60	82	68	78	59	76	56	65	60	71	41	60	53	70	49	84	68	95	72
12	104	85	84	65	82	56	79	67	81	57	56	45	71	59	78	54	63	50	58	36	89	67	99	74
13	103	80	87	67	76	59	83	66	84	60	47	41	62	45	81	60	50	43	73	39	87	65	90	77
14	89	75	87	67	83	59	84	68	81	61	52	40	51	31	61	52	63	43	79	49	78	66	99	79
15	92	74	85	74	82	63	82	69	82	65	65	44	55	40	62	42	73	55	83	57	75	57	97	81
16	96	74	91	73	86	56	83	72	81	67	56	35	64	47	64	34	72	61	81	59	77	54	91	67
17	94	72	89	72	90	61	81	74	75	62	67	35	62	37	71	45	64	43	87	62	84	58	84	63
18	89	73	86	72	89	60	82	72	70	52	71	41	68	48	77	55	64	48	89	63	87	63	86	63
19	79	69	88	73	86	65	75	66	54	34	71	42	72	39	67	51	69	52	82	66	87	65	85	63
20	87	71	89	76	79	70	66	59	57	32	70	41	71	47	56	38	65	44	71	65	86	66	87	60
21	87	70	87	72	67	62	63	55	48	27	74	51	68	47	58	42	70	47	69	61	84	66	87	66
22	89	71	81	73	68	62	70	59	55	28	72	55	67	56	66	37	65	49	73	59	82	67	91	67
23	90	75	86	74	70	62	75	63	67	31	71	61	56	41	74	45	73	46	79	62	83	71	92	70
24	92	75	87	72	78	64	62	50	60	37	75	54	51	39	69	39	70	50	82	61	85	69	87	74
25	88	76	87	75	74	61	56	41	66	33	75	50	54	35	78	46	64	42	88	65	85	67	88	71
26	88	74	83	65	71	51	62	40	72	37	50	30	50	42	74	54	71	45	80	67	85	65	92	72
27	86	74	77	64	76	53	58	54	71	47	50	29	56	45	80	58	75	56	81	60	86	67	95	73
28	90	75	81	69	80	54	73	53	75	58	61	41	72	46	81	58	71	55	80	54	86	68	96	75
29	88	74	83	65	84	63	71	42	62	44	68	43	72	43	79	62	65	43	76	63	87	70	95	76
30	81	73	83	67	80	69	76	43	55	36	74	41	67	53	......	......	61	39	75	59	84	70	95	74
31	81	70	89	70	......	......	68	48	......	......	72	46	64	49	......	......	67	35	......	......	89	67	......	......
Range	38°		31°		40°		49°		57°		47°		45°		48°		49°		54°		39°		39°	
Monthly mean	82°.7		78°.7		73°.3		69°.2		57°.0		55°.3		56°.5		55°.1		59°.9		66°.1		73°.4		81°.0	

Elevation of thermometers above ground, 18 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, BALTIMORE, MD.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1.	82	62.5	89	70	85	67	80	56	49	34	46	28	46	33	41	26	52	40	60	36	61	38	86	60
2.	87	63	92	75	79	70	82	62	49	33	51	31	54	35	26	15	51	31	66	42	78	48	67	53
3.	95	68	92	75	83	69	89	64	44	33	58	37	52	39	36	21	52	36	65	54	79	56	76	52
4.	98	74	90	74	82	68	74	62	41	28	63	51	56	34	38	24	74	48	77	53	77	57	77	58
5.	82	66	90	73	82	64	81	58	41	25	54	43	57	40	35	19	76	56	77	53	75	59	79	64
6.	82	60	90	76	83	65	84	61	46	37	60	45	45	37	43	31	59	45	69	51	86	60	84	68
7.	81.5	63	83	70	84	68	74	62	50	33	60	49	49	43	45	29	50	35	51	40	75	61	86	70
8.	86	69	87	72	78	63	78	64	56	37	57	42	45	40	40	23	49	38	47	32	76	57	83	66
9.	87	72	73	63	71	56	84	68	71	54	51	42	44	37	47	26	40	29	55	34	91	63	69	64
10.	92.5	68	77	56	69	53	83	69	74	56	57	44	55	42	32	17	43	32	68	37	87	69	70	64
11.	95	70	80	58	71	50	73	65	63	53	61	42	49	37	46	28	43	29	56	35	87	68	87	67
12.	84.5	72	82.5	62	72	51	72	61	78	54	43	31	54	34	59	38	36	28	50	30	81	64	95	73
13.	84	68	82	63	73	60	79	59	74	54	37	26	35	26	66	51	35	24	68	36	68	54	92	72
14.	89	65	86	67	70	56	75	64	67	53	42	33	38	17	56	43	45	32	80	50	63	47	80	73
15.	94	71.5	82	68	70	52	81	61	75	56	53	38	42	27	45	36	43	37	79	51	67	45	73	61
16.	99	78	84	62	74	52	82	63	62	51	43	31	43	28	54	30	46	36	75	60	81	51	75	59
17.	91	74	77	70	76	58	82	60	54	39	53	35	41	30	58	38	44	36	72	54	90	64	84	59
18.	85	66	72	62	74	51	75	68	52	40	41	28	54	36	62	44	41	30	64	44	90	66	83	64
19.	82	66	82	59	71	59	68	52	40	31	40	31	60	33	45	25	43	37	72	48	80	58	85	66
20.	80	62	82	65	64	58	63	43	39	23	43	35	63	43	35	20	54	40	66	46	91	64	87	67
21.	84	66.5	84	66	62	56	61	45	31	21	43	25	51	41	46	26	49	35	68	44	85	68	89	70
22.	90	68	87	68	65	55	64	59	37	20	37	22	49	36	50	31	53	33	72	49	77	65	92	72
23.	91.5	68	88	69	73	53	73	52	52	32	44	35	48	38	50	36	61	37	69	48	69	62	93	72
24.	87	75	80	71	70	54	52	39	41	29	52	36	46	32	49	29	51	31	50	44	84	66	95	73
25.	79	72	75	62	59	45	47	33	56	31	52	32	45	29	57	38	44	22	52	43	90	68	93	72
26.	81	73	69	60	61	40	53	30	46	35	34	18	47	29	65	49	44	28	70	50	92	74	90	74
27.	90	71	75	59	66	43	56	38	51	23	34	13	55	41	64	48	56	40	65	51	93	75	91	74
28.	88	75	76	62	68	50	60	43	60	44	41	28	65	47	56	49	59	38	63	46	89	73	94	76
29.	85	72	84	62	71	55	64	43	61	35	49	34	50	36	67	49	46	33	58	50	78	66	89	73
30.	80	74	86	73	75	54	63	47	39	29	63	39	43	31	......	......	53	35	62	44	75	64	87	71
31.	84	72	84	66	......	......	53	41	......	......	39	29	53	31	......	......	58	37	......	......	84	67	......	......
Range	39°		36°		45°		59°		58°		50°		48°		52°		54°		50°		55°		43°	
Monthly mean	78°.6		76°.3		64°.9		63°.1		46°.4		41°.8		43°.1		41°.7		43°.2		55°.4		71°.1		75°.3	

Elevation of thermometers above ground, 33 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, BARNEGAT, N. J.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	73	58	81	70	83	65	82	57	47	29	43	22	41	30	41	17	48	35	53	35	55	34	75	62
2	79	59	89	70	76	68	72	63	49	33	49	30	48	33	32	11	42	29	54	39	66	48	62	52
3	83	63	92	72	71	67	82	63	47	30	52	40	44	32	47	30	50	35	54	47	71	53	65	52
4	80	56	83	70	84	67	69	54	37	26	60	45	51	38	39	25	69	49	54	48	70	54	65	50
5	62	53	80	70	78	64	72	53	38	24	49	43	51	43	33	17	73	48	73	48	59	54	70	59
6	62	53	86	73	72	64	70	58	45	32	56	46	49	41	43	23	53	41	53	43	84	51	70	62
7	73	57	76	72	75	65	69	62	46	32	56	41	45	41	48	23	43	39	46	32	60	52	77	61
8	80	61	82	72	80	60	78	58	54	36	50	40	43	39	34	20	46	35	44	27	61	51	66	58
9	83	65	72	62	71	55	78	66	63	51	48	43	43	40	39	18	38	34	46	32	72	52	63	54
10	87	63	70	53	67	53	72	63	67	51	53	45	51	41	38	15	46	32	56	41	77	57	69	48
11	83	67	80	55	69	55	66	62	56	46	58	42	48	41	41	27	37	30	51	30	80	57	69	61
12	78	60	83	61	69	56	71	60	73	53	42	29	50	37	52	39	34	26	44	26	74	57	91	66
13	71	60	80	62	73	53	71	59	65	51	40	27	37	24	56	43	36	30	63	33	61	51	84	68
14	79	58	82	68	68	57	66	56	60	50	48	39	37	18	55	38	45	36	79	47	55	48	72	64
15	88	66	74	65	67	53	78	54	65	56	49	35	42	32	40	33	38	34	59	47	57	44	65	59
16	96	66	76	69	69	60	79	63	61	47	36	28	41	29	48	29	43	35	60	47	77	46	69	59
17	85	65	75	68	75	60	73	58	52	41	47	33	39	25	47	35	43	32	64	41	84	57	72	55
18	73	62	70	61	72	52	72	65	53	38	34	25	45	37	54	44	39	26	51	39	66	54	79	57
19	71	57	78	57	66	62	69	46	41	33	43	23	52	34	53	23	42	33	53	43	59	63	78	57
20	73	55	71	64	68	58	58	42	38	22	44	35	52	39	31	18	49	33	63	44	70	52	83	62
21	78	59	77	62	65	60	65	45	27	18	37	23	49	34	40	22	44	30	56	42	70	59	89	62
22	78	63	80	67	61	54	66	58	35	18	49	31	49	38	46	28	56	29	61	39	69	58	82	65
23	73	61	89	68	69	51	68	51	52	30	43	31	49	36	49	29	50	33	53	43	66	59	76	65
24	71	60	78	67	72	54	56	36	41	27	49	40	43	31	40	24	43	21	46	40	69	59	93	69
25	70	59	70	63	55	46	42	30	49	28	47	27.	43	24	46	27	38	18	48	42	83	59	87	70
26	76	63	65	62	60	45	51	32	42	26	27	12	46	26	53	43	41	22	61	46	82	67	93	72
27	82	68	68	61	63	50	59	40	50	26	27	10	50	42	53	39	47	39	62	50	91	68	84	70
28	81	70	68	59	67	51	64	45	55	45	42	27	61	44	50	42	49	35	54	43	89	64	92	72
29	82	69	82	58	69	52	62	44	55	32	47	34	44	33	70	47	38	31	57	46	68	60	91	68
30	79	68	75	64	74	56	62	44	34	25	58	30	49	33	......	......	43	32	64	42	72	61	87	67
31	77	69	71	61	......	......	51	35	......	......	41	28	54	34	......	......	53	31	......	......	78	64	......	......
Range	43°		39°		39°		52°		55°		50°		43°		59°		55°		53°		57°		45°	
Monthly mean	69°.2		70°.4		63°.9		59°.2		42°.8		39°.7		40°.6		37°.0		39°.2		47°.9		62°.0		68°.7	

Elevation of thermometers above ground, 5 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, BISMARCK, DAK.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	78	60	79	57	81	48	81	41	27	6	21	5	45	17	33	4	26	1	34	23	80	47	67	40
2	73	57	80	45	70	53	67	42	19	7	19	zero.	30	14	27	2	40	13	37	19	85	48	76	44
3	74	56	78	51	68	41	84	36	34	16	24	10	40	15	19	1	13	zero.	47	19	74	51	77	50
4	82	54	81	49	77	36	82	40	48	18	25	13	34	2	20	5	27	3	33	17	69	46	69	54
5	88	66	89	50	64	48	88	48	66	29	31	12	33	—9	31	4	28	1	48	22	79	48	64	52
6	86	69	68	48	63	39	82	54	55	32	35	—2	13	—14	31	zero.	27	—5	40	12	68	54	68	44
7	78	58	74	43	62	33	60	37	50	33	1	—12	17	1	34	2	5	—16	45	20	65	45	75	50
8	86	53	78	47	72	39	56	43	38	23	10	—12	41	—5	11	—7	18	—5	67	25	65	39	70	53
9	90	65	90	52	77	50	59	41	47	21	19	1	—2	—16	29	1	6	—11	66	35	54	44	67	47
10	81	59	89	55	70	50	66	38	51	23	2	—7	31	—6	36	5	13	2	41	25	65	37	76	49
11	86	60	70	54	70	48	57	41	55	26	4	—18	—5	—20	30	10	3	—16	53	20	80	45	65	56
12	95	66	65	49	66	42	68	31	44	33	8	—17	3	—21	21	1	3	—12	70	33	92	60	70	52
13	85	64	77	41	66	36	85	61	50	23	10	—16	41	—11	33	8	8	—15	38	23	89	65	70	48
14	80	62	77	56	81	44	64	50	51	21	—5	—18	28	—5	34	8	21	—9	25	13	88	66	69	55
15	83	52	78	49	63	43	55	49	36	21	18	—15	44	15	34	15	8	—8	55	7	72	55	71	49
16	82	56	81	51	67	48	56	43	30	18	18	—13	46	33	25	3	26	—10	69	35	84	55	73	53
17	80	56	83	56	55	39	54	36	38	17	1	—20	49	25	4	—7	33	6	53	34	72	56	79	53
18	86	62	73	51	59	29	68	35	56	18	—1	—10	45	18	6	—13	45	19	34	22	72	51	81	57
19	82	61	84	55	65	40	77	38	44	5	—5	—14	20	10	34	—17	33	21	43	21	59	44	85	62
20	83	62	89	55	75	37	69	43	25	1	—5	—14	32	15	43	9	48	23	56	21	60	39	83	58
21	81	61	81	60	65	39	63	32	41	23	2	—15	35	14	41	5	48	26	66	33	73	42	75	56
22	72	52	87	61	62	34	46	29	42	22	—11	—23	23	4	40	26	48	32	52	35	67	49	82	60
23	68	54	86	63	64	25	49	26	37	8	—13	—33	33	6	55	27	46	20	40	33	72	48	79	55
24	72	60	85	63	70	36	56	29	39	18	—16	—38	25	8	44	14	60	30	33	28	64	45	80	60
25	71	54	78	50	76	40	54	32	35	13	4	—31	44	18	42	11	67	28	35	28	60	45	84	53
26	77	53	83	53	76	44	57	35	28	15	36	—4	22	3	31	3	53	32	44	22	58	47	84	63
27	77	53	83	56	78	44	58	43	17	2	30	1	22	—13	3	—12	37	28	62	31	67	44	66	52
28	77	48	90	68	79	58	61	32	20	6	2	—15	zero.	—17	—1	—12	48	22	53	33	79	46	70	47
29	84	56	80	58	67	53	42	29	29	6	—6	—27	14	zero.	20	—9	64	36	48	31	64	52	79	47
30	92	61	70	56	70	34	29	10	39	19	14	—17	15	—7	......	......	43	30	74	33	56	44	75	55
31	82	65	78	55	......	......	43	12	......	......	30	3	26	4	......	......	41	28	......	......	59	38	......	......
Range	47°		49°		56°		78°		65°		74°		70°		72°		83°		67°		55°		45°	
Monthly mean	70°.6		67°.1		55°.1		48°.7		28°.2		— 1°.2		14°.8		14°.7		19°.7		36°.4		59°.5		64°.1	

Elevation of thermometers above ground, 16 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, BOERNE, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	100	75	95	66	(*)	64	90	65	72	43	68	34	66	46	44	33	66	48	72	63	63	53	95	72
2	101	75	96	77	98	68	84	67	69	35	74	58	67	59	51	33	69	54	88	54	67	52	81	73
3	84	74	93	70	100	57	88	62	72	38	76	52	69	54	49	33	74	59	90	52	68	60	88	72
4	91	74	95	73	99	59	87	69	71	37	76	52	67	54	51	32	84	60	93	49	88	60	95	69
5	92	75	93	74	(*)	(*)	86	70	78	57	67	39	69	51	50	33	82	63	90	57	83	59	91	69
6	97	74	95	74	......	......	86	66	81	47	72	36	79	58	48	36	80	63	84	67	87	61	86	70
7	98	74	98	76	94	59	87	68	82	59	72	58	71	57	49	35	81	59	64	43	82	64	95	71
8	98	74	93	76	95	61	86	72	82	57	72	58	72	62	54	39	68	42	60	39	87	65	92	71
9	98	74	83	65	92	68	85	72	84	57	77	60	80	56	57	44	69	40	72	32	84	68	92	71
10	98	73	71	64	82	69	(*)	74	79	70	57	39	74	54	64	50	63	53	75	40	92	68	89	73
11	100	75	75	66	85	73	......	(*)	73	55	57	27	74	59	73	57	63	55	66	42	91	66	94	73
12	99	74	83	65	76	66	87	67	80	48	53	20	66	45	81	49	62	41	80	41	93	67	83	73
13	101	73	87	67	80	64	85	61	84	68	46	37	58	36	59	33	(*)	35	79	55	92	63	91	70
14	98	75	91	65	88	53	85	62	81	61	65	32	61	44	54	33	......	(*)	82	63	88	62	92	71
15	98	77	90	71	89	52	87	70	87	51	62	29	62	43	62	25	46	23	92	66	88	59	90	71
16	101	73	91	62	90	53	80	65	81	50	69	47	72	38	70	39	56	23	90	65	85	64	91	68
17	102	76	93	66	87	53	78	58	74	46	72	42	73	52	72	54	55	32	87	65	89	64	89	70
18	102	76	88	64	83	54	72	47	74	34	60	35	70	48	66	44	75	46	89	69	92	67	86	67
19	98	77	87	64	89	57	80	46	67	23	67	48	(*)	57	48	36	76	37	79	53	92	69	92	60
20	100	77	91	65	87	61	80	42	62	34	76	50	......	(*)	56	39	68	44	80	38	83	63	94	65
21	100	76	92	66	89	53	81	39	66	23	73	58	79	49	75	47	61	47	78	55	86	58	88	64
22	101	71	95	59	92	52	83	39	69	28	69	58	57	36	71	48	67	48	82	68	95	60	88	59
23	104	70	98	62	92	53	75	47	71	40	77	58	59	27	67	51	72	55	93	68	89	62	90	57
24	100	74	104	65	84	54	85	37	69	48	66	18	54	36	80	62	72	49	93	70	94	66	93	62
25	100	77	99	67	85	65	69	31	(*)	48	31	14	61	32	73	51	76	58	86	57	95	64	97	63
26	102	75	100	68	85	63	70	34	......	(*)	56	14	66	37	73	50	85	63	90	44	90	73	99	71
27	101	74	100	68	86	69	74	48	......	......	58	26	73	43	76	61	68	48	82	63	92	73	95	73
28	102	74	96	64	77	71	79	37	......	......	72	47	72	58	76	34	78	37	78	63	82	64	90	73
29	102	75	91	58	87	68	81	38	62	30	77	58	72	60	53	33	78	54	75	59	87	70	97	73
30	100	71	93	65	89	68	71	49	63	25	77	62	74	40	......	......	67	55	69	49	90	70	92	69
31	98	65	93	66	......	......	65	42	......	......	66	46	48	33	......	......	67	61	......	......	91	71	......	......
Range	39°		46°		......	......	......	......	......	......	63°		......	......	56°		......	......	61°		43°		42°	

*Observer absent on repair duty.

Elevation of thermometers above ground, 6 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, BOISE CITY, IDAHO.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	78	48	83	50	86	57	70	54	53	25	53	42	47	40	35	15	53	33	52	35	83	49	81	46
2	79	48	90	52	89	50	80	45	57	29	54	41	49	42	38	15	48	34	52	41	69	53	79	48
3	88	50	92	54	85	48	80	49	58	33	50	41	50	38	40	19	46	31	55	40	68	43	77	50
4	82	62	95	56	87	50	85	51	57	33	41	34	53	34	47	31	40	28	50	36	67	49	62	41
5	73	43	95	62	92	52	72	55	62	46	49	38	56	38	48	32	47	28	51	30	56	40	70	40
6	84	46	94	61	91	68	57	45	61	43	44	32	49	40	47	26	45	37	56	31	55	35	74	44
7	89	52	97	61	86	55	53	39	48	29	40	28	54	47	52	27	52	29	62	35	53	39	70	56
8	93	55	99	60	86	59	61	36	48	32	34	27	51	35	45	25	46	30	66	38	57	35	64	46
9	88	58	103	65	75	56	56	41	52	38	35	14	50	30	53	25	48	23	73	40	53	35	64	45
10	85	55	100	68	65	46	54	37	52	41	32	20	47	28	42	27	55	27	70	52	67	45	59	43
11	88	59	99	67	72	39	62	39	52	38	35	24	37	28	36	23	43	25	72	44	63	44	73	43
12	75	60	94	67	79	43	57	44	41	32	35	24	37	26	35	11	30	12	67	41	48	41	79	48
13	82	55	96	64	85	46	52	43	40	28	53	35	47	35	38	25	28	10	58	35	55	34	83	56
14	83	55	97	65	83	50	54	35	46	34	59	38	47	34	48	27	33	10	53	38	54	36	77	55
15	88	60	97	63	86	52	55	43	48	37	48	36	55	38	46	34	39	19	50	39	65	36	75	43
16	87	56	90	64	89	57	55	32	43	30	44	34	54	35	35	20	41	26	45	33	70	38	86	48
17	90	56	89	62	88	54	67	33	41	25	45	31	57	39	34	15	56	27	48	36	76	49	90	51
18	90	55	90	54	86	55	70	36	42	25	35	31	52	33	35	25	51	27	51	32	70	48	88	53
19	93	57	90	59	92	58	67	39	43	22	46	32	52	37	39	28	50	33	57	34	74	54	71	48
20	86	62	84	62	87	53	73	42	44	22	50	33	52	37	42	25	53	28	54	41	81	60	72	40
21	95	59	82	60	89	53	60	41	43	22	34	28	51	32	42	26	55	29	68	41	68	45	75	43
22	90	60	75	60	83	52	61	30	42	21	33	16	48	35	41	28	62	30	54	40	70	48	84	51
23	87	63	87	50	84	50	65	38	43	22	16	3	51	33	40	30	62	33	52	33	59	43	86	55
24	90	60	78	50	86	54	63	39	43	23	18	—4	52	36	48	32	64	35	55	42	55	38	91	59
25	90	60	89	48	82	50	57	38	45	27	22	9	50	27	45	36	56	40	61	38	63	39	91	60
26	89	60	91	55	75	53	62	35	40	27	30	13	38	21	44	31	48	30	66	41	79	50	88	58
27	90	59	79	55	70	58	64	36	40	16.5	40	33	30	23	31	17	56	38	67	41	76	47	88	50
28	95	60	65	50	68	52	63	38	40	20	35	20	31	23	32	15	51	36	70	40	75	49	90	56
29	100	62	72	47	60	39	60	36	40	32	35	14	32	22	38	25	42	30	74	44	68	44	89	55
30	92	63	78	46	70	36	59	29	50	32	29	7	30	13	......	......	48	26	79	48	67	43	86	56
31	87	58	89	51	......	......	52	25	......	......	45	23	34	17	......	......	45	30	......	......	70	40	......	......
Range	57°		57°		56°		60°		45°.5		63°		44°		42°		54°		49°		49°		51°	
Monthly mean	75°.5		76°.4		67°.5		49°.8		37°.5		31°.6		38°.3		32°.8		38°.0		49°.7		55°.0		66°.5	

Elevation of thermometers above ground, 19 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, BOSTON, MASS.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	73	56	91	66	89	61	86	60	44	30	43	16	38	8	38	3	42	31	44	34	50	33	88	60
2	87	57	95	70	88	67	72	59	46	26	55	34	51	25	18	— 5	39	25	57	32	56	44	62	48
3	94	66	91	75	75	62	83	57	43	28	54	42	40	22	33	10	53	27	57	41	81	45	69	50
4	91	63	84	69	65	61	70	52	33	21	55	36	55	29	28	15	62	44	67	53	88	52	66	53
5	76	56	90	67	75	57	81	53	35	17	42	29	45	30	39	15	72	42	61	46	75	55	70	50
6	74	50	88	69	75	52	69	52	33	21	49	36	38	29	41	22	45	30	55	39	79	51	66	56
7	66	55	82	60	74	59	74	51	40	30	58	43	45	32	28	17	39	30	39	27	51	45	65	55
8	72	61	66	60	78	61	88	60	58	31	51	39	45	25	35	12	37	17	43	22	63	47	56	49
9	82	65	69	59	69	52	78	62	67	46	42	30	39	32	35	4	25	15	54	27	90	53	63	49
10	85	65	75	56	72	55	69	54	63	44	53	33	49	32	31	— 4	41	16	62	37	92	46	73	49
11	80	66	75	54	67	52	64	50	51	40	63	40	40	25	40	22	25	15	49	28	85	59	86	57
12	73	61	79	59.5	75	52	66	50	69	46	41	27	56	33	52	27	38	18	41	23	70	54	87	63
13	83	60	87	63	72	51	71	51	52	40	35	21	33	11	49	39	26	17	64	30	55	42	83	64
14	92	64	85	66	68	58	69	44	57	40	41	28	29	8	53	32	35	24	53	37	56	45	75	59
15	90	69	71	61	73	54	76	49	69	57	43	34	43	21	34	25	42	29	72	37	60	39	71	57
16	93	66	61	53	61	56	81	54	58	44	37	29	38	28	42	24	35	30	62	39	67	46	80	55
17	80	66	58	54	75	49	62	56	62	39	42	26	46	31	52	30	38	26	39	33	84	50	72	54
18	67	58	62	55	73	48	69	52	46	28	27	11	38	34	63	41	38	21	48	33	59	48	81	59
19	66	55	75	56	72	53	65	39	37	25	29	18	47	31	56	18	35	29	53	37	67	47	88	58
20	77	54	79.5	53	64	48	52	35	41	20	41	22	38	34	30	12	49	28	62	45	86	58	90	60
21	77	58	85	60	65	45	71	36	23	10	29	zero.	38	17	43	21	46	26	60	42	87	58	84	61
22	84	62	89	66	58	52	67	53	33	9	32	1	37	16	46	26	56	26	73	44	77	60	71	55
23	75	66	86	70	70	51	73	56	48	27	36	15	52	36	39	30	55	30	51	41	72	60	78	56
24	74	66	85	65	75	49	56	31	40	24	39	27	41	27	35	16	43	21	43	33	90	59	90	63
25	71	59	75	60	69	40	39	26	50	24	39	14	40	23	41	19	34	12	52	35	80	63	92	66
26	65	58	61	55	59	34	59	25	43	29	17	zero.	52	30	48	34	39	18	63	42	97	69	90	71
27	85	59	69	55	62	40	60	40	40	29	31	8	44	31	61	33	39	17	62	49	96	70	93	69
28	88	66	70	53	68	44	57	45	58	39	47	19	59	37	56	37	34	29	59	39	88	65	91	68
29	90	63	80	52	74	54	58	45	58	30	52	34	38	13	64	39	36	26	68	45	70	57	92	71
30	89	69	74	58	83	56	58	44	30	20	46	13	52	12	......	......	39	28	67	36	62	54	88	69
31	83	68	81	58	......	......	49	36	......	......	17	5	53	27	......	......	48	27	......	......	82	60	......	......
Range	44°		43°		55°		63°		60°		63°		51°		69°		60°		51°		64°		45°	
Monthly mean	69°.9		67°.7		60°.8		56°.6		39°.2		32°.6		35°.0		32°.2		33°.1		45°.9		62°.7		67°.7	

Elevation of thermometers above ground, 156 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, BRACKETTVILLE, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	100	78	97	76	98	71	86	67	67	48	72	44	63	46	48	38	60	51	79	62	64	59	92	74
2	99	79	98	81	101	65	86	66	69	45	72	56	70	57	56	34	67	56	85	64	77	59	94	74
3	99	80	98	75	101	69	85	68	72	48	75	50	65	55	51	35	75	60	89	53	74	64	92	72
4	98	79	97	74	100	66	86	67	76	56	81	57	62	51	52	37	87	62	95	54	86	67	92	70
5	96	79	96	76	97	71	86	71	91	65	71	49	70	50	52	36	88	66	92	66	83	64	92	70
6	99	78	96	79	94	70	88	70	85	57	77	39	70	56	46	40	83	63	81	68	88	64	91	73
7	97	77	93	76	94	68	90	71	78	60	74	52	70	61	43	37	77	63	70	46	83	67	92	73
8	99	79	95	76	90	75	89	72	90	68	76	57	67	58	55	41	68	47	64	45	88	68	94	74
9	97	76	85	68	90	73	90	72	84	59	80	63	72	58	58	43	72	50	72	38	89	72	94	72
10	98	77	74	(*)	90	73	90	74	83	72	69	48	75	57	65	51	68	57	75	40	91	68	92	75
11	102	78	81	......	78	68	85	71	78	59	54	36	70	58	74	59	76	59	84	45	89	67	93	76
12	102	75	87	......	84	68	81	70	83	46	49	23	65	52	73	55	68	43	81	51	89	68	94	76
13	104	76	90	......	90	62	86	68	82	65	53	36	59	38	63	38	52	35	82	59	90	68	89	73
14	100	75	91	......	91	60	84	65	85	61	68	43	60	48	60	34	35	28	85	64	87	67	92	75
15	100	73	82	......	92	60	85	68	86	55	63	36	67	45	65	31	43	29	93	66	88	67	93	72
16	100	80	94	......	89	62	87	67	84	64	70	43	72	47	70	43	56	22	93	64	85	67	93	70
17	102	79	93	......	89	62	86	62	75	52	74	48	73	57	77	51	59	39	91	65	83	69	94	71
18	102	80	91	......	89	62	83	53	58	39	64	47	71	55	65	48	75	48	97	73	89	69	94	71
19	101	79	90	66	87	66	82	49	65	27	63	50	71	60	59	46	77	44	81	63	87	71	94	65
20	100	76	92	69	90	68	86	50	67	38	75	50	72	53	63	44	65	51	79	47	90	65	90	68
21	100	76	94	66	92	64	86	54	67	36	71	58	76	44	76	44	60	50	86	57	90	66	91	70
22	102	77	96	66	95	60	85	52	72	35	73	63	63	42	72	54	62	55	82	67	93	68	90	66
23	103	77	100	64	95	63	83	52	74	47	83	61	62	37	73	58	70	57	97	69	91	67	95	68
24	102	79	103	68	90	66	73	42	73	57	70	25	63	44	80	64	65	56	96	70	90	66	96	71
25	100	77	103	69	91	73	73	45	71	58	41	20	66	32	74	55	78	56	96	69	90	64	99	72
26	100	78	100	70	86	69	73	47	74	63	48	19	71	40	77	54	88	66	91	58	88	73	97	74
27	100	76	99	71	85	70	80	56	79	60	58	28	76	45	77	61	77	56	83	65	90	75	97	75
28	100	75	97	71	85	71	85	43	68	47	72	45	70	56	80	42	80	48	80	65	83	70	94	75
29	102	76	99	69	(‡)	(‡)	85	42	60	32	77	56	77	63	53	43	81	55	82	64	88	72	96	75
30	96	79	100	70	91	67	73	58	63	37	78	62	59	49	......	......	73	58	69	56	89	71	95	72
31	97	76	96	70	......	......	53	47	......	......	71	51	50	38	......	......	73	63	......	......	92	72	......	......
Range	31°		......		......		48°		64°		64°		45°		49°		66°		59°		33°		34°	
Monthly mean	86°.3		82°.2		77°.5		70°.0		(†)		56°.3		58°.1		54°.3		60°.4		71°.8		(†)		(†)	

* Minimum thermometer broken.

† Data incomplete.

‡ No observations taken.

Elevation of thermometers above ground, 6 feet.

The monthly means are obtained by dividing the sum of the daily means by the number of days in the month. The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 a. m. observations by *four*.

Maximum, minimum and mean temperatures—Continued.

STATION, BRECKENRIDGE, MINN.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	80	63	81	58	74	47	88	47	25	12	27	10	41	15	19	—28	17	—14	43	27	80	40	65	37
2	79	53	74	45	76	47	68	48	22	8	18	4	27	6	12	—16	42	6	39	23	85	40	70	43
3	75	63	75	49	67	44	80	32	28	zero.	24	16	34	19	1	—16	31	— 1	43	31	84	43	78	51
4	86	54	81	52	72	36	80	45	38	21	35	24	20	3	12	—19	18	— 4	31	20	82	53	74	58
5	79	64	85	52	63	50	84	39	54	15	24	3	38	10	7	—22	16	— 8	36	23	78	41	68	57
6	86	68	68	55	63	38	89	61	65	26	17	5	16	—12	10	—13	20	— 3	29	17	82	59	67	47
7	78	61	68	52	63	36	80	54	58	44	7	— 7	31	— 2	27	—22	— 1	—19	44	18	60	45	74	45
8	85	53	76	44	62	29	84	63	43	25	10	—10	36	9	26	—22	26	— 8	60	23	72	35	67	44
9	91	59	86	46	70	42	73	52	47	20	28	10	20	—14	16	—18	1	—18	67	34	60	45	67	53
10	84	63	89	57	67	48	68	38	50	22	15	— 5	38	—12	29	— 6	16	—10	37	25	65	34	78	53
11	83	59	76	58	66	48	63	43	46	32	— 5	—21	21	—14	38	15	— 2	—18	49	21	78	36	76	65
12	88	62	62	51	66	37	68	35	43	32	— 5	—32	2	—18	15	— 2	— 1	—20	80	30	78	57	69	47
13	90	71	72	56	57	39	84	63	42	28	19	— 7	37	—13	25	—14	3	—17	59	30	74	57	70	48
14	90	66	74	48	66	31	86	65	48	27	— 7	—26	40	—10	26	— 4	9	—25	41	20	80	56	60	55
15	80	55	74	46	65	45	86	55	32	24	4	—30	41	— 7	29	14	2	—15	52	13	83	55	71	44
16	77	55	76	45	64	41	73	49	25	14	5	—15	42	22	39	14	13	—30	62	28	78	56	73	50
17	78	56	82	50	54	40	54	40	29	9	— 6	—25	42	22	21	— 3	27	zero.	58	39	88	59	79	59
18	82	55	74	59	59	24	58	28	36	16	— 2	—14	40	10	— 3	—11	27	3	43	24	68	53	77	59
19	80	66	82	57	63	32	72	38	42	3	— 6	—15	36	2	18	—22	31	6	42	24	68	43	82	46
20	84	61	89	58	68	25	76	37	20	— 4	— 8	—18	36	12	33	10	38	— 2	44	25	58	35	85	62
21	81	65	76	62	69	42	67	31	29	13	10	— 8	32	12	35	3	39	19	63	31	68	33	85	66
22	74	62	83	53	66	34	53	35	32	15	zero.	—20	13	— 2	34	16	45	31	54	32	67	48	85	65
23	71	56	84	62	52	31	48	23	23	4	—10	—28	22	— 2	49	24	33	11	47	34	70	44	86	55
24	76	56	78	65	69	27	56	19	39	21	—28	—40	22	2	42	10	29	24	37	31	66	42	80	59
25	72	53	74	63	74	38	59	36	32	8	— 5	—40	39	1	29	zero.	38	34	43	28	64	51	83	53
26	77	52	80	58	67	43	63	31	32	25	18	—18	31	— 4	28	8	43	36	42	28	65	47	87	58
27	83	56	82	56	74	49	61	42	25	2	13	— 4	— 3	—18	8	—10	38	32	59	32	64	36	68	57
28	73	48	83	68	59	48	65	28	17	— 2	7	—17	—10	—28	— 3	—10	47	33	60	34	78	48	71	53
29	83	52	92	66	77	46	48	25	25	— 4	—17	—25	21	—19	6	— 9	54	32	44	32	76	52	75	48
30	91	56	77	63	71	40	28	17	42	21	— 2	—28	18	—17	......	......	54	34	65	28	65	48	78	56
31	80	65	73	56	......	......	28	13	......	......	15	— 8	21	—16	......	......	46	29	......	......	58	35	......	......
Range	43°		48°		53°		76°		69°		75°		70°		77°		84°		67°		55°		50°	
Monthly mean	70°.8		66°.5		52°.9		53°.3		26°.3		—3°.0		11°.6		9°.3		15°.4		37°.5		60°.3		65°.5	

Elevation of thermometers above ground, 6 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, BROWNSVILLE, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	95	80	87	73	92	72	85	69	68	52	72	61	76	63	53	42	68	49	80	71	83	71	92	75
2	90	79	92	73	96	69	86	69	71	53	78	67	78	69	58	37	77	60	87	72	87	71	93	76
3	89	81	89	74	96	76	81	71	76	60	79	70	77	70	61	39	80	70	88	73	86	69	92	75
4	91	80	93	75	92	72	85	70	77	62	79	68	79	70	54	46	80	70	88	67	88	66	90	80
5	93	77	92	80	89	69	86	70	83	67	75	59	81	67	55	40	82	70	84	75	89	70	90	80
6	92	82	90	81	89	70	87	70	84	69	78	56	80	64	49	39	83	71	84	73	89	67	92	81
7	91	82	92	81	85	69	87	72	82	71	79	65	80	69	50	39	83	71	83	73	88	69	90	81
8	91	81	91	79	84	70	88	74	83	73	80	72	80	66	50	43	78	59	83	46	87	73	89	80
9	91	75	92	80	79	70	87	74	85	74	80	72	80	64	61	44	68	57	70	51	88	77	89	81
10	91	79	85	72	87	71	86	73	85	74	80	55	79	64	77	52	76	65	73	49	89	72	92	82
11	90	80	86	71	88	75	85	72	84	75	58	46	80	67	76	62	82	70	79	59	91	72	92	79
12	90	79	85	71	88	74	85	71	86	74	63	42	79	63	77	66	79	62	78	53	89	70	88	79
13	92	74	85	73	83	72	85	69	85	75	61	43	66	53	72	47	68	54	78	64	89	68	90	80
14	95	74	85	72	83	70	85	67	85	75	62	44	73	54	70	44	58	36	81	73	89	67	89	82
15	92	81	89	73	83	64	85	69	86	77	68	43	71	54	67	38	47	35	80	74	87	70	90	73
16	92	78	85	69	84	65	89	70	85	75	72	52	76	61	73	53	58	36	86	74	85	71	88	74
17	93	76	85	69	85	65	84	63	84	63	76	55	77	62	72	62	67	44	84	75	84	71	91	72
18	92	81	87	70	88	71	78	56	66	43	74	60	78	59	79	57	77	61	86	76	85	70	90	71
19	91	82	89	73	86	70	77	54	63	39	78	69	79	62	61	47	72	66	83	77	88	71	92	69
20	92	77	86	72	89	69	78	51	67	42	79	68	79	66	69	50	78	65	73	62	90	72	92	72
21	92	73	88	72	88	69	79	53	70	42	78	69	82	65	77	60	80	68	81	68	87	72	90	71
22	92	81	92	73	89	66	80	60	73	52	79	69	71	59	79	65	73	64	83	70	90	68	91	70
23	92	79	94	73	86	66	79	57	75	59	79	71	62	53	79	68	77	64	85	74	90	70	90	75
24	92	81	93	79	78	71	73	54	77	59	80	35	68	50	79	70	78	66	86	76	89	74	91	79
25	92	82	89	74	85	69	72	49	72	62	36	27	65	49	74	64	81	66	87	76	90	77	91	81
26	92	80	94	75	85	71	79	49	79	63	50	30	70	53	79	62	83	70	84	76	90	81	89	77
27	94	80	90	73	84	72	73	63	79	67	69	35	74	60	79	69	78	61	87	74	90	81	89	80
28	95	75	81	71	88	75	77	57	77	57	74	60	76	64	82	66	77	51	84	77	90	79	90	80
29	95	75	89	71	87	74	78	59	65	47	77	61	78	68	71	46	77	52	88	76	91	81	89	78
30	93	75	86	73	86	70	80	65	72	48	77	68	79	64	......	......	78	69	80	73	91	81	84	72
31	92	73	90	74	......	......	80	61	......	......	78	63	69	44	......	......	79	70	......	......	91	71	......	......
Range	22°		25°		32°		40°		47°		53°		38°		45°		48°		37°		25°		22°	

Elevation of thermometers above ground, 20 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, BUFFALO, N. Y.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1.	80	53	82	67	79	69	69	65	36	28	44	28	40	29	32	9	31	26	45	34	47	30	65	48
2.	79	62	80	74	78	66	78.5	64	36	31	47	39	41	31	18	9	36	28	53	32	55	43.5	64	42.5
3.	77	71	79	71	80	67	73.5	60	34	22	44	34	50	26	21	15	50	33	63	49	57	48	61	54.5
4.	77	63	76	64	72	59	66	48	29	20.5	36	31.5	53	37	27	15	48	37	59	40	67	49	73	47
5.	74	57	78	69	65	54	72	56	36	23	58	31	40	30	30	16	54	35	47	33	73	53.5	73	62
6.	81	58	79	69	70	50	83	60	39	28.5	55	45	45	38	27	18	36	31	35	27	58	47	80	62
7.	77	68	82	61	68	58	82	67	54	30	45	39	46	35	31	16	41	29	30	22.5	73	47	67	58
8.	79	69	70	57	63	53	72	66	66	51	39	32	51	38	38	14	29	12	36	26	70	46.5	69	55
9.	75	64	65	50	58	51	70	65	63	49	48	31	52	42	38	2	32	11.5	45	33.5	71	58	80	53
10.	74	68	69	52	60	47	77	65	50	40	56	43	43	32	35	1	33	17	53	28	73	52	77	63.5
11.	78	65	73	63	66	41	79	60	62	38	45	26	57	34	44	21.5	33	17	30	20	59	48	71	64
12.	79	62	77	56	74	49	74	64	61	49	26	21	41	26	47	37	32	15	37	24	67	49	70	63
13.	81	60	78	67	67	56	67	49.5	59	48	28	21.5	32.5	22.5	39	30	33	17	51	36	53	39.5	70	60
14.	79	68	70	61	59	49	70.5	46.5	66	57	34	24	41	26	31	22.5	35	25	67	44	53	38.5	61	52.5
15.	81	72	63	55	62	49	71	54	59	47.5	35	28	38	27	32	25.5	33	25	65	42	53	38.5	67	55
16.	80	69	58	50	64	58	80	57	49	41	36	19	44	32	39	27	32	27	47	35	56	48	77	58
17.	69	58	61	51	63	50	77	65	43	36	36	18	48	41.5	52	36.5	28	25	44	35	63	51	70	58
18.	73	58	70	56	62	52	71	55	36	26	20	10	43	35.5	52	28	39	24	58	33	68	55	77.5	54
19.	74	52	73	58	61	44	55	44	38	28	27	12	47	34	29	14	41	31	72	41	73	59.5	73	57
20.	81	59	80	59	59	49	58.5	41	37	13	33	12	40	22	29	15	38	23	48	38.5	75	59.5	72	63
21.	78	66	77	65	62	39	61	45	23	10	12	1.5	29	22	34	27	35	20.5	58	44.5	71	59	72	65
22.	78	67	79	71	67	45	64	54	33	21	40	8	44	27	38	27	39	33.5	61	46	70	56	73	63
23.	74	67	73	65	67	62	61	37	39	24	34	23	39	28	35	23	42.5	26	46	32	67	57	76	66
24.	74	62	72	59	62	45	37.5	30	34	24	43	30	32	28	45	22.5	27	13.5	46	35	79	61	76	68
25.	78	58	68	52	54	39	45	25	43	33	31	10	40	31	53	42	27	13.5	56	39	74	63	79	69
26.	78	69	72	54	60	37	56.5	34.5	37	31.5	14	8	50	36	44	36.5	48	24	55	42	73	64	76	67
27.	75	70	71	53	69	45	57	47.5	56	34	33	8.5	46	40	52	40.5	45	35	45	40	73	61	79	65
28.	76	68	72	58	69	58	52	48	59.5	43	39	30.5	45	25	57	46	36	28	51	39	65	56	78.5	65
29.	77	67	74	67	72	63	58	45	44	22	44	36	26	16	55	30	35	29	61	44	71	46.5	71	64
30.	81	65	80	65	70	63	49	36	29	17.5	36	13.5	50	22	......	......	42	31	47	32	75	58	71	61
31.	80	63	77	63	......	......	39	32	......	......	34	11.5	40	27	......	......	44	32.5	......	......	66	55	......	......
Range	29°		32°		43°		58°		56°.0		56°.5		41°		56°		42°.5		52°		49°		37°.5	
Monthly mean	71°.9		68.°4		59°.8		58°.3		39°		30°.9		36°.9		30°.1		30°.8		43°.1		59°.7		66°.7	

Elevation of thermometers above ground, 72 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, BURKES, ARIZ.*

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	103	63	112	82	113	75	92	66	84	50	67	40	60	40	60	30	74	44	82	47	93	55	100	58
2	102	70	100	80	112	70	101	62	80	45	72	40	60	40	57	32	76	46	79	47	96	57	105	61
3	104	72	106	83	112	75	101	70	73	50	65	39	60	39	56	37	71	50	77	45	95	55	100	62
4	106	67	109	82	110	73	99	64	84	50	72	40	61	36	53	31	69	45	83	48	96	54	101	76
5	106	75	112	85	110	67	91	76	84	42	63	33	69	35	59	30	69	43	88	49	98	60	99	63
6	108	79	105	82	107	65	90	67	86	44	69	38	59	47	63	26	71	47	83	61	89	58	100	57
7	111	80	107	79	105	75	88	61	76	42	70	39	65	41	63	30	73	46	84	44	90	50	104	61
8	106	80	105	78	106	71	78	63	74	41	70	37	53	48	62	34	77	39	90	52	94	50	101	63
9	106	74	103	81	107	69	82	50	64	54	64	38	63	38	71	32	80	41	86	58	94	53	93	77
10	106	74	105	82	106	72	85	44	63	54	60	31	59	36	68	47	68	39	90	50	98	60	87	64
11	106	76	109	72	108	70	87	40	65	44	69	40	62	44	53	40	73	44	91	50	96	58	93	57
12	107	78	109	71	108	73	90	50	67	46	69	37	60	36	60	31	72	44	90	52	85	59	95	56
13	107	79	109	73	104	80	88	73	68	46	69	34	67	35	61	31	64	44	75	48	75	48	94	59
14	107	79	112	74	102	80	72	60	67	40	65	36	61	37	63	29	55	45	75	44	79	49	98	59
15	106	78	112	76	100	72	74	44	70	43	69	35	74	33	68	31	61	29	73	50	88	44	100	61
16	111	78	111	82	103	71	83	43	72	46	68	34	74	37	72	36	64	29	78	42	87	45	105	80
17	106	82	110	76	105	71	83	40	71	44	69	35	74	36	63	34	64	34	76	54	86	54	108	70
18	105	78	102	80	107	67	93	50	70	50	68	34	74	43	63	34	67	33	66	42	89	50	106	77
19	107	82	110	80	108	61	94	61	70	49	75	34	71	42	69	35	70	38	75	44	97	53	98	85
20	109	70	107	79	108	65	94	50	78	41	70	49	74	37	72	37	74	33	86	45	101	58	101	78
21	112	76	105	70	106	75	95	50	70	40	67	57	72	37	73	50	77	35	87	55	100	60	104	75
22	103	88	105	65	105	70	92	48	75	40	59	34	75	37	65	43	77	39	81	41	101	64	105	66
23	108	78	104	67	105	66	95	47	74	40	56	45	72	36	66	46	78	38	76	53	98	61	105	73
24	111	81	105	67	102	63	94	50	70	35	40	31	68	40	66	44	79	36	79	51	96	63	104	69
25	114	82	112	68	99	65	93	49	71	37	50	26	66	32	68	37	75	50	85	45	94	56	102	63
26	114	77	112	70	94	62	91	63	69	43	55	34	66	48	68	35	69	40	90	53	88	55	103	64
27	98	83	107	90	77	68	88	60	63	38	50	43	58	40	71	45	79	36	88	45	94	62	107	63
28	112	79	105	85	98	61	91	64	64	33	59	48	49	44	68	45	80	39	91	45	97	55	105	64
29	112	80	105	70	91	67	87	55	67	34	58	49	52	36	68	44	84	48	91	53	100	54	110	65
30	112	80	106	66	95	69	87	62	75	39	54	38	47	31	......	......	75	47	92	75	99	61	107	60
31	115	90	110	70	......	......	87	50	......	......	60	37	45	33	......	......	77	42	......	......	97	56	......	......
Range	52°		47°		52°		61°		53°		49°		44°		47°		55°		51°		57°		54°	

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* There are no maximum or minimum thermometers at this station, and the highest and lowest exposed readings are given. Elevation of thermometers above ground, 6 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, BURLINGTON, VT.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	76	50	90	65	85	61	73	61	33	25	37	13	30	14	29	—10	31	19	50	27	46	27	63	50
2	84	56	90	71	78	64	78	56	38	20	40	23	45	25	7	—12	28	18	57	30	60	40	66	46
3	83	69	83	65	81	59	71	60	33	27	28	20	28	7	15	4	46	20	59	44	77	47	69	41
4	81	58	85	58	77	65	63	50	28	20	34	24	42	26	23	6	51	36	66	52	65	43	68	46
5	71	50	86	59	67	53	70	52	30	17	38	22	39	15	27	14	53	22	56	34	78	48	73	52
6	76	51	80	59	73	48	62	48	32	22	45	34	37	16	28	14	29	19	39	28	64	42	74	56
7	68	60	75	50	74	59	70	54	39	27	48	37	37	26	24	8	39	25	35	19	59	38	83	58
8	78	61	78	60	68	55	71	58	48	35	44	24	40	26	26	8	35	—1	38	21	78	44	73	54
9	78	63	66	54	61	54	73	60	62	46	30	18	46	27	27	—7	30	zero.	48	27	87	53	76	55
10	78	62	71	48	63	44	67	55	60	41	48	28	42	20	20	—8	29	10	51	37	85	60	82	56
11	78	60	77	51	67	42	65	53	45	38	54	35	43	18	32	6	18	1	41	22	72	54	84	63
12	84	60	81	54	70	46	69	55	54	39	37	14	44	19	50	28	22	12	35	16	59	41	72	57
13	88	60	83	60	63	55	56	44	46	34	30	12	21	9	48	30	22	7	53	32	50	37	75	54
14	90	69	75	58	61	46	60	41	56	44	33	23	27	7	32	16	36	17	39	30	54	35	69	55
15	88	66	62	47	63	46	66	46	63	49	39	29	34	23	31	10	37	22	64	31	63	38	75	53
16	86	67	59	45	64	51	73	57	52	43	32	20	35	21	34	21	33	23	53	35	59	49	77	49
17	72	58	60	52	64	54	78	60	46	35	31	4	43	33	47	21	31	21	46	32	74	50	80	49
18	69	54	62	56	62	49	68	58	36	27	22	—3	41	33	51	36	34	19	45	30	59	48	85	52
19	71	49	61	53	63	49	63	37	33	23	23	4	40	33	38	9	42	23	57	38	74	51	87	55
20	78	50	76	50	60	44	48	34	32	13	25	zero.	37	12	22	6	42	28	60	42	76	59	78	59
21	82	57	76	58	62	44	65	40	16	7	2	—19	19	4	31	19	36	23	69	41	80	53	73	59
22	79	66	86	68	66	41	63	51	28	8	27	—11	33	zero.	36	21	41	25	66	38	79	49	71	50
23	73	61	79	67	70	49	64	41	36	22	31	17	38	31	36	14	44	23	42	29	79	56	70	48
24	71	56	76	62	63	43	43	30	30	19	38	18	34	23	18	0	37	11	48	28	81	58	87	58
25	74	49	70	53	52	37	37	26	41	26	34	—2	35	19	41	15	22	4	60	28	88	63	89	69
26	79	64	71	52	58	34	51	26	37	20	13	—11	40	29	52	37	28	9	55	44	91	68	85	67
27	81	63	72	54	62	43	54	38	40	22	21	—1	42	35	50	27	44	15	53	39	87	70	88	61
28	83	65	75	55	61	51	51	44	54	39	32	18	45	26	50	29	37	22	54	32	75	59	86	69
29	85	68	76	59	69	57	53	42	56	16	41	30	28	2	53	29	38	22	58	42	69	49	83	66
30	81	65	69	55	78	59	50	38	22	11	39	—4	40	3	......	......	37	20	54	29	60	53	79	59
31	86	58	74	51	......	......	42	32	......	......	23	—10	46	26	......	......	45	23	......	......	69	53	......	......
Range	41°		45°		51°		52°		56°		73°		46°		65°		54°		53°		64°		48°	
Monthly mean	70°.3		67°.9		59°.1		54°.7		35°.0		23°.6		30°.0		25°.4		27°.5		43°.6		61°.5		68°.1	

Elevation of thermometers above ground, 55 feet.
The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, CAIRO, ILL.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	88	69	89	73	78	70	84	68	49	30	55	37	48	35	38	30	47	32	64	48	68	48	72	61
2	89	74	92	74	72	66	86	70	56	37	62	43	59	47	32	25	60	38	65	59	72	52	73	60
3	90	73	93	73	80	65	85	69	41	29	57	42	66	53	36	28	69	52	76	60	72	55	76	60
4	90	75	94	77	78	65	87	68	49	28	56	38	65	61	37	23	71	63	80	64	70	60	78	62
5	87	71	95	77	78	60	87	67	63	41	65	54	63	60	46	30	71	53	82	62	78	58	85	72
6	90	75	93	77	76	64	81	69	59	47	54	43	67	59	47	31	53	47	71	55	84	64	80	67
7	92	75	84	72	83	65	72	67	71	55	58	40	63	51	44	35	52	47	55	34	86	67	80	63
8	92	79	77	67	71	56	81	68	72	59	58	41	63	58	54	31	50	38	53	41	85	67	81	70
9	95	77	76	62	64	56	83	69	75	60	66	45	70	49	54	36	58	45	61	42	84	66	84	71
10	96	79	78	62	68	55	85	71	75	56	66	40	62	39	61	43	56	40	70	52	85	70	90	72
11	96	79	80	64	77	60	84	71	73	67	40	24	69	44	63	49	54	39	53	39	79	68	91	73
12	95	77	83	65	73	63	80	67	79	67	31	21	44	34	63	49	41	35	58	39	83	65	92	74
13	86	76	83	70	75	55	81	69	78	65	36	23	42	33	49	32	43	33	73	51	84	64	92	75
14	89	72	84	70	68	52	84	67	73	62	38	32	52	37	43	31	43	34	73	62	75	62	93	78
15	93	76	75	66	72	52	83	69	67	58	36	26	48	42	52	32	34	29	72	59	77	53	84	64
16	94	79	67	62	75	56	75	65	62	45	55	32	62	40	59	42	35	28	71	58	80	53	77	61
17	87	74	75	62	76	59	73	59	56	41	50	31	59	49	63	52	42	29	69	51	84	61	81	63
18	83	69	78	59	82	59	66	51	45	39	34	26	64	43	60	34	53	39	81	61	84	61	83	64
19	86	68	81	62	70	56	56	49	48	33	44	32	66	52	38	27	56	42	78	54	85	67	83	69
20	86	73	84	66	68	51	62	45	45	26	44	31	62	44	42	28	58	42	65	50	82	69	85	65
21	88	77	87	68	73	52	64	56	39	25	61	26	58	41	51	39	55	40	73	53	69	63	87	68
22	85	77	88	72	76	56	69	57	55	32	61	35	53	40	60	41	61	44	77	60	77	59	89	68
23	82	77	79	68	79	60	61	43	51	39	47	34	47	38	55	46	68	47	80	68	81	65	89	73
24	82	73	74	68	69	56	54	37	56	32	45	18	52	37	68	46	56	42	83	71	86	66	87	77
25	85	75	77	63	65	45	58	35	54	48	10	12	57	39	65	56	62	45	79	67	83	71	85	71
26	86	77	79	64	72	47	53	36	66	51	28	16	59	42	67	51	65	56	71	55	85	71	83	72
27	86	71	79	64	76	59	64	46	62	58	40	23	64	45	61	55	65	57	63	47	83	69	81	73
28	83	68	81	66	77	59	65	49	62	41	53	36	54	38	63	39	58	47	63	52	72	62	80	70
29	87	72	82	64	79	62	75	47	43	32	63	46	53	36	39	29	57	40	68	57	82	66	80	66
30	85	71	84	66	83	62	60	44	46	29	46	33	61	37	......	......	62	46	62	49	82	67	83	66
31	89	71	82	69	......	......	62	37	......	......	43	38	40	30	......	......	66	47	......	......	88	70	......	......
Range	28°		36°		38°		52°		54°		54°		40°		45°		43°		49°		40°		33°	
Monthly mean	82°.5		75°.8		67°.0		65°.3		52°.6		40°.8		51°.6		45°.7		50°.1		63°.0		73°.4		77°.0	

The elevation of thermometers above ground, 44 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, CAMPO, CAL.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	78	35	97	53	98	52	86	44	76	27	(*)	(*)	(*)	(*)	(*)	(*)	71	28	62	29	77	35	92	36
2	82	30	(*)	(*)	99	52	91	44	80	22	(*)	(*)	(*)	(*)	58	22	57	24	51	45	72	43	92	39
3	87	39	(*)	(*)	96	52	93	43	77	38	(*)	(*)	(*)	(*)	49	35	52	42	56	45	73	44	86	34
4	87	40	(*)	(*)	91	46	92	42	77	31	(*)	(*)	(*)	(*)	52	30	51	39	68	33	79	36	88	31
5	91	39	(*)	(*)	92	41	75	46	82	25	(*)	(*)	(*)	(*)	52	24	58	31	71	33	72	34	92	34
6	92	44	(*)	(*)	92	41	63	51	79	30	64	30	(*)	(*)	53	25	61	25	57	45	74	30	92	39
7	92	42	(*)	(*)	91	40	58	47	61	26	61	27	(*)	(*)	57	25	67	25	72	28	82	36	89	36
8	93	42	92	51	93	39	(*)	(*)	59	25	53	33	56	37	63	23	61	24	77	37	83	33	85	38
9	93	47	97	53	95	48	(*)	(*)	50	41	49	32	53	23	63	25	54	36	79	39	(*)	(*)	79	42
10	92	45	100	60	92	46	76	28	52	38	57	25	52	29	53	36	64	38	84	39	(*)	(*)	72	50
11	87	44	103	54	97	48	78	29	59	30	65	40	53	28	43	34	61	26	76	39	(*)	(*)	77	45
12	88	36	97	52	100	49	(*)	(*)	59	30	66	32	53	27	51	18	52	42	64	24	(*)	(*)	75	41
13	89	45	97	50	100	50	(*)	(*)	56	39	66	29	68	26	59	22	53	35	54	42	(*)	(*)	89	34
14	91	42	97	53	97	51	(*)	(*)	61	29	69	28	66	25	57	37	42	33	59	35	68	31	89	41
15	93	39	100	52	96	52	(*)	(*)	65	30	71	29	63	45	62	26	52	19	53	41	74	24	91	35
16	92	43	102	54	(*)	48	(*)	(*)	62	32	69	28	69	42	52	26	51	28	55	44	64	44	95	36
17	90	42	100	58	(*)	(*)	(*)	(*)	55	46	67	26	72	44	51	34	47	34	48	40	72	29	98	37
18	87	39	92	53	(*)	(*)	(*)	(*)	58	47	53	24	69	32	55	21	53	35	51	36	80	29	98	41
19	87	38	94	47	93	43	(*)	(*)	66	48	59	37	69	32	55	23	59	26	65	29	91	38	92	43
20	88	34	92	45	95	50	(*)	(*)	71	35	58	42	(*)	(*)	55	33	61	25	67	30	93	40	91	37
21	93	34	88	38	91	48	(*)	(*)	72	33	55	32	(*)	(*)	52	32	63	28	63	34	88	42	87	34
22	93	51	84	34	90	40	82	(*)	73	24	44	32	(*)	(*)	51	37	70	22	57	45	86	36	88	35
23	93	53	85	43	86	36	83	28	73	24	41	35	(*)	(*)	51	31	70	25	59	40	82	37	85	34
24	94	53	94	42	82	33	87	26	72	25	(*)	(*)	(*)	(*)	53	30	65	28	70	28	84	36	83	35
25	96	48	95	46	82	32	84	33	67	24	(*)	(*)	(*)	(*)	59	31	52	31	74	29	84	37	87	34
26	96	48	97	50	84	32	77	41	47	43	(*)	(*)	48	33	61	27	55	35	75	27	79	44	91	36
27	92	53	89	54	81	40	(*)	(*)	52	34	(*)	(*)	42	32	52	32	66	27	74	29	86	34	94	38
28	95	65	(*)	(*)	84	39	(*)	(*)	57	26	(*)	(*)	40	18	(*)	(*)	63	27	77	30	89	34	93	40
29	96	57	(*)	(*)	77	36	83	38	(*)	(*)	(*)	(*)	40	zero.	(*)	(*)	56	38	76	39	88	35	92	40
30	100	55	97	37	83	37	74	30	(*)	(*)	(*)	(*)	(*)	19	......	......	59	27	70	48	85	34	91	40
31	99	58	97	50	......	......	71	24	......	......	(*)	(*)	(*)	(*)	......	......	66	27	......	......	88	35	......	......
Range	70°		......	......	......	......	......	......	......	......	......	......	......	......	......	......	52°		60°		......	......	*67°	

*No observations taken. Observer out repairing telegraph line.

Elevation of thermometers above ground, 5 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, CAMP THOMAS, A. T.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	*73	41	82	45	93	46
2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	71	43	82	43	102	50
3	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	72	51	88	44	101	51
4	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	77	39	89	46	93	61
5	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	80	40	92	51	92	52
6	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	80	49	87	55	97	47
7	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	75	43	84	45	99	46
8	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	74	41	85	40	100	64
9	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	75	48	90	38	98	60
10	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	79	35	92	46	97	64
11	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	84	35	92	48	95	53
12	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	86	43	89	48	98	54
13	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	79	40	80	53	90	60
14	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	73	45	79	43	96	45
15	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	70	52	89	41	102	52
16	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	76	37	94	45	106	59
17	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	80	49	89	44	107	70
18	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	55	39	88	46	106	76
19	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	66	26	93	46	94	70
20	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	71	31	96	49	86	69
21	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	79	56	96	53	95	67
22	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	80	49	96	52	98	70
23	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	75	44	95	57	100	65
24	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	68	40	95	61	100	61
25	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	79	35	87	62	100	62
26	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	82	35	85	46	100	56
27	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	85	38	84	43	101	51
28	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	81	35	85	42	102	54
29	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	84	41	92	45	103	54
30	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	81	60	94	47	102	51
31	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	93	50	......	......
Range	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	60°		58°		62°	

*Observations commenced.

Elevation of thermometers above ground, 5 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, CAPE HATTERAS, N. C.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	77	70	85	78	80	69. 5	73	67	57	50	59	44	56	47	60	45	63	53	53	40	57	50	80	73
2	77	68	86	76	82	72	75	69	57	51	62	49	62	47	60	41	53	49	67	49	66	54	78	63
3	79	66	85	76	84	74. 5	79	70	57	43	66	51	59	53	60	45	63	49	64	56	71	59	67	63
4	80	71	84	76	81	75	75	69	43	38	67	57	67	54	45	38	64	60	68	59	70	64	69	61
5	81	73	85	77	76	67	77	69. 5	45	40	65	56	63	52	47	40	66	61	67	59	68	61	76	63
6	73	68	86	78	81	63. 5	77	71. 5	58	41	66	60	62	51	45	38	65	55	66	58	72	58	77	70
7	78	69	87	76	82	68	79	72. 5	64	52	63	53	57	51	50	38	67	54	64	47	71	65	79	73
8	81	73	86	76	82	71	80	71	67	62	67	52	52	50	50	43	60	49	49	41	77	66	79	71
9	83	76	83	68	75	67	80	70	72	62	62	55	54	50	55	44	57	47	45	40	78	67	75	66
10	83	69	72	65. 5	70	63	78	72	71	61	69	58	58	51	56	49	51	46	55	37	78	67	75	66
11	84	68	75	65	69	62	74	69	71	61	67	62	59	52	58	47	58	47	56	46	78	67	81	73
12	90	75	78	69	69	62	72	67	72	64	65	46	65	52	65	52	52	47. 5	48	36	75	66	89	70
13	77	72	79	73	76	59	71	66	74	67	58	47	60	37	67	60	53	51	60	47	72	58	88	71
14	74	70	80	72	72	64	72	66	74	68	67	58	51	42	67	60	55	49	65	56	65	56	87	74
15	82	69	83	74	70	65	71	62	75	68	65	51	54	49	61	45	54	48	70	60	58	53	85	72
16	84	74	79	74	78	68	75	60	72	64	51	40	50	44	50	42	67	53	71	63	67	46	74	66
17	84	71	85	77	80	67	75	64	68	61	56	46	54	46	61	47	62	44	68	62	72	60	70	65
18	78	73	80	73	77	69	77	67	70	49	54	48	54	51	68	58	56	43	62	59	74	64	71	65
19	78	72	77	70	76	69	75	62	50	41	59	50	53	45	62	42	63	52	72	61	75	66	71	65
20	78	72	77	72	73	69	65	57	46	32	60	52	59	49	42	33	53	49	73	56	78	66	72	63
21	78	72	80	72	74	68	72	62	34	28	59	53	58	50	56	42	52	46	59	54	77	68	79	61
22	80	69	83	72	74	65	76	69	43	29	61	52	63	52	50	42	60	45	61	54	77	70	79	70
23	83	75. 5	83	72	68	64	73	68	58	39	60	56	60	49	61	44	60	45	72	55	76	69	84	72
24	85	77	84	78	70	66	68	52	52	42	63	59	51	46	46	40	57	43	70	59	75	68	82	73
25	84	78	85	77	68	59	52	47	55	39	64	60	54	45	61	39	43	36	63	56	77	68	81	75
26	85. 5	78	80	67	68	58	59	51	56	41	64	34	62	45	64	59	53	39	73	63	78	69	82	75
27	84	78	69	65	68	59	65	58	61	43	47	33	68	60	63	52	64	52	71	59	79	69	86	76
28	81	77	69	65	71	66	65	59	69	55	58	40	65	51	68	51	66	55	59	55	76	70	83	77
29	82	76	71	65	70	65	64	52	65	48	63	56	53	49	65	59	55	38	70	55	78	72	85	76
30	84	74	80	60	70	65	70	58	48	41	60	56	61	50	......	....	47	36	70	57	80	70	81	72
31	85	78	76	70	......	......	62	56	......	......	61	53	66	55	......	......	50	43	......	......	79	71	......	......
Range	24°		27°		26°		33°		47°		36°		31°		35°		31°		37°		34°		28°	
Monthly mean	77°. 5		76°. 4		70°. 6		68°. 0		55°. 4		56°. 3		53°. 4		51°. 4		52°. 7		59°. 1		69°. 2		74°. 3	

Elevation of thermometers above ground, 7 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

CAPE HENRY, VA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	82	68	86	71	83	70	80	61	55	47	54	36	54	41	51	35	60	48	61	41	61	46	83	66
2	82	63	88	76	78	71	84	64	57	45	60	35	67	39	45	28	56	42	63	46	75	47	78	60
3	87	67	91	74	83	70	89	64	47	40	70	50	60	47	63	37	60	45	73	54	73	56	71	57
4	94	68	93	73	82	75	77	67	42	35	66	58	68	45	46	31	76	58	82	61	67	55	77	55
5	78	63	88	78	85	70	77	61	49	35	62	52	62	50	45	33	79	66	74	57	66	58	76	60
6	73	62	91	78	87	68	85	67	64	35	65	54	58	49	43	36	71	52	72	50	86	58	84	64
7	77	63	87	78	87	69	78	67	62	52	63	52	58	47	55	35	56	44	56	43	74	59	87	70
8	90	70	90	78	83	71	80	67	66	53	64	47	54	39	47	33	52	44	50	36	86	59	75	67
9	90	74	75	63	72	65	82	68	75	57	60	50	51	43	59	37	52	43	58	37	80	66	75	62
10	88	70	74	60	75	63	82	69	73	61	72	54	53	46	54	37	58	37	67	37	78	65	76	62
11	96	73	81	63	76	64	73	68	80	60	74	45	53	46	54	38	57	40	60	41	87	66	78	67
12	85	71	79	68	78	62	74	64	79	60	51	39	69	45	63	48	47	39	53	33	73	60	93	69
13	81	71	81	71	80	61	80	60	76	62	51	35	46	34	80	60	48	41	68	39	69	56	90	68
14	85	68	85	72	74	64	76	63	76	60	53	46	49	32	72	49	47	41	80	52	62	53	84	72
15	88	65	82	75	77	63	73	62	81	65	62	45	52	41	52	43	49	42	82	58	60	49	73	68
16	92	74	83	75	80	64	82	63	81	58	54	40	52	38	55	40	69	45	83	59	68	47	69	63
17	88	74	83	75	80	65	81	63	66	54	60	39	55	35	60	40	49	40	76	57	84	58	71	61
18	77	70	76	68	77	65	84	65	66	47	52	41	53	45	70	50	50	38	63	51	81	65	81	62
19	82	69	81	65	83	66	71	58	54	39	53	43	56	37	59	35	49	43	69	53	91	67	82	57
20	80	68	80	66	74	66	65	52	41	30	70	49	67	52	37	26	52	40	70	48	86	64	85	59
21	82	69	81	63	69	65	67	55	34	25	61	44	59	45	50	28	48	42	66	48	82	66	92	64
22	84	67	83	63	67	62	71	63	46	29	62	46	63	46	59	38	62	38	65	45	77	63	94	67
23	94	72	88	74	71	60	70	61	60	33	61	46	60	43	55	41	63	43	79	52	78	64	86	70
24	85	74	85	75	80	60	62	47	50	33	59	46	46	41	55	39	57	38	69	51	81	66	87	70
25	88	74	90	73	65	55	50	43	60	34	73	41	51	40	64	40	42	28	56	48	87	67	96	76
26	90	75	81	67	68	55	56	44	51	45	46	29	53	42	72	58	54	34	85	54	91	68	94	75
27	85	76	70	64	71	59	66	48	58	45	43	25	60	50	65	48	64	45	75	57	91	71	92	74
28	83	24	72	63	77	62	70	56	72	54	53	32	57	47	62	49	61	47	62	52	92	68	97	72
29	84	72	80	64	77	61	70	46	72	43	66	47	52	43	77	59	47	36	66	51	78	69	97	68
30	86	71	82	66	77	61	74	54	47	36	72	52	57	44	......	......	47	34	68	51	87	66	83	67
31	81	70	79	70	......	......	57	50	......	......	56	43	62	47	......	......	49	40	......	......	81	69	......	......
Range	34°		33°		32°		46°		56°		49°		37°		54°		51°		52°		46°		42°	
Monthly mean	76°.6		75°.1		69°.8		66°.0		52°.5		51°.7		49°.5		48°		49°.2		58°.5		70°.2		74°.8	

Elevation of thermometers above ground, 16 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, CAPE LOOKOUT, N. C.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	78	70	87	79	81	76	76	67	57	50	55	37	54	47	62	47	63	56	63	51	59	51	82	74
2	79	72	84	79	80	75	74	70	56	50	60	44	65	47	62	41	57	54	66	52	68	58	77	63
3	79	73	85	79	81	77	78	72	60	41	64	54	59	47	64	46	64	54	65	59	69	62	69	62
4	80	73	84	77	81	76	79	70	44	35	65	58	64	51	52	37	64	61	66	61	66	64	72	61
5	82	75	85	79	81	71	77	69	47	36	64	54	67	54	51	41	66	62	68	60	72	64	80	71
6	75	70	87	81	82	73	78	72	62	41	65	61	60	52	47	37	67	57	65	61	74	63	80	71
7	80	68	87	82	82	76	79	74	64	51	62	55	60	53	52	39	68	55	63	51	75	66	80	70
8	81	75	86	73	82	67	81	74	70	54	68	53	53	48	49	42	62	50	52	42	76	68	81	73
9	88	77	82	67	75	68	79	73	72	64	62	54	53	48	58	42	59	48	43	40	78	67	75	70
10	90	78	75	63	71	63	79	73	73	62	66	56	59	49	61	44	55	46	58	41	78	68	81	70
11	85	77	75	65	72	62	76	69	72	63	66	63	63	51	59	44	59	53	63	47	79	69	82	74
12	89	75	79	69	72	59	75	69	73	65	65	44	61	54	65	57	56	47	52	36	76	69	84	75
13	80	75	79	73	75	63	74	67	72	66	54	44	59	35	67	58	54	49	61	51	77	67	84	71
14	80	74	80	69	75	68	74	68	72	66	67	54	50	34	65	56	58	48	65	57	67	56	87	78
15	82	72	82	71	72	67	75	70	74	67	65	51	56	46	59	47	62	52	69	59	61	53	85	73
16	83	77	80	74	74	66	75	67	73	63	51	42	52	43	51	41	70	61	72	61	67	52	74	67
17	85	75	84	79	79	71	79	71	69	60	58	49	56	45	63	47	63	46	69	63	73	64	73	65
18	82	74	81	73	81	70	80	74	69	54	58	46	61	51	66	59	60	46	66	59	74	67	75	65
19	79	71	79	71	79	72	77	60	54	35	61	45	55	45	61	43	65	57	72	62	76	68	75	66
20	78	71	80	76	76	69	68	60	44	31	61	55	60	53	44	33	57	47	67	56	79	68	75	62
21	80	69	84	76	75	69	74	68	35	27	59	50	59	53	58	40	57	49	60	55	79	69	80	68
22	81	71	83	74	74	67	75	68	45	30	62	49	64	52	53	42	61	53	63	53	80	70	80	71
23	83	76	83	78	69	64	73	68	58	41	62	53	60	51	60	46	64	50	73	60	79	69	82	68
24	84	78	82	79	73	64	69	50	57	38	66	59	53	46	52	40	60	48	70	63	80	70	82	75
25	83	79	84	79	73	57	51	44	58	37	66	62	52	44	65	50	48	37	66	59	79	71	82	76
26	85	79	81	67	65	57	57	49	56	45	63	34	59	45	63	58	57	43	72	65	79	72	83	77
27	84	79	70	66	70	59	66	54	63	47	43	32	65	50	65	56	65	56	67	60	79	72	84	77
28	84	78	73	64	73	63	68	54	66	60	57	41	63	53	67	58	66	55	62	59	78	71	84	78
29	82	77	74	64	72	64	66	52	66	46	63	55	56	50	66	60	55	43	69	61	80	72	86	75
30	84	78	80	66	75	65	70	63	46	36	61	57	63	51	......	......	49	36	72	59	81	72	79	72
31	85	79	81	71	......	......	65	55	......	......	62	51	66	59	......	......	56	41	......	......	81	73	......	......
Range	22°		24°		25°		37°		47°		36°		33°		34°		34°		37°		30°		26°	
Monthly mean	78°.9		77°.5		72°.4		69°.2		55°.1		56°.0		54°.0		53°.0		55°.4		60°.8		70°.6		75°.7	

Elevation of thermometers above ground, 18 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, CAPE MAY POINT, N. J.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	76	65	82	70	79	69	75	64	46	40	50	28	43	35	44	26	50	40	54	40	58	41	74	67
2	72	66	86	72	76	70	79	65	55	36	56	41	51	42	35	12	47	32	57	46	66	54	69	52
3	78	66	85	73	77	70	81	66	56	38	59	49	48	38	48	34	55	45	55	49	65	58	69	54
4	77	68	82	71	81	70	73	60	39	32	60	52	54	40	*	*	63	50	60	50	67	58	74	61
5	76	64	83	71	80	69	74	63	46	31	54	43	51	43	*	*	65	54	58	50	65	60	72	63
6	73	57	87	72	80	68	76	66	53	44	59	49	53	43	47	32	55	45	59	51	71	58	72	64
7	72	63	83	73	81	72	76	65	51	40	57	48	47	42	46	33	49	44	51	36	67	55	81	67
8	79	66	81	72	79	66	76	67	59	45	56	48	46	39	38	25	47	38	42	32	72	57	73	63
9	79	69	77	62	70	61	80	69	64	57	52	42	46	40	42	28	41	35	53	38	76	60	69	59
10	83	69	75	61	69	57	78	67	64	59	58	49	46	41	42	14	43	34	54	46	69	62	70	60
11	85	71	77	66	71	56	71	65	64	55	60	43	53	38	47	30	48	30	53	34	73	60	74	65
12	77	68	78	68	74	57	72	62	69	61	45	33	53	37	55	45	37	28	47	31	70	63	82	69
13	79	63	78	67	72	66	76	64	69	59	44	25	37	25	59	48	41	28	61	44	64	53	81	69
14	79	67	80	71	71	64	72	58	64	57	52	33	40	18	50	42	45	39	62	51	57	47	74	62
15	79	68	80	71	73	60	76	64	72	62	50	39	44	35	42	36	44	37	59	51	62	44	70	61
16	81	71	78	73	76	63	77	69	63	54	46	33	37	28	46	35	49	40	62	54	69	54	69	59
17	83	73	77	71	75	68	78	69	57	48	47	38	45	35	47	40	43	37	60	50	75	61	73	55
18	80	66	73	65	75	60	73	69	70	42	41	30	46	35	54	46	44	26	56	44	78	64	75	55
19	80	67	77	65	75	60	72	51	42	34	49	38	48	39	46	31	47	38	60	50	74	58	75	67
20	78	63	80	69	70	61	60	48	43	28	46	37	53	45	36	22	51	37	58	47	74	63	79	66
21	80	65	76	68	66	60	66	57	30	23	43	28	54	39	45	36	47	36	62	48	69	64	80	69
22	77	68	79	69	64	58	68	58	45	22	46	30	52	42	45	36	53	40	59	49	69	62	82	71
23	80	70	84	72	70	55	69	57	53	38	47	38	50	39	47	38	53	42	61	55	69	63	76	65
24	83	72	77	73	72	63	57	41	45	31	51	45	41	38	44	30	47	28	56	46	73	64	84	72
25	78	70	80	68	63	48	44	36	54	43	51	33	43	37	52	42	40	23	54	45	81	67	84	74
26	77	69	70	62	66	45	54	33	49	39	34	18	47	32	53	43	45	25	67	51	81	67	84	73
27	80	69	69	59	70	52	64	53	55	37	39	15	56	46	54	40	51	44	59	42	81	70	84	73
28	83	71	74	58	72	56	67	51	61	53	47	37	53	48	52	47	54	38	57	47	79	69	84	75
29	83	70	76	64	73	64	65	52	60	37	53	43	48	36	57	52	39	31	60	53	74	62	89	74
30	76	71	80	70	71	61	65	51	37	29	53	36	53	37	......	......	46	34	61	46	70	65	83	73
31	79	70	78	67	......	......	52	45	......	......	45	36	56	44	......	......	48	37	......	......	74	66	......	....
Range	28°		29°		36°		48°		50°		45°		38°		....		42°		36°		40°		37°	
Monthly mean	72°.8		72°.5		67°.1		63°.9		48°.3		44°.8		43°.6		†		......		......		......		......	

*Observer on repair duty.

†Local observations discontinued January 31, 1880.

Elevation of thermometers above ground, 19 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, CASTROVILLE, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	100	76	98	73	98	68	88	68	67	48	73	38	73	53	45	37	64	51	73	66	65	57	99	77
2	102	79	97	75	100	66	88	70	73	40	76	61	73	62	54	37	73	51	86	65	72	56	91	79
3	87	70	91	74	99	64	(*)	70	74	43	77	62	69	56	52	35	79	65	93	52	71	63	95	75
4	94	77	93	72	99	65	91	70	76	49	81	56	66	57	52	38	92	64	96	53	88	66	97	74
5	97	76	95	75	95	67	91	72	83	63	72	51	73	61	50	35	87	62	89	65	84	64	92	76
6	(*)	......	98	76	94	67	91	71	87	54	79	37	75	64	48	38	84	65	88	67	86	67	94	76
7	100	76	99	77	96	66	89	73	82	63	78	48	78	63	49	37	79	64	77	50	85	67	99	77
8	99	77	99	77	92	68	90	74	86	69	79	58	75	63	55	44	71	49	63	45	90	69	98	76
9	98	76	86	70	89	72	85	75	86	60	81	68	78	59	56	47	(*)	......	75	37	87	73	98	77
10	99	74	74	67	85	71	88	74	83	74	69	47	81	60	66	53	71	46	80	38	89	71	(*)	......
11	102	77	(*)	......	87	74	89	72	79	63	53	40	81	62	76	62	69	58	88	44	88	69	97	77
12	102	76	85	67	79	70	89	71	87	57	52	26	70	52	77	55	65	47	83	47	91	69	(*)	......
13	102	72	87	69	83	68	87	65	85	70	51	41	63	42	63	38	53	41	85	53	87	67	91	73
14	100	75	92	70	87	61	87	65	85	67	70	41	64	45	59	37	43	29	87	67	87	67	94	76
15	100	79	90	74	91	59	87	69	89	57	65	35	70	48	67	30	45	30	94	69	87	65	95	75
16	103	77	93	68	91	58	92	66	84	65	74	35	75	46	74	40	62	27	93	66	89	69	96	76
17	103	74	93	69	88	58	84	59	76	53	76	43	74	59	78	49	55	36	89	66	87	70	93	75
18	103	75	91	68	87	60	83	50	57	41	57	43	76	55	66	51	76	49	93	72	91	72	91	75
19	101	76	86	69	89	62	81	50	67	29	71	49	75	60	52	44	80	46	80	62	90	73	92	65
20	101	76	93	68	90	65	82	45	66	40	81	51	76	57	58	45	65	52	80	53	91	69	95	68
21	101	76	94	72	92	61	83	44	(*)	......	75	59	80	49	78	48	58	52	81	56	91	64	92	72
22	101	74	98	67	94	60	85	46	......	......	78	61	(*)	......	76	51	64	55	88	71	95	64	93	65
23	104	75	100	69	92	60	79	50	......	......	84	66	64	35	79	57	75	58	95	72	91	63	95	64
24	102	75	102	71	86	63	72	49	......	......	70	26	54	44	87	65	73	56	92	75	93	69	96	70
25	102	79	100	71	85	70	71	43	......	......	36	21	65	35	79	61	77	61	92	67	94	67	101	72
26	102	78	100	55	88	66	73	41	......	......	51	18	71	34	84	58	86	66	90	55	94	76	98	76
27	102	77	99	76	86	70	78	58	81	64	(*)	......	76	41	80	66	76	57	81	70	96	77	99	78
28	101	74	95	70	80	75	82	44	67	50	77	24	76	59	79	43	84	45	80	60	88	70	93	77
29	101	77	93	66	88	67	82	41	67	34	82	54	76	64	54	40	82	48	80	66	94	75	98	78
30	99	68	95	70	88	72	74	49	68	33	82	66	70	47	......	......	70	58	71	56	95	75	97	73
31	97	73	95	70	......	......	70	47	......	......	(*)	......	47	39	......	......	72	65	......	......	97	76	......	......
Range	......	......	......	......	42°		......	......	......	......	......	......	......	......	57°		......	......	59°		41°		......	......

*Observer absent on repair duty.
Elevation of thermometers above ground, 16 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, CEDAR KEYS, FLA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1											66	51	77	64	69	61	75	67	73	56	85	61	90	78.5
2											69	56	76	63	71	62	76	65	73	63	83	62	87	72.5
3											71	58	75	63	66	49	75	61	78	63	78	68	88	67
4											70	63	76	63	57	44	76	68	79	68	78	67	90	70.5
5											72	62	74	63	57	43	75	68	80	70	78	69	91	71
6											69	63	74	65	56	44	78	69	80	71	84	69	90	74
7											66	55	73	66	60	46	77	67	79	71	88	70	87	74
8											71	58	73	64	61	49	78	69	79	62	82	70	87	72
9											73	65	73	62	61	56	77	71	62	50	84	70	90	77.5
10											74	65	72	62	65	52	77	70	64	50	84	71	94	78
11											72	67	76	63	71	55	79	71	74	60	86	71	92	77.5
12											70	63	74	61	72	61	79	72	70	51	86	69	90	79.5
13											71	61	70	60	71	63	79	72	73	55	82	69.5	89	79.5
14											74	67	69	51	69	61	80	71	77	60	82	69	90	80
15											71	56	67	53	64	53	80	72	79	64	78	65	89	80.5
16									*77	72	62	47	68	51	70	45	80	66	81	68	80	60	85	70
17									77	71	65	47	67	54	72	55	76	67	79	70	83.5	62	87	72
18									77	67	66	52	67	59	74	64	81	63	83	68	84	66	86	70
19									67	45	72	57	67	49	72	65	80	72	82	73	87	70	87	69
20									58	44	69	60	69	55	69	60	72	63	82	73	88.5	72	77	71
21									55	36	66	59	69	60	69	58	64	59	82	70	91	73	76	65
22									58	41	69	59	71	62	63	53	61	55	83	69	83.5	74	87	69
23									61	43	72	63	65	49	67	58	72	54	85	71	88	73	79	70
24									64	50	72	66	52	48	71	56	73	57	85	74	86	70	89	73
25									66	50	72	66	55	50	72	58	78	57	84	76	90	71	89	74
26									71	55	69	43	68	53	74	64	77	59	83	74	89	72	90	77
27									74	63	62	36	60	52	74	63	77	66	84	71	89	72	91	78
28									72	63	68	52	62	53	75	65	72	62	88	74	88	73	88	79
29									71	56	71	60	73	57	74	66	65	56	83	74	87	73	92	79.5
30									64	50	71	62	75	64			69	49	80	72	86	74	91	72
31											73	63	71	64			69	52			89	76		
Range											38°		29°		32°		32°		38°		31°		29°	
Monthly mean											63°.6		63°.6		60°.7		69°		71°.4		76°.2		80°.8	

*Observations commenced November 16, 1879.

Elevation of thermometers above ground, 20 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, CHARLESTON, S. C.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	85	74	89	79	84	75	82	70	63	53	58	37	69	55	66	54	69	61	72	52	66	53	88	75
2	83	73	88	79	86	75	83	68	65	51	66	41	73	55	56	40	66	52	76	59	72	58	86	65
3	85	73	86	74	89	75	82	69	67	45	67	54	66	53	53	47	72	54	76	64	71	64	76	62
4	88	71	89	74	88	73	80	70	51	36	69	57	69	53	61	36	75	61	74	65	73	63	78	65
5	90	74	91	74	85	72	82	71	57	41	68	53	70	56	54	42	76	63	82	61	76	64	81	72
6	85	76	94	78	84	76	82	72	68	49	70	60	68	57	49	40	80	63	81	61	79	65	85	72
7	86	76	95	80	85	72	81	76	69	57	65	50	74	56	55	37	80	62	71	59	82	66	86	75
8	93	77	95	77	89	73	80	73	72	62	65	51	63	56.	55	45	74	56	61	41	79	67	86	68
9	98	79	86	66	81	69	83	69	73	64	66	52	68	55	60	44	69	52	57	39	79	69	84	75
10	103	81	80	62	77	68	87	68	74	61	74	58	67	57	63	44	63	50	67	42	79	71	88	76
11	99	84	86	67	77	65	80	68	74	62	75	64	65	57	64	49	65	56	72	53	80	72	90	76
12	104	83	81	68	77	62	77	68	78	63	65	45	68	47	72	57	66	59	59	41	81	71	97	76
13	90	75	84	72	80	67	77	70	82	65	50	43	64	40	71	62	63	53	67	46	80	69	100	79
14	85	74	88	72	79	70	80	71	77	64	66	46	55	33	64	57	68	50	74	56	75	65	100	80
15	86	75	87	76	79	69	81	71	78	67	66	50	62	41	62	49	79	62	78	66	68	56	99	80
16	89	78	87	76	82	64	83	75	80	68	66	40	62	45	58	43	77	65	79	64	72	57	94	70
17	92	79	85	72	84	68	83	75	72	61	65	43	62	47	65	50	68	56	87	64	80	59	82	64
18	91	72	88	71	82	69	84	73	78	54	63	47	66	52	70	56	64	54	76	66	82	65	81	67
19	81	72	87	75	81	73	80	60	57	34	65	48	65	47	69	50	76	54	81	68	81	68	81	67
20	82	72	86	75	76	68	63	58	52	34	67	50	68	53	53	41	64	51	81	66	81	71	82	67
21	84	72	86	75	72	67	78	58	45	30	66	55	64	53	59	43	64	50	67	59	81	72	83	67
22	84	72	84	79	71	65	73	65	54	37	69	56	69	58	60	44	66	53	68	58	80	72	84	69
23	90	75	88	77	72	64	73	67	63	41	72	59	62	48	73	50	71	50	75	52	82	72	89	72
24	92	79	87	76	78	67	68	52	63	42	74	60	54	46	61	48	69	53	83	65	83	72	88	73
25	92	78	89	76	71	63	55	44	63	42	73	61	51	42	72	52	58	44	87	69	81	72	90	72
26	90	78	85	69	70	54	63	44	65	47	65	39	59	43	73	58	66	50	87	71	83	70	91	78
27	91	77	77	67	76	58	66	56	66	56	53	34	66	54	78	60	72	50	84	68	83	70	93	78
28	91	80	78	68	79	62	70	58	74	60	60	42	69	55	78	58	69	59	75	60	85	69	97	79
29	90	80	77	67	82	68	69	54	68	51	72	52	66	52	75	60	60	48	77	69	84	72	95	78
30	89	79	79	70	82	72	76	55	54	39	72	53	68	52	......	......	58	40	78	64	86	73	93	80
31	88	76	83	73	......	......	67	56	......	......	67	53	77	62	......	......	65	41	......	......	89	75	......	......
Range	33°		33°		35°		43°		52°		41°		44°		42°		40°		48°		36°		38°	
Monthly mean	84°.1		80°.5		75°.0		70°.6		59°.3		58°.3		58°.2		56°.4		61°.7		67°.0		73°.7		80°.6	

Elevation of thermometers above ground, 40 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, CHARLOTTE, N. C.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	84	66	84	68	85	67	85	59	58	45	49	27	62	44	56	41	60	50	75	45	63	42	91	69
2	86	65	80	68	84	69	85	63	61	46	60	33	57	46	43	24	61	44	75	51	72	46	83	59
3	89	66	83	69	85	71	87	61	56	32	66	42	69	43	43	27	56	43	65	59	70	57	75	52
4	93	66	86	71	82	66	85	64	46	25	66	55	68	49	43	27	74	50	78	55	70	56	80	56
5	94	71	91	72	83	64	82	65	51	28	64	55	70	49	43	30	79	62	75	57	77	59	82	58
6	77	70	93	72	86	64	85	67	66	35	65	53	58	46	48	31	69	55	78	57	85	59	84	63
7	85	68	90	71	86	65	80	68	70	44	65	42	62	52	54	31	62	47	64	48	88	63	82	66
8	92	72	90	70	85	65	81	68	73	56	65	42	56	46	48	34	55	43	50	33	86	64	85	67
9	93	76	73	60	73	56	82	68	74	61	66	47	51	45	59	33	49	41	55	34	84	62	86	66
10	95	77	74	56	75	56	87	67	78	59	66	50	59	48	52	32	53	44	65	38	82	62	80	65
11	99	72	79	58	76	55	78	66	77	57	67	47	55	50	63	37	60	48	59	40	84	63	90	68
12	101	78	79	64	78	55	75	65	76	58	49	35	61	49	60	53	56	36	55	33	81	63	96	72
13	92	71	81	61	74	61	80	58	80	63	40	28	57	33	72	57	39	33	70	37	82	61	95	74
14	83	71	83	62	76	59	82	62	80	61	43	32	45	26	59	47	49	34	76	48	71	58	95	75
15	90	70	79	68	74	51	82	62	76	63	57	40	51	34	51	41	49	44	80	55	70	51	94	72
16	94	72	85	70	80	52	80	62	70	54	50	29	55	33	57	34	65	42	77	59	77	51	78	59
17	97	78	83	68	85	58	81	67	60	47	60	35	59	35	62	38	61	42	83	59	85	56	78	54
18	83	68	83	68	85	59	76	67	59	43	54	40	62	44	68	52	52	35	84	60	88	63	80	57
19	84	64	83	64	85	61	69	53	44	30	64	42	68	40	58	39	63	41	79	61	89	64	80	60
20	83	63	82	67	71	61	63	46	42	27	65	45	67	52	45	28	60	41	70	55	85	65	83	60
21	84	64	84	68	62	57	57	50	38	21	65	45	64	45	60	35	63	43	67	49	82	64	86	62
22	88	66	85	67	66	57	67	53	45	21	52	42	62	52	61	36	66	43	73	47	80	67	90	65
23	92	71	84	71	68	59	74	53	59	33	61	42	54	39	67	42	67	45	78	55	80	67	92	68
24	90	72	84	70	79	54	56	40	48	33	62	39	45	33	62	39	60	43	84	61	83	66	88	72
25	91	73	85	70	67	50	51	33	59	34	70	42	45	29	71	43	56	35	85	62	86	67	90	71
26	87	73	74	61	66	43	56	30	63	40	49	19	44	34	70	54	62	40	75	61	86	67	88	70
27	83	74	74	64	70	45	60	40	63	42	39	22	55	39	73	53	65	53	74	56	86	65	92	70
28	84	73	77	59	75	44	71	47	70	57	55	29	69	51	76	55	65	48	72	50	87	64	93	71
29	82	71	79	59	80	57	71	42	61	36	63	40	65	48	74	59	58	39	67	55	85	69	93	69
30	81	69	82	61	81	56	75	45	44	30	70	44	49	40	......	......	56	33	70	50	76	65	89	67
31	83	69	86	64	......	......	62	47	......	......	60	44	64	45	......	......	64	39	......	......	87	65	......	......
Range	38°		37°		43°		57°		59°		51°		44°		52°		46°		52°		47°		44°	
Monthly mean	79°.1		74°.0		68°.2		65°.1		52°.1		49°.7		50°.7		49°.1		51°.5		61°.8		71°.7		76°.6	

Elevation of thermometers above ground, 35 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, CHARLOTTETOWN, PRINCE EDWARD ISLAND.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	62.9	48.1	82.6	61.9	64.6	53.9	73.9	55.3	38.6	30.1	30.5	14.8	19.7	— 4.0	25.9	5.1	38.8	17.4	26.9	19.5	44.3	30.0	72.2	51.2
2	71.0	47.1	81.9	63.4	70.4	56.7	64.7	50.5	38.7	26.7	36.8	26.9	38.8	1.5	7.7	— 8.9	19.8	9.7	34.0	13.0	42.0	30.1	60.8	44.0
3	82.7	57.8	83.9	65.2	59.8	52.0	67.4	52.1	34.4	27.1	38.2	27.1	34.1	0.1	12.3	— 4.7	25.2	10.1	46.7	16.8	50.8	30.9	53.7	38.3
4	78.3	47.7	75.1	62.3	63.9	50.9	56.5	42.2	34.8	26.0	44.0	28.1	37.2	1.0	27.6	9.0	39.0	23.4	41.4	34.4	47.0	30.0	48.3	38.2
5	57.0	45.2	77.9	61.2	68.9	55.1	47.7	41.2	29.8	22.6	30.0	25.0	36.0	9.3	20.8	8.4	32.7	14.9	47.9	34.7	59.0	30.6	52.2	40.2
6	64.0	43.0	71.9	55.1	70.4	60.1	45.4	35.1	30.9	17.2	32.6	23.1	31.1	1.6	30.6	6.1	22.2	12.9	42.3	28.3	49.8	31.5	49.8	41.2
7	68.4	45.1	68.9	53.9	68.8	58.6	55.5	35.3	32.3	15.0	50.0	31.1	35.7	13.6	19.8	— 2.1	23.2	5.1	31.9	19.6	39.0	28.2	60.7	41.0
8	67.9	52.4	66.0	53.6	66.7	56.9	63.0	51.1	39.2	20.0	43.6	23.3	31.2	10.1	22.3	— 0.9	36.0	1.7	26.9	16.3	45.2	26.5	64.0	48.1
9	63.0	56.9	67.9	55.1	70.1	55.7	57.6	49.1	46.0	37.9	26.8	19.4	27.5	3.2	33.3	— 2.1	4.4	— 4.0	30.7	16.1	53.4	(*)	66.9	46.2
10	70.2	59.1	69.2	55.3	61.0	49.6	50.2	40.1	54.1	38.1	31.9	22.8	39.8	25.6	4.5	— 9.3	21.3	— 0.4	42.0	27.0	61.3	39.2	65.1	44.1
11	72.7	57.6	73.6	55.2	64.3	49.0	43.3	38.2	40.5	30.7	48.4	30.7	27.6	10.3	18.7	— 5.7	8.6	— 8.5	48.6	33.5	62.2	40.2	71.4	48.6
12	73.0	54.7	76.9	56.6	65.6	51.3	48.6	37.2	36.5	31.1	40.8	23.9	32.9	10.0	37.0	— 1.9	8.7	—11.3	34.9	16.4	61.6	39.2	66.4	51.0
13	78.5	54.0	75.8	57.4	68.1	53.1	50.2	37.3	36.8	28.2	25.8	12.3	27.4	10.1	42.1	22.1	14.5	— 1.9	35.9	15.1	42.2	32.1	63.1	48.5
14	71.9	59.2	77.2	61.7	66.8	54.7	46.2	41.1	40.4	26.9	26.1	14.0	12.7	zero.	24.1	8.1	15.9	5.1	39.9	22.6	39.8	32.6	51.6	45.9
15	74.7	60.1	65.4	50.3	68.7	52.4	47.4	40.0	54.0	39.0	34.7	24.1	26.1	— 4.3	18.3	— 0.9	15.0	2.1	43.3	23.3	43.1	33.1	48.8	38.6
16	69.8	57.6	67.7	48.4	61.0	49.1	54.7	41.2	54.0	33.6	31.7	19.1	26.9	8.1	21.2	12.1	23.8	4.0	41.9	27.2	52.0	32.1	63.8	38.5
17	60.9	50.1	64.5	53.1	70.6	57.2	50.7	40.9	42.9	31.1	21.6	12.4	31.8	22.1	22.5	8.1	18.9	6.1	32.8	23.5	56.0	32.3	68.8	44.8
18	56.4	47.5	64.2	53.4	64.6	53.5	58.4	42.5	33.7	27.2	20.3	0.3	32.9	27.0	40.4	15.6	20.0	4.0	29.2	24.8	44.0	31.1	72.8	46.2
19	58.0	45.6	60.5	52.1	60.1	50.9	56.3	37.0	33.9	24.1	12.9	— 0.1	33.0	23.7	40.9	8.9	33.4	7.2	40.1	22.0	58.0	28.8	76.2	51.1
20	69.0	45.1	59.9	52.1	64.7	45.6	40.0	31.1	36.6	26.0	28.1	0.4	26.3	8.0	19.5	1.0	26.8	12.1	49.0	31.5	63.1	40.5	75.9	55.6
21	68.9	54.2	73.9	51.1	61.8	46.8	49.9	30.0	33.8	15.1	10.3	—17.9	34.9	8.6	32.9	9.2	28.4	6.1	50.8	32.9	74.4	39.2	67.7	54.7
22	68.3	57.1	75.0	57.2	60.2	45.8	55.6	39.5	24.3	12.0	19.5	—16.6	15.6	— 0.3	35.1	19.6	34.7	11.4	58.2	31.2	57.2	37.4	58.3	47.9
23	70.1	56.8	70.5	60.0	60.7	52.1	61.9	47.4	40.8	22.2	25.2	11.0	40.1	— 0.6	29.2	16.1	33.3	18.9	40.0	29.1	67.6	44.2	52.3	43.9
24	69.5	59.5	77.2	61.6	66.1	52.3	57.1	32.0	40.3	17.9	22.0	5.1	38.0	23.3	22.1	16.4	32.9	17.3	43.0	27.7	70.1	51.1	49.4	43.3
25	69.6	53.4	63.7	55.0	53.8	39.1	35.0	27.3	36.7	14.2	29.8	— 0.4	25.2	10.3	30.9	16.9	35.9	19.9	48.7	26.1	53.7	39.9	64.4	45.0
26	69.4	52.2	72.0	52.5	50.1	35.4	42.3	25.4	34.9	23.1	2.1	—14.1	30.6	10.1	41.6	17.1	22.0	11.0	42.1	28.1	56.8	45.6	65.2	50.1
27	60.0	53.9	66.2	50.5	58.1	44.3	51.0	34.5	25.2	19.1	1.3	—13.0	35.9	9.9	41.2	29.0	25.0	7.2	48.9	35.7	73.8	46.3	69.9	56.1
28	63.0	53.1	68.8	49.8	61.0	46.2	51.4	38.6	40.8	22.2	27.1	— 8.9	42.1	32.6	36.3	25.3	23.2	6.1	41.6	29.4	78.3	55.1	76.6	54.5
29	73.4	54.1	57.8	50.6	60.0	47.8	50.4	45.0	50.2	37.4	35.9	13.5	36.1	3.7	42.5	32.4	26.2	12.3	52.4	29.4	60.4	42.3	74.8	58.6
30	71.9	60.2	58.2	51.5	64.9	54.3	51.5	38.6	47.4	16.1	34.6	— 0.5	28.7	— 0.4	......	......	30.8	18.7	47.3	35.9	61.4	40.2	82.8	61.3
31	77.1	60.3	57.5	52.7	......	......	45.4	35.7	......	......	4.7	—10.0	41.7	23.9	......	......	29.9	24.6	......	......	56.0	48.7	......	......
Range	39°.7		35.°5		35°.2		48°.5		42°.1		67°.9		46°		51°.8		50°.3		45°.2		....		44°.6	

* Not set.

Maximum, minimum and mean temperatures—Continued.

STATION, CHATHAM, NEW BRUNSWICK.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	71.7	48.9	90.5	59.3	74.2	44.8	80.4	55.5	36.4	28.3	24.3	8.9	13.0	—6.5	19.2	—3.6	35.6	13.3	34.6	13.1	53.1	28.0	74.5	48.5
2	85.5	43.3	88.5	59.5	74.9	55.2	70.8	47.9	34.6	21.9	29.9	18.2	33.8	1.1	7.6	—13.3	20.6	3.8	53.5	3.2	49.2	24.1	65.6	44.9
3	85.5	60.2	85.5	58.6	62.1	53.8	72.5	47.0	35.5	20.8	27.7	16.9	31.7	—2.0	5.8	—13.5	27.2	3.0	52.2	15.9	56.4	27.7	61.5	41.5
4	72.5	46.1	79.5	53.6	63.0	51.5	56.7	45.4	31.7	25.4	36.4	22.9	32.0	—3.3	16.6	5.8	39.5	24.8	47.5	35.6	56.1	35.3	61.5	38.8
5	67.1	43.9	81.1	54.0	63.2	56.1	49.7	31.2	29.4	18.9	28.6	10.0	28.0	—1.3	20.6	—1.8	30.1	13.3	48.8	34.9	56.2	34.8	71.7	35.4
6	73.8	41.0	72.6	51.7	70.9	54.9	54.5	30.5	31.4	15.3	34.3	8.9	31.6	—18.0	26.6	—7.3	27.3	—1.6	42.6	28.0	53.5	33.5	69.1	35.5
7	77.5	41.9	72.8	50.8	74.5	55.4	68.5	29.4	31.8	10.1	52.5	32.0	33.4	6.3	15.2	—7.8	32.6	—3.3	33.0	21.7	52.1	29.0	57.2	43.3
8	69.4	53.0	70.5	49.8	69.7	53.1	75.9	52.6	42.3	24.7	41.3	16.8	35.5	5.0	21.7	—20.3	30.8	—3.6	26.6	14.8	56.8	23.4	61.2	47.9
9	71.6	57.0	69.1	55.8	69.7	53.1	56.7	46.8	52.5	38.0	24.0	10.9	26.6	—1.3	27.2	—6.6	8.6	—15.1	36.1	10.3	62.5	39.2	72.5	50.5
10	73.5	55.4	72.1	54.2	66.3	50.2	48.6	35.6	49.5	37.6	26.6	10.9	34.6	14.0	7.5	—20.2	23.5	—8.4	46.1	30.4	74.4	40.8	79.0	45.8
11	76.5	54.3	76.5	49.4	69.0	48.0	45.5	31.9	42.5	29.0	45.2	26.6	24.6	—0.3	23.5	—1.3	11.0	—6.8	49.5	25.7	70.1	49.8	78.1	54.3
12	79.9	48.0	79.9	49.8	71.3	43.0	52.3	40.0	34.0	28.3	37.4	10.7	30.5	2.2	27.9	zero.	16.6	—20.9	28.6	13.9	53.5	42.0	72.1	51.4
13	85.5	55.2	80.8	52.0	70.5	45.8	52.8	41.1	35.1	28.0	17.6	2.7	28.6	3.8	42.6	21.5	19.2	—14.6	37.5	10.1	43.5	34.0	66.6	49.8
14	79.1	64.0	74.5	58.8	59.1	52.1	54.1	38.1	42.2	25.6	24.4	6.0	14.6	—3.2	21.5	—6.6	14.6	—5.7	40.3	18.1	45.1	35.9	61.5	46.9
15	82.4	57.3	66.1	45.1	63.5	46.7	56.5	33.2	55.8	41.0	31.6	20.6	19.7	—8.7	14.6	—18.4	26.6	—8.0	50.5	24.6	59.5	32.2	62.5	42.3
16	70.5	56.6	69.4	41.8	58.1	36.9	61.6	40.9	53.7	32.1	29.6	7.2	18.3	—7.0	27.6	5.8	29.6	—10.6	46.1	29.9	64.2	35.8	72.6	39.5
17	56.6	48.1	70.1	49.9	63.2	50.7	61.1	37.0	42.1	26.8	21.2	4.6	26.6	14.3	33.6	1.7	22.6	2.2	29.9	24.9	52.6	33.7	77.5	44.7
18	58.7	46.8	63.5	51.2	63.9	47.9	61.2	38.8	33.4	21.9	9.7	—13.4	34.6	23.9	47.5	23.8	29.6	—4.3	42.1	22.1	54.5	31.3	86.1	45.0
19	64.4	46.6	57.1	49.8	64.3	44.9	55.4	35.6	33.5	24.2	5.4	—15.1	32.3	16.6	44.6	3.3	38.4	10.8	55.4	16.9	67.5	25.8	87.2	47.0
20	76.1	44.8	73.9	51.2	62.5	37.7	38.3	30.8	34.2	25.1	7.6	—15.5	23.2	7.8	21.6	0.4	32.5	6.3	57.4	39.0	76.2	48.7	86.5	58.4
21	71.1	51.2	79.1	48.0	62.5	36.2	55.2	24.9	30.7	10.5	—14.5	—22.1	12.6	7.8	32.2	6.7	39.6	2.4	62.5	34.5	62.4	42.3	71.2	53.8
22	77.5	55.6	72.4	54.3	63.5	34.0	57.5	32.0	27.6	—1.6	2.0	—23.2	25.6	—2.2	32.4	—1.5	42.2	17.7	66.6	29.8	42.8	40.2	57.6	49.7
23	63.0	49.8	70.9	58.8	63.5	39.8	63.1	42.9	34.6	—3.3	19.5	—6.9	34.5	—9.4	27.7	—9.1	33.5	16.3	47.4	28.1	73.4	39.2	52.9	46.2
24	71.3	53.3	76.4	59.4	61.3	47.1	53.3	28.7	35.6	7.5	12.0	—6.3	37.1	16.3	28.6	8.5	29.5	11.6	50.6	22.2	69.4	47.6	63.9	43.9
25	74.5	49.8	61.5	53.5	49.5	32.1	31.4	20.7	27.6	—1.8	12.0	—10.4	29.4	1.8	31.2	5.6	27.9	20.2	53.5	25.7	58.5	42.2	69.1	42.1
26	73.4	46.4	66.7	48.1	56.5	27.1	48.1	18.1	29.6	12.0	—1.5	—23.3	34.5	4.8	37.3	19.5	29.2	12.0	46.1	27.0	73.4	44.0	68.4	53.0
27	60.1	54.0	69.4	43.8	63.4	37.8	55.5	26.8	24.6	2.7	2.6	—29.3	39.1	6.1	47.5	29.8	30.3	0.3	51.5	33.0	85.4	41.2	83.2	58.5
28	71.1	52.8	72.4	41.7	67.5	41.0	51.9	29.9	37.4	18.9	22.5	—17.3	42.9	29.1	37.5	17.9	27.2	—0.5	47.5	25.2	74.4	48.2	84.5	58.5
29	76.3	53.2	61.3	48.2	63.5	43.9	47.8	37.0	52.8	34.5	26.2	—1.3	29.1	—2.3	37.3	29.0	35.4	13.9	60.6	25.5	65.0	41.0	85.1	64.9
30	82.1	58.9	67.1	52.7	73.5	55.1	49.2	34.8	41.9	15.1	24.0	—9.9	31.6	—11.7	......	......	33.6	13.9	52.5	41.5	69.1	36.5	83.4	60.9
31	83.1	54.3	71.9	47.6	......	......	40.2	33.9	......	......	—2.6	—21.8	42.5	17.2	......	......	33.3	27.0	......	......	58.5	47.2	......	......
Range	44°.5		48°.8		47°.8		62°.3		59°.1		81°.8		60°.9		67°.8		60°.5		63°.4		61°.3		51°.8	

Elevation of thermometers above ground, 19 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, CHATTANOOGA, TENN.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	91	65	74	68	75	69	83	66	56	45	51	32	61	50	45	36	58	42	66	50	65	43	80	71
2	91	69	85	68	79	69	86	65	60	43	58	37	69	44	41	31	60	44	64	49	70	45	77	65
3	92	65	86	72	81	68	86	64	50	35	62	49	67	44	42	28	57	51	77	57	72	55	79	58
4	97	68	91	70	81	64	85	66	48	26	62	47	69	56	40	30	73	56	82	62	73	58	80	60
5	92	73	92	72	83	63	83	64	55	30	60	44	67	48	45	28	73	64	86	66	77	60	82	63
6	97	70	89	75	83	60	83	65	61	42	60	44	61	56	51	29	65	50	79	61	84	58	77	69
7	90	73	87	75	85	63	76	68	67	43	56	35	62	55	53	34	74	52	61	47	86	61	85	64
8	95	73	82	72	78	63	76	70	71	62	65	39	63	56	56	33	60	50	47	34	86	61	85	65
9	97	76	76	65	72	56	78	68	75	64	67	49	61	55	59	35	59	50	56	36	83	62	90	66
10	94	76	76	60	77	57	80	67	74	65	67	55	69	53	63	39	63	50	71	38	86	65	91	70
11	99	76	77	57	74	60	82	66	74	65	58	34	66	59	64	38	66	52	60	42	86	62	94	72
12	101	78	81	63	80	58	76	65	75	62	41	28	66	45	62	53	61	45	58	34	83	63	93	68
13	97	73	82	62	70	62	79	62	77	66	45	29	46	34	67	49	56	49	72	38	84	65	94	74
14	90	71	83	67	70	56	81	63	77	66	47	39	52	35	50	35	52	47	76	55	79	65	92	74
15	95	71	83	68	76	52	81	62	72	60	48	39	52	35	49	33	50	45	77	62	79	57	90	69
16	98	73	85	68	79	52	73	64	65	54	50	30	57	36	59	32	55	35	77	60	82	57	71	64
17	96	74	75	65	81	56	77	70	65	46	59	40	55	45	62	46	47	33	80	60	86	61	81	61
18	81	69	80	62	81	55	72	57	60	39	57	45	62	45	62	41	57	40	88	59	87	63	82	60
19	85	71	83	62	81	58	62	52	49	33	68	51	67	41	48	33	57	48	73	60	88	63	83	62
20	89	65	87	62	79	60	60	48	44	28	59	50	66	54	54	32	60	40	67	50	84	64	85	61
21	90	65	87	70	78	60	62	53	41	22	65	53	62	42	52	42	64	43	72	48	74	66	86	65
22	90	65	81	70	78	60	68	57	49	24	70	58	58	42	60	34	64	45	69	58	80	59	90	65
23	96	72	78	69	78	62	62	47	57	38	69	57	46	34	63	52	68	42	73	61	86	60	93	65
24	90	75	85	72	80	60	54	40	55	33	72	64	47	31	67	36	61	44	81	65	81	68	87	74
25	87	73	80	65	70	54	58	37	63	41	68	18	47	29	70	50	63	39	85	63	83	64	83	71
26	85	74	75	58	71	47	59	35	65	43	30	12	53	36	68	56	64	48	75	62	86	65	84	71
27	90	73	75	58	72	50	58	44	65	51	42	22	63	44	70	53	74	59	70	49	82	66	90	71
28	90	70	78	61	76	50	66	51	66	50	52	34	65	39	74	59	61	45	71	50	77	68	84	69
29	78	67	80	60	81	50	71	40	52	35	64	42	67	42	61	44	58	40	68	58	83	69	82	67
30	83	69	81	61	82	60	69	51	45	31	68	50	63	53	......	......	62	41	63	51	80	67	87	67
31	80	70	83	61	......	......	55	45	......	......	67	57	55	41	......	......	67	41	......	......	87	68	......	......
Range	36°		35°		38°		51°		55°		60°		40°		46°		41°		54°		45°		36°	
Monthly mean	81°.2		73°.2		68°.0		64°.0		52°.2		49°.6		52°.0		48°.4		54°.2		62°.4		71°.5		75°.7	

Elevation of thermometers above ground, 42 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, CHEYENNE, WYO.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	80	49	88	55	83	41	77	48	55	18	57	32	51	37	38	9	47	24	53	29	70	34	65	37
2	72	56	69	59	74	40	70	39	56	24	48	32	54	21	26	12	49	29	55	31	73	35	79	42
3	80	42	85	57	75	42	79	40	61	26	53	28	53	30	19	6	51	30	49	36	70	48	89	44
4	85	53	82	60	79	46	80	40	57	30	41	23	48	14	22	4	39	20	48	32	75	42	80	50
5	89	54	78	55	71	43	79	40	60	30	44	21	51	22	24	1	38	18	47	32	81	44	57	40
6	89	59	66	55	78	46	72	41	67	41	38	25	54	21	34	13	49	23	42	24	65	34	70	38
7	86	58	79	47	65	38	76	37	46	26	29	12	55	34	42	8	40	24	44	28	57	28	77	45
8	90	58	78	48	83	40	57	34	32	19	33	11	57	29	38	17	46	21	58	20	46	30	71	44
9	94	61	84	49	85	51	50	36	39	20	30	6	40	24	39	21	42	16	62	30	44	30	57	42
10	90	66	86	50	87	51	59	28	53	24	19	5	51	18	46	16	42	24	63	32	70	32	71	40
11	92	50	84	53	67	40	68	32	53	32	22	—7	23	12	39	27	32	—5	68	37	83	41	80	48
12	95	60	75	53	69	33	74	32	53	28	33	10	30	11	30	6	—5	—16	68	36	83	42	77	40
13	93	53	72	55	74	30	80	38	38	24	33	16	48	22	26	16	12	—17	73	37	78	45	82	51
14	94	58	80	49	76	45	73	46	39	23	33	19	42	31	30	4	16	—17	59	26	76	45	82	47
15	78	60	80	50	75	38	52	29	38	24	45	29	44	35	46	20	21	—13	50	32	76	40	84	49
16	85	59	84	52	81	45	41	33	36	24	50	13	44	36	41	17	29	—1	61	29	83	38	74	49
17	88	54	83	50	78	42	54	34	28	13	27	10	54	39	20	9	36	5	68	27	84	48	82	52
18	85	61	83	56	54	36	63	34	48	14	51	27	63	33	25	2	33	16	39	18	67	43	90	52
19	82	52	84	52	67	35	70	31	46	22	41	7	48	41	45	9	33	16	39	15	63	49	97	57
20	88	52	81	53	79	43	65	39	54	18	49	4	49	35	48	20	39	12	59	28	67	41	82	57
21	92	56	86	48	73	43	65	35	58	25	43	16	38	15	50	26	44	20	67	32	73	41	78	55
22	86	58	83	46	77	40	43	33	56	30	35	—1	36	12	52	30	52	27	70	37	74	38	83	50
23	84	53	84	46	60	41	52	28	60	28	—1	—21	33	14	59	26	57	29	47	32	73	51	85	54
24	81	52	86	47	71	43	68	29	54	26	—4	—24	39	14	43	28	56	26	36	21	69	42	75	52
25	73	48	89	44	82	44	51	30	51	22	29	—8	50	32	38	26	64	30	37	19	56	36	80	48
26	72	47	88	51	73	48	55	23	28	17	51	29	36	15	36	22	46	26	56	21	56	31	85	48
27	80	49	92	52	70	41	59	34	26	14	51	33	17	—11	22	—10	46	20	63	25	65	33	61	46
28	86	51	85	61	74	50	66	35	41	11	46	26	11	—2	20	—10	61	23	46	30	70	33	73	38
29	89	49	78	52	74	43	52	26	52	28	34	15	12	4	29	6	69	26	62	19	70	47	83	40
30	92	55	70	43	72	39	36	18	57	38	34	19	17	—7	......	......	46	27	73	29	60	32	80	51
31	88	63	83	40	......	......	32	18	......	......	45	17	32	9	......	......	46	11	......	......	56	32	......	....
Range	53°		52°		57°		62°		56°		81°		74°		69°		86°		58°		56°		60°	
Monthly mean	69°.9		65°.8		58°.0		46°.1		35°.4		25°.8		30°.5		24°.0		27°.6		41°.4		53°.8		62°.5	

Elevation of thermometers above ground, 15 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, CHICAGO, ILL.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	79	66	88	72	80	71	83	70	38	21	52	35	42	26	30	12	42	25	50	38	70	37	64	56
2	87	70	91	74	75	66	83	65	35	25	55	40	40	28	35	20	53	32	50	45	78	55	72	53
3	90	75	85	73	72	64	72	60	32	22	40	36	59	37	32	20	56	48	71	47	78	56	76	59
4	80	64	81	71	70	60	75	60	39	17	48	37	59	37	22	14	58	48	65	43	72	59	74	63
5	75	60	80	72	72	56	84	67	46	34	62	43	47	37	31	12	56	33	46	40	79	60	78	63
6	88	68	79	71	71	55	84	70	56	40	56	36	53	37	39	18	47	33	49	35	83	63	77	61
7	83	65	74	64	64	54	77	66	62	49	36	33	50	40	31	15	47	30	43	31	85	68	67	55
8	84	72	69	62	61	47	73	66	69	57	44	33	53	40	49	28	49	23	45	36	75	54	67	62
9	83	67	71	57	61	50	82	68	60	43	62	36	60	33	37	24	43	30	66	36	75	62	77	62
10	92	73	80	59	65	49	81	68	61	46	62	28	46	32	47	34	38	21	57	32	72	61	87	71.5
11	90	69	82	65	75	55	78	66	69	52	28	15	61	34	54	38	43	31	37	27	62	55	91	77
12	78	67	82	65	71	60	77	61	60	52	29	12	35	29	54	36	34	22	56	31	62	54	88	72
13	86	73	82	65	64	51	70	62	68	49	35	19	38	29	36	24	33	23	77	46	59	53	83	70
14	91	78	71	64	61	46	75	66	60	50	39	30	47	32	37	29	30	21	76	58	56	50	71	56
15	93	79	68	62	71	51	77	66	58	42	34	15	42	20	46	34	36	19	65	41	58	51	60	52
16	90	73	67	59	77	47	75	68	52	35	40	17	54	38	57	36	33	20	47	36	73	52	69	55
17	78	65	69	52	72	47	70	53	53	41	20	8	50	40	60	41	42	20	53	34	83	60	75	61
18	74	65	71	57	69	53	55	51	47	37	28	1	55	36	41	21	47	36	80	50	83	67	73	63
19	77	66	78	65	58	43	54	47	46	26	36	26	51	38	25	14	44	37	70	39	74	66	72	65
20	79	69	85	68	60	45	60	44	30	16	29	19	41	35	38	23	45	33	65	39	66	56	80	63
21	85	73	88	71	63	49	63	47	34	17	33	21	46	35	38	28	53	33	71	51	56	48	81	68
22	87	74	87	73	70	55	69	48	46	28	33	14	46	32	47	35	54	34	61	42	72	47	86	70
23	83	66	81	67	65	54	48	36	40	27	38	14	35	32	43	34	50	35	49	41	70	63	89	73
24	73	66	70	66	56	40	48	34	46	25	37	14	48	31	57	40	36	30	46	40	83	66	88	68
25	79	65	69	66	60	39	55	37	42	31	15	2	51	31	57	38	40	30	60	43	83	71	81	69
26	82	67	71	58	65	46	59	37	52	35	21	− 2	56	31	63	38	50	38	53	45	83	70	83	71
27	83	62	77	65	70	60	63	42	60	50	38	21	48	33	54	36	56	39	63	39	70	60	82	69
28	84	65	89	68	77	65	58	43	60	32	44	30	33	25	45	25	40	37	66	46	68	56	77	67
29	74	65	86	69	77	66	56	43	34	25	44	31	40	24	27	18	41	35	57	42	65	59	76	61
30	80	63	82	71	83	64	50	35	39	27	35	28	49	25	......	......	49	36	47	37	70	59	80	59
31	82	70	86	71	......	......	42	28	......	......	36	28	38	19	......	......	60	42	......	......	73	57	......	......
Range	33°		39°		44°		56°		53°		64°		42°		51°		41°		53°		48°		39°	
Monthly mean	76°.0		73°.0		61°.5		60°.5		42°.1		30°.4		40°.1		35°.1		38°.8		49°.0		64°.5		70°.2	

Elevation of thermometers above ground, 69 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, CHINCOTEAGUE, VA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	56	38	55	40	73	65
2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	53	44	59	51	72	56
3	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	54	48	61	56	67	54
4	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	47	64	57	68	59
5	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	64	49	65	57	68	58
6	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	64	52	84	58	70	65
7	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	55	42	69	56	80	66
8	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	42	35	67	56	72	61
9	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	46	34	85	62	66	60
10	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	51	43	67	62	66	59
11	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	56	36	73	63	81	64
12	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	46	29	73	64	93	68
13	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	52	42	68	53	88	69
14	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	60	50	58	47	82	68
15	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	60	52	56	45	69	60
16	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	*50	......	58	53	72	51	67	59
17	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	45	37	72	54	84	60	70	58
18	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	44	31	56	45	86	64	73	60
19	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	47	38	59	42	75	65	72	61
20	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	52	36	65	47	69	65	84	61
21	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	48	33	60	44	69	65	85	68
22	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	48	39	57	47	69	64	89	70
23	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	52	42	60	53	69	64	75	69
24	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	51	32	61	46	70	65	91	71
25	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	42	24	53	45	74	67	79	75
26	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	45	32	75	52	86	69	86	75
27	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	50	44	69	54	77	70	89	70
28	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	61	46	55	45	76	69	84	75
29	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	46	32	59	51	70	56	81	73
30	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	49	32	65	46	70	55	81	72
31	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	51	33	......	......	79	66	......	......
Range	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	46°		46°		39°	
Monthly mean	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	51°.6		64°.6		70°.6	

*Observations commenced March 16, 1880.

Elevation of thermometers above ground, 29 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, CINCINNATI, OHIO.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	89	66	90	72	79	70	81	63	50	33	56	36	49	34	35	25	44	30	62	51	66	42	72	57
2	92	70	90	72	79	66	85	66	47	28	57	39	58	49	34	21	57	34	70	53	74	52	72	53
3	91	70	96	74	73	67	80	68	38	26	58	51	67	54	36	24	62	46	72	60	75	53	77	54
4	93	76	90	76	78	63	81	63	43	23	53	46	61	59	30	19	70	61	70	60	78	57	77	58
5	89	70	87	69	72	57	85	66	51	31	66	48	62	54	42	19	67	49	73	53	80	60	84	67
6	91	69	86	71	75	58	86	66	52	45	58	46	66	57	45	33	53	40	62	47	82	61	80	71
7	91	74	82	73	74	54	83	68	69	51	54	41	59	51	40	33	50	44	50	37	85.5	63	79	66
8	89	73	75	65	68	54	80	69	73	56	55	43	59	55	47	25	48	37	48	37	86	68	83	66
9	87	74	73	57	67	53	83	68	72	61	64	42	64	46	43	34	56	35	60	40	84	69	76	66
10	92	71	77	56	69	51	84	68	68	57	62	42	57	40	56	33	48	37	65	38	83	67	91	69
11	98	77	80	59	73	53	86	71	72	63	42	28	66	48	57	35	48	36	42	31	75	65	93	74
12	92	79	82	62	75	58	84	69	75	67	28	23	48	32	63	52	44	30	55	33	77	60	93	76
13	94	76	81	67	72	57	84	68	75	63	38	24	36	25	52	37	43	28	73	43	74	57	93	71
14	93	76	81	67	67	52	83	68	74	62	39	35	47	26	40	35	42	36	76	59	69	48	80	70
15	96	75	75	65	68	51	84	67	66	56	38	28	47	40	45	30	43	32	71	63	71	49	76	64
16	98	75	68	60	71	59	79	66	58	48	51	28	59	40	58	39	42	33	72	51	77	52	76	59
17	86	70	76	56	70	57	77	70	48	40	47	32	56	50	65	49	44	28	62	42	83	57	81	61
18	84	64	77	59	73	54	71	54	42	36	39	24	57	40	59	35	58	35	83	53	85	60	83	62
19	87	65	78	59	64	51	54	46	47	31	46	34	59	44	35	26	54	45	73	52	86	65	83	61
20	92	65	84	61	66	51	65	43	42	25	42	34	58	45	43	25	55	40	62	45	84	66	86	67
21	94	73	87	64	69	49	62	55	33	21	47	33	57	43	49	38	53	35	71	49	74	63	87	69
22	83	77	89	71	74	58	69	58	46	28	59	36	55	40	58	35	58	40	77	57	77	58	88	69
23	95	71	80	73	76	60	58	43	46	31	45	33	44	38	53	40	63	39	77	57	81	59	90	69
24	84	73	77	69	67	51	49	38	46	25	46	34	51	35	61	35	46	30	74	59	87	63	88	73
25	91	74	71	57	60	43	54	33	56	40	34	17	52	35	67	58	42	32	75	62	88	71	85	72
26	88	76	73	57	68	44	60	34	59	34	21	11	57	36	64	54	55	41	71	51	87	69	85	72
27	87	70	75	59	69	53	60	51	65	53	41	21	61	37	67	50	69	53	60	47	86	71	85	74
28	86	71	79	59	75	60	60	49	62	42	49	32	53	39	64	57	56	42	65	47	76	65	85	70
29	89	68	81	62	78	59	71	45	42	31	59	49	47	35	57	33	52	37	65	54	74	62	76	64
30	88	68	85	65	80	55	56	44	39	27	59	41	63	42	......	......	53	37	56	43	75	63	82	62
31	89	70	87	66	......	......	51	37	......	......	54	39	45	31	......	......	61	38	......	......	83	58	......	......
Range	34°		40°		37°		53°		54°		55°		42°		48°		42°		52°		46°		40°	
Monthly mean	81°.3		73°.3		64°.1		64°.8		48°.4		41°.5		48°.7		42°.9		45°.7		58°.0		70°.8		74°.8	

Elevation of thermometers above ground, 67 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, CLEVELAND, OHIO.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	80	56	90	68	86	68	80	60	38	30	49	31	40	26	29	16	30	23	48	39	61	33	65	51.5
2	90	65	89	72	77	67	85	63	38	27	51	39	43	33	25	13	40	27.5	60	37	74	52	64	46
3	92	75	80	71	75	65	72	56	35	23	51	47	60	30	25	21	55	39	63	54	79	59	65	53
4	78	67	75	68	72	62	75	46	32	24	47	40	60	36	23	15	63	49	64	45	73	53	77	54
5	73	63	80	67	67	55	83	59	35	20	62	40	45	33	29	11	58	36	55	44	74	60	76	63
6	80	58	81	69	75	50	83	65	45	32	55	43	55	38	30	17	37	34	51	34	67	55	79	69
7	82	71	80	69	68	50	87	67	62	34	50	37	42	35	31	15	43	29	42	30	86	59	70	58
8	83	70	72	62	73	52	77	65	72	54	39	36	55	34	40	11.5	29	20	43	31	86.5	66	67	56
9	79	65	67	57	60	49	74	67	67	50	53	34	58	40	40	17	34	20	55	32	85	67	79.5	58
10	84	67	74	53	62	45	78	64	50	43	58	40	42	33	42	16	32	20	65	29	83	58	83	65
11	93	67	77	65	66	45	84	66	70	48	40	20	63	36	48	26	32	22	39	27	67	56	89	72.5
12	73	67	81	61	77	49	80	63	72	53	22	18	36	28	59	46	29	21	43	27	69	50	84	66.5
13	77	61	78	63	72	51	71	62	71	48	27	18	32	18	48	32	34	22	73	38	58	46	80	64
14	85	66	74	67	61	51	69	59	70	59	35	25	39	21.5	32	27	34	29	78	60	54	41	65	55
15	91	76	70	60	65	52	67	58	60	47	33	18	35	33	32	27	33	27	73	52	56	40	63	55
16	89	76	62	57	65	55	77	60	47	40	37	14	52	35	47	29	32	27	77	38	70	42	70	56
17	77	66	66	57	66	50	75	68	47	38	37	23	53	39	57	41.5	31	24	50	36	73	58	72	57.5
18	72	60	69	50	60	55	68	53	38	33	23	13	45	36	57	28	44	24	71	35	80	58	74	52
19	75	57	74	55	61	45	53	42	40	29	33	21	58	36	28	16	45	34	82	41	86	64	76	52
20	78	60	82	57	59	48	61	36	37	20	33	23	40	33	30	12	44	33	61	39	83	61	79	53.5
21	81	63	87	61	67	43	61	43	24	17	32	16	39	32	35	27	46	25	71	48	72	63	80	64
22	80	68	90	72	74	54	66	53	38	18	47	27	48	36	48	27	45	37.5	72	43	71	59	83	66
23	83	67	80	68	70	58	58	43	39	30	38	23	36	32	37	32	53.5	27	52	41	80	58	86	66
24	75	69	71	64	64	48	43	38	38	20	38	30	38	31	50	29	28	20	50	41	83	61	87	70
25	76	67	67	62	54	44	46	32	41	36	30	13	48	33	60	46	32	15.5	71	45	80	64	83	67
26	78	69	68	60	64	40	58	33	43	24	13	-1	51	34	52	43	51	28	66	43	82	65	78	68
27	78	67	71	52	70	48	60	44	62	40	33	2	55	37	56	45.5	57	40	47	39	85	65	84	68
28	81	65	74	54	73	63	52	46	60	38	42	28	43	31	61	53	46	31	64	39	67	57	82	67
29	81	65	81	65	80	58	64	42	38	28	50	35	36	28	60	26	36	30	62	47	72	51	73	62
30	80	65	79	69	81	57	50	42	32	27	35	25	54	35.5	......	......	41	31	49	36	75	59	76	58
31	81	63	82	65	......	......	42	36	......	......	35	19	37	26	......	......	42	31	......	......	79	54	......	......
Range	37°		40°		46°		55°		55°		63°		45°		50°		47°.5		55°		53°.5		43°	
Monthly mean	73°.7		70°.2		60°.7		59°.6		41°.3		33°.1		39°.4		34°.2		34°.5		49°.1		60°.7		69°.4	

Elevation of thermometers above ground, 78 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, COLEMAN CITY, TEXAS.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	100	74	98	72	90	64	87	60	54	40	71	36	50	35	35	31	68	42	(*)	......	60	52	(*)	......
2	99	72	100	74	93	64	86	63	67	34	73	46	61	50	38	28	63	55	......	......	67	55	78	60
3	98	74	99	73	97	61	78	66	69	45	63	34	63	52	(*)	......	75	57	......	......	76	59	90	68
4	95	73	98	72	92	64	85	64	72	45	81	46	59	42	......	......	86	57	......	......	84	58	93	69
5	98	72	97	72	94	66	85	66	73	58	62	38	67	48	......	......	71	58	......	......	86	63	90	71
6	97	74	98	76	92	70	85	64	76	43	74	43	64	50	......	......	74	55	......	......	88	61	85	64
7	98	75	78	73	93	66	85	65	78	50	82	42	74	52	......	......	74	35	......	......	83	65	95	69
8	97	75	75	63	93	61	87	70	77	51	55	35	70	56	......	......	55	34	55	36	95	63	95	74
9	97	72	67	60	90	67	88	68	81	45	77	54	64	47	......	......	(*)	......	70	39	93	69	94	73
10	100	72	(*)	......	90	69	85	70	80	65	63	30	73	46	69	46	......	......	77	46	93	67	90	74
11	101	75	......	......	86	66	85	69	74	55	40	23	65	50	72	56	......	......	73	43	87	66	90	73
12	107	76	85	63	75	59	85	63	80	42	46	17	51	38	66	40	......	......	83	43	88	66	86	73
13	106	75	88	65	82	53	87	60	82	52	48	30	55	28	51	30	31	22	80	54	87	68	90	70
14	103	71	95	65	85	53	84	60	78	60	52	31	68	37	50	27	27	14	89	64	88	65	93	74
15	101	75	87	68	90	55	84	62	73	49	70	21	59	36	67	26	31	18	(*)	......	85	64	97	70
16	98	75	88	62	90	60	82	60	82	45	72	39	74	38	73	39	45	19	......	......	85	62	82	69
17	95	74	88	66	86	55	73	48	66	41	51	24	68	41	76	52	54	28	......	......	85	62	83	69
18	104	75	92	65	85	53	77	50	50	31	48	18	71	39	63	33	71	42	94	69	85	65	87	65
19	99	76	90	66	85	60	72	47	67	31	70	39	70	50	48	27	69	38	70	42	87	66	88	64
20	101	80	91	67	85	62	75	46	51	34	57	30	73	50	63	39	72	43	80	38	74	60	90	65
21	102	75	91	65	88	56	80	42	64	24	76	42	68	46	79	46	60	48	87	50	85	57	88	68
22	103	73	90	64	91	58	82	42	71	32	65	45	52	34	84	47	70	50	90	63	88	65	87	64
23	105	75	91	66	91	56	65	46	67	36	74	35	60	28	84	50	75	56	94	66	90	65	88	62
24	105	75	97	68	84	55	64	38	70	47	35	8	57	35	79	56	74	50	89	65	88	67	89	63
25	100	80	98	68	90	60	67	36	73	45	27	5	62	35	68	50	83	60	80	53	90	70	96	67
26	97	75	100	68	90	61	65	36	75	59	57	5	71	34	72	44	92	64	85	47	90	73	95	67
27	100	75	97	69	87	65	68	40	76	57	63	25	65	40	74	57	68	46	83	53	88	68	90	64
28	101	75	91	65	80	70	76	37	60	31	74	36	55	36	61	24	81	43	81	53	80	65	81	63
29	95	73	88	62	89	65	85	50	55	22	75	43	72	39	42	29	78	48	66	53	86	62	84	71
30	98	68	89	64	86	70	63	46	63	28	63	32	63	33	......	......	72	51	69	48	91	67	92	70
31	95	69	90	63	......	......	47	38	......	......	36	32	35	30	......	......	83	60	......	......	(*)	......	......	......
Range	39°		......	......	44°		52°		60°		77°		46°		......	......	......	......	......	......	43°		37°	

* Observer absent on repair duty.

Elevation of thermometers above ground, 4 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, COLUMBUS, OHIO.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	87	65	91	71	82	70	82	58	44	26	50	31	43	30	34	20	37	26	60	46	64	36	69	54
2	91	75	89	71	76	69	83	64	45	25	54	47	52	42	29	16	54	30	69	49	72	47	70	49
3	90	77	90	70	73	65	77	64	36	21	56	48	63	46	28	23	56	41	67	53	76	54	77	53
4	90	74	83	71	76	60	77	60	37	23	51	44	58	52	29	17	67	48	69	54	79	54	79	59
5	85	66	84	69	71	54	84	60	40	26	62	44	55	46	33	11	60	42	67	55	81	56	82	65
6	89	70	82	72	73	54	86	63	54	38	59	43	63	54	36	27	47	36	57	40	82	61	78	66
7	87	72	82	70	72	53	85	68	66	43	51	38	55	49	34	26	47	41	41	33	85	63	77	62
8	86	72	74	62	64	51	78	68	72	55	46	40	56	51	41	19	46	30	47	31	87	67	80	62
9	86	66	71	54	65	48	83	69	68	57	55	38	60	46	41	27	53	30	55	34	84	67	75	65
10	90	64	75	51	68	50	83	66	60	50	57	43	49	37	50	24	41	32	62	36	83	65	89	65
11	95	68	79	58	73	48	84	67	71	56	43	24	64	45	53	33	42	29	41	30	77	62	92	74
12	85	68	82	60	74	50	83	68	74	60	25	13	46	29	61	48	42	26	51	28	78	53	91	76
13	90	71	80	64	70	52	82	65	73	54	32	20	30	15	52	35	42	24	70	39	67	52	91	69
14	92	72	82	67	60	50	82	62	72	59	38	30	39	17	42	32	37	34	75	55	65	43	76	65
15	96	76	73	63	66	45	82	62	63	53	35	20	42	36	43	27	42	31	68	59	69	41	68	61
16	95	76	66	61	70	55	82	61	55	45	42	19	50	36	55	36	37	31	72	48	79	45	77	56
17	81	69	75	56	68	53	78	68	48	37	40	30	51	44	62	44	41	25	60	38	84	55	81	57
18	79	61	77	55	70	53	73	52	40	35	32	15	50	38	58	30	52	31	78	46	86	61	81	64
19	84	64	78	54	63	46	53	43	40	27	38	27	54	40	31	20	52	40	71	47	86	64	84	61
20	88	67	83	57	65	51	63	36	39	22	39	30	54	40	35	17	50	36	62	43	84	65	87	65
21	92	67	87	62	68	47	60	49	27	20	34	26	47	39	40	32	48	29	70	46	77	64	87	64
22	84	71	89	68	73	59	68	56	39	22	49	33	48	36	55	33	54	38	78	54	74	58	88	69
23	88	68	83	73	76	57	56	40	39	29	39	29	36	33	47	35	60	36	67	51	83	58	92	66
24	82	69	79	64	66	46	43	33	38	20	51	33	44	32	54	32	36	26	64	46	90	68	90	74
25	88	71	66	57	57	37	48	25	47	36	33	14	46	33	64	50	42	23	73	55	89	68	82	72
26	83	71	72	54	66	40	60	31	48	26	16	5	52	34	61	48	57	38	69	46	88	75	86	70
27	83	68	75	53	69	50	60	46	63	48	36	13	55	39	65	48	66	47	54	42	86	67	83	70
28	84	69	78	56	74	59	55	45	57	39	44	30	47	35	62	55	47	36	63	42	75	63	83	68
29	87	68	83	61	78	58	68	40	40	28	54	44	40	31	57	30	42	32	62	51	70	58	73	60
30	87	67	86	64	81	52	55	42	36	19	54	35	53	37	......	......	50	30	51	40	74	61	82	58
31	88	68	86	68	......	......	47	33	......	......	46	34	44	29	......	......	57	31	......	......	82	56	......	......
Range	35°		40°		45°		61°		55°		57°		49°		54°		44°		50°		54°		39°	
Monthly mean	79°.6		72°.0		62°.1		62°.9		44°.4		37°.2		44°.1		39°.1		41°.1		54°.2		69°.6		73°.4	

Elevation of thermometers above ground, 52 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, CONCHO, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	102	73	100	72	90	62	87	59	59	39	75	38	50	35	40	31	73	32	85	63	62	50	71	57
2	100	74	98	74	95	59	84	58	73	33	75	54	61	48	44	29	66	45	85	60	71	55	80	59
3	97	74	98	74	100	59	85	60	72	43	62	33	63	50	39	27	77	51	88	54	82	58	98	60
4	95	75	98	73	94	64	88	59	73	44	74	59	62	47	49	22	86	58	93	55	87	55	99	70
5	100	72	98	73	96	63	85	65	76	43	65	40	70	50	45	22	74	54	98	59	91	61	99	61
6	100	73	82	72	91	68	88	65	84	40	80	38	70	53	50	23	79	54	98	67	96	63	92	63
7	101	73	80	72	94	65	88	65	82	52	80	43	72	55	48	28	75	37	68	38	89	66	98	70
8	98	73	75	64	93	63	88	65	78	56	60	38	72	55	56	35	60	36	59	37	96	66	101	73
9	99	70	(*)	58	93	65	88	69	84	46	75	45	68	50	62	34	73	44	72	32	98	69	98	72
10	102	72	......	57	92	65	90	68	80	62	57	30	72	44	72	45	71	50	79	34	94	66	98	73
11	102	74	......	58	88	65	90	66	78	58	58	25	62	49	73	55	59	50	77	41	95	68	98	74
12	102	75	......	63	75	60	82	63	81	38	51	15	55	40	60	42	52	32	84	42	92	63	95	73
13	108	78	......	60	80	54	85	61	81	48	59	33	59	28	54	30	37	23	84	55	92	66	94	73
14	104	73	......	65	85	54	88	61	82	62	63	34	71	43	55	29	29	16	90	63	92	62	97	72
15	104	73	......	65	93	53	85	61	75	44	70	30	60	34	68	28	41	19	87	61	89	61	97	67
16	98	75	......	63	88	57	82	63	81	53	73	44	73	34	73	43	51	21	92	47	88	61	98	66
17	97	73	......	65	90	55	75	47	64	40	51	26	68	43	74	51	61	32	95	55	88	64	85	68
18	103	72	......	63	83	55	74	46	54	30	54	20	72	38	58	33	73	41	95	67	91	67	92	67
19	102	78	......	64	85	58	80	46	70	26	72	53	74	50	47	30	73	36	71	45	94	66	93	65
20	102	75	......	67	84	59	75	38	55	38	69	38	74	48	60	32	74	46	83	41	78	60	93	64
21	102	76	......	68	88	55	82	39	65	24	79	46	69	43	81	42	57	50	89	54	86	56	93	66
22	105	73	......	65	92	54	85	40	51	26	72	53	56	33	86	49	71	50	93	60	98	67	92	65
23	105	74	......	62	91	53	67	41	68	35	78	47	61	28	87	40	78	50	94	65	95	67	93	66
24	103	77	......	68	84	55	67	35	68	53	47	13	58	41	82	59	73	52	89	63	95	68	92	66
25	100	78	......	68	91	62	74	34	73	49	31	8	68	27	69	40	84	60	83	46	99	68	94	66
26	98	80	......	68	89	65	68	37	74	60	53	8	72	39	61	40	91	65	86	45	94	71	101	69
27	101	73	......	70	96	72	70	39	77	55	65	32	72	45	79	50	77	47	81	54	95	66	98	68
28	102	78	94	68	82	71	78	34	58	34	78	42	53	41	60	32	84	39	85	59	85	65	92	64
29	100	73	91	62	90	66	87	44	62	22	80	46	75	39	53	32	84	51	68	56	92	60	92	73
30	98	71	90	60	88	70	65	45	68	25	62	40	55	34	......	......	82	57	71	50	97	63	100	72
31	98	68	88	62	......	......	65	40	......	......	42	32	39	32	......	......	85	64	......	......	84	62	......	......
Range	40°		......	......	47°		56°		62°		72°		48°		65°		75°		66°		49°		44°	

* Maximum thermometer broken.

Elevation of thermometers above ground, 6 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, CORSICANA, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	97	73	100	73	94	67	83	71	63	39	69	38	62	42	41	36	52	36	76	64	65	55	90	72
2	97	74	98	75	94	66	75	69	69	38	71	52	71	56	44	31	66	51	82	63	66	54	73	65
3	92	75	99	75	99	66	84	68	73	44	66	45	66	59	45	32	75	63	90	55	74	60	81	69
4	91	73	100	76	94	65	82	69	74	46	78	52	65	55	48	29	83	65	93	60	78	60	93	73
5	92	70	99	75	97	67	86	69	73	60	70	47	68	57	51	34	84	67	94	63	87	64	91	74
6	96	71	99	76	99	70	88	69	70	56	69	42	79	63	52	32	82	64	90	69	90	63	86	67
7	97	71	99	78	96	72	91	68	83	63	72	52	71	60	59	33	73	53	69	43	87	64	94	65
8	98	76	92	74	97	70	88	71	84	70	66	52	76	63	62	46	54	43	58	38	88	66	94	74
9	98	75	76	65	89	72	87	74	87	60	78	55	72	63	68	45	65	50	67	42	86	66	97	74
10	99	76	80	65	94	69	89	72	84	72	72	39	74	51	72	53	61	48	78	47	91	68	90	75
11	98	73	85	64	89	72	89	72	79	67	45	28	77	53	76	63	57	54	72	49	92	66	86	73
12	101	76	88	63	78	65	88	68	83	57	44	22	53	44	74	54	56	44	81	47	94	68	93	73
13	100	76	90	65	83	63	88	67	84	67	42	33	55	34	52	35	44	34	81	56	92	69	92	72
14	103	77	96	70	84	60	86	68	82	65	57	33	61	39	53	32	34	23	81	67	87	66	96	70
15	102	79	90	75	89	60	88	68	73	60	54	30	65	46	65	34	33	25	85	70	89	67	91	75
16	103	81	89	67	91	61	90	68	81	50	68	42	73	48	71	46	36	27	93	71	89	65	88	73
17	103	78	92	68	93	65	78	50	73	49	60	35	70	56	74	56	50	30	91	70	89	63	88	65
18	98	75	95	68	92	66	79	47	54	41	50	31	76	44	67	44	59	44	85	73	90	63	90	64
19	100	75	96	73	92	67	77	48	64	33	63	50	73	60	52	31	63	43	65	50	80	64	91	68
20	101	78	94	73	87	66	73	47	52	41	63	41	73	60	55	45	72	48	75	45	77	63	93	68
21	101	78	96	70	88	58	77	45	63	32	68	40	72	54	61	52	68	53	76	50	82	58	92	65
22	103	75	94	69	92	59	81	48	72	38	68	47	56	41	82	52	72	53	85	70	88	62	92	64
23	103	78	92	73	93	62	71	52	73	47	75	47	64	33	72	58	78	51	84	61	93	65	90	68
24	102	80	98	71	91	65	65	40	75	55	47	17	63	39	81	60	79	53	89	70	89	68	90	65
25	101	82	102	73	92	69	67	39	76	60	26	12	63	38	72	55	80	57	77	62	94	72	95	71
26	98	79	101	72	92	71	70	44	68	64	42	15	69	38	78	53	78	67	80	52	95	70	93	71
27	98	75	99	68	91	71	74	48	77	65	55	25	75	44	76	65	73	52	83	52	91	69	81	75
28	100	80	94	67	90	71	80	47	53	42	73	44	65	49	70	29	80	43	83	63	89	70	84	76
29	96	78	94	67	88	73	84	50	55	29	76	63	74	46	39	30	84	52	74	58	89	73	92	69
30	99	74	91	65	92	63	73	55	63	35	69	47	67	42	......	......	80	57	72	51	94	69	91	73
31	98	73	94	69	......	......	60	46	......	......	47	38	42	35	......	......	78	62	......	......	97	75	......	......
Range	33°		39°		41°		52°		58°		66°		46°		53°		61°		56°		43°		33°	
Monthly mean	88°.1		83°.1		79°.9		70°.1		62°.0		50°.6		59°.2		53°.6		58°.3		69°.6		76°.6		80°.5	

Elevation of thermometers above ground, 18 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, DAVENPORT, IOWA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	85	67	90	70	80	65	83	68	37	20	49	33	39	23	(*)	(*)	42	24	56	36	71	45	70	51
2	91	70	89	74	77	61	76	64	36	19	44	36	40	33	......	......	54	30	59	48	79	58	74	55
3	91	71	81	66	79	62	72	57	33	16	37	33	55	36	......	......	56	47	68	52	77	58	79	60
4	83	70	84	64	77	51	79	60	42	20	44	34	55	39	28	7	64	37	61	47	77	59	72	58
5	84	64	79	72	72	49	83	66	55	39	57	42	51	36	27	20	40	32	51	39	81	60	79	69
6	90	69	77	68	70	51	84	68	61	37	43	35	52	40	44	18	48	32	46	31	88	66	72	60
7	88	67	74	61	66	47	78	68	62	49	35	24	48	37	37	14	45	22	46	30	87	65	74	57
8	85	72	72	51	64	44	80	65	71	47	37	24	53	44	47	20	41	20	45	31	74	54	79	61
9	85	65	77	54	67	44	85	69	50	41	55	33	54	29	38	17	37	28	66	38	79	60	83	67
10	91	75	79	61	70	45	78	68	55	39	49	17	47	26	47	29	41	21	58	37	70	57	89	74
11	91	77	83	63	78	59	83	65	66	50	17	9	56	27	55	38	36	25	45	29	73	53	88	76
12	87	72	82	70	72	54	84	66	61	52	18	5	33	20	50	25	30	15	59	36	79	56	88	76
13	91	70	76	65	63	48	76	64	63	47	34	16	39	23	33	20	32	23	78	51	74	56	84	73
14	94	76	77	59	64	42	80	66	55	48	37	15	44	26	41	24	24	8	79	57	73	52	81	61
15	92	77	70	60	72	54	82	66	54	43	24	4	40	19	47	30	37	17	57	40	75	48	69	54
16	85	70	70	50	77	49	82	66	53	36	36	18	53	36	54	38	30	14	48	39	82	55	78	58
17	81	67	73	50	73	48	72	51	49	37	18	zero.	45	35	52	30	42	20	61	39	86	64	79	65
18	81	61	77	54	65	48	56	47	39	32	17	—1	54	33	30	17	42	35	72	55	85	66	78	63
19	84	61	75	62	55	39	58	38	46	26	26	16	49	36	28	12	50	34	66	35	76	65	82	65
20	89	67	88	67	64 .	39	59	42	26	15	19	6	38	32	36	20	44	30	66	39	73	61	86	66
21	89	71	89	72	68	43	64	41	33	22	31	12	44	36	40	24	58	32	72	50	70	52	85	69
22	88	71	86	71	68	53	65	43	42	28	30	8	38	30	52	31	56	32	72	49	79	53	87	70
23	81	70	86	68	61	48	50	33	37	25	21	9	37	20	48	34	50	36	53	43	80	60	89	73
24	77	61	77	62	56	36	52	30	49	25	17	—4	46	31	58	42	52	32	49	42	89	69	84	74
25	84	63	76	54	62	42	55	35	40	29	5	—14	51	34	56	38	45	36	62	48	86	71	84	70
26	81	65	80	60	72	47	59	38	52	32	21	—5	52	42	62	35	56	38	54	42	81	65	85	70
27	84	63	76	66	79	60	66	40	57	39	39	21	47	32	47	36	57	36	61	42	69	54	83	66
28	86	66	81	66	80	68	58	42	39	25	39	27	32	21	42	17	52	36	63	47	76	57	76	65
29	79	58	85	66	73	67	53	41	29	18	33	19	37	17	27	10	52	35	54	43	69	55	78	63
30	84	62	84	66	81	64	47	29	38	24	31	19	42	20	......	......	57	34	56	37	76	54	83	62
31	87	66	83	66	......	......	35	24	......	......	34	23	44	20	......	......	53	40	......	......	70	56	......	......
Range	36°		40°		45°		61°		56°		71°		39°		....		56°		50°		44°		38°	
Monthly mean	76°.9		72°.0		60°.7		59°.9		40°.1		24°.1		37°.6		34°.0		37°.2		50°.4		68°.2		72°.9	

* Thermometers broken during a fire in the building.

Elevation of thermometers above ground, 46 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, DAYTON, WASH. TER.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	......	......	......	......	......	......	......	......	......	......	53	42	44	35	45	22	52	37	50	21	90	52	79	49
2	......	......	......	......	......	......	......	......	......	......	53	44	45	34	45	22	48	30	47	34	65	50	76	51
3	......	......	......	......	......	......	......	......	......	......	50	40	40	33	43	28	47	31	48	36	64	38	67	45
4	......	......	......	......	......	......	......	......	......	......	50	32	46	34	51	29	42	26	46	31	62	38	68	42
5	......	......	......	......	......	......	......	......	......	......	48	36	41	31	54	29	46	32	58	28	62	38	70	42
6	......	......	......	......	......	......	......	......	......	......	40	33	54	32	53	29	48	35	64	30	60	34	76	50
7	......	......	......	......	......	......	......	......	......	......	39	28	56	38	49	28	49	34	70	32	58	36	68	50
8	......	......	......	......	......	......	......	......	......	......	31	22	40	32	50	24	52	26	77	35	62	36	67	45
9	......	......	......	......	......	......	......	......	......	......	36	20	50	32	48	28	54	27	82	47	64	36	67	44
10	......	......	......	......	......	......	......	......	......	......	34	25	36	23	42	27	57	32	71	56	61	37	62	44
11	......	......	......	......	......	......	......	......	......	......	36	24	34	24	42	20	45	21	71	42	56	44	74	48
12	......	......	......	......	......	......	......	......	......	......	40	34	41	25	42	29	27	8	49	38	48	40	84	50
13	......	......	......	......	......	......	......	......	......	......	49	39	50	36	41	28	33	17	43	33	63	36	78	48
14	......	......	......	......	......	......	......	......	......	......	50	45	51	34	47	34	48	13	58	35	62	35	68	46
15	......	......	......	......	......	......	......	......	......	......	54	41	51	42	41	31	51	19	54	37	71	43	79	39
16	......	......	......	......	......	......	......	......	......	......	45	30	55	40	40	16	41	27	54	32	75	39	81	47
17	......	......	......	......	......	......	......	......	......	......	41	32	61	43	44	8	45	32	62	32	75	38	79	50
18	......	......	......	......	......	......	......	......	......	......	35	26	54	34	41	25	48	32	50	34	77	44	77	49
19	......	......	......	......	......	......	......	......	......	......	26	16	43	35	40	17	53	34	62	35	80	46	66	44
20	......	......	......	......	......	......	......	......	......	......	22	8	47	36	32	14	60	28	66	34	70	55	66	45
21	......	......	......	......	......	......	......	......	......	......	19	3	52	33	36	19	64	31	53	41	66	42	75	42
22	......	......	......	......	......	......	......	......	......	......	14	—14	46	39	34	23	66	34	60	38	59	46	84	42
23	......	......	......	......	......	......	......	......	......	......	5	—17	47	34	39	20	71	32	55	37	57	43	91	52
24	......	......	......	......	......	......	......	......	......	......	12	—13	55	43	45	34	75	44	61	42	61	39	97	56
25	......	......	......	......	......	......	......	......	......	......	17	0	43	29	47	33	56	30	72	36	69	37	92	53
26	......	......	......	......	......	......	......	......	......	......	40	14	40	27	41	25	55	32	74	39	80	42	91	59
27	......	......	......	......	......	......	......	......	......	......	42	33	43	22	32	8	57	35	77	41	86	52	92	50
28	......	......	......	......	......	......	......	......	......	......	36	16	31	13	39	13	52	26	80	43	75	52	95	53
29	......	......	......	......	......	......	......	......	......	......	23	5	40	19	45	26	50	25	89	46	70	38	91	62
30	......	......	......	......	......	......	......	......	......	......	42	13	39	20	..	..	47	30	91	52	75	39	88	57
31	......	......	......	......	......	......	......	......	......	......	50	40	46	23	......	....	47	33	......	......	82	42	......	......
Range	......	......	......	......	......	......	......	......	......	......	71°		48°		46°		67°		70°		56°		58°	

NOTE.—Observations commenced December 1, 1879.
Elevation of thermometers above ground, 5 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, DEADWOOD, DAK.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	68	54	73	55	84	49	......	......	22	12	42	18	53	30	40	......	42	......	45	......	75	37	67	33
2	64	53	78	52	66	51	......	......	38	10	50	20	51	30	30	......	55	......	56	......	78	37	80	43
3	68	49	79	55	63	37	......	......	56	30	49	25	48	23	23	......	44	......	54	......	74	42	76	44
4	78	46	79	49	75	43	......	......	49	28	48	22	48	20	24	......	37	......	42	......	74	44	66	48
5	90	62	84	56	60	47	......	......	56	26	42	18	49	27	32	......	36	......	44	......	84	54	59	44
6	82	52	66	47	67	35	......	......	63	33	35	14	52	16	39	......	37	......	44	......	62	42	02	37
7	74	54	75	50	64	30	......	......	47	30	14	zero.	52	33	44	......	44	......	50	......	61	35	72	41
8	84	54	76	50	76	48	......	......	40	22	27	2	55	29	30	......	47	......	60	......	62	34	68	51
9	86	64	82	50	85	47	......	......	42	22	20	1	45	22	41	......	39	......	68	......	49	30	68	42
10	81	68	85	53	68	44	......	......	47	29	20	— 5	44	15	48	......	36	......	55	......	64	27	72	44
11	85	54	84	53	61	40	......	......	55	25	24	—11	24	— 7	44	......	28	......	67	......	82	44	68	49
12	92	66	74	48	63	38	......	......	48	31	33	5	26	1	27	......	— 1	......	52	......	81	48	68	44
13	84	54	77	52	68	33	......	......	42	20	31	15	45	20	31	......	12	......	54	26	74	52	66	49
14	77	60	79	56	73	45	......	......	45	25	17	3	40	17	37	......	28	......	44	11	65	46	74	43
15	78	54	74	50	73	43	......	......	43	26	45	4	51	33	42	......	20	......	54	19	71	40	72	49
16	81	59	79	51	68	41	......	......	36	10	42	— 1	51	36	43	......	36	......	57	31	73	51	69	48
17	85	58	77	58	66	41	......	......	36	15	28	— 6	53	23	18	......	31	......	45	27	72	44	84	48
18	82	63	76	53	56	38	......	......	53	18	(†)	7	54	31	26	......	42	......	35	18	67	45	85	53
19	78	56	82	53	59	35	......	......	50	17	......	......	42	22	47	......	36	......	41	13	60	39	95	69
20	76	59	78	53	76	42	......	......	48	17	......	......	47	22	45	......	45	......	56	24	67	33	83	45
21	78	59	80	51	64	39	......	......	53	25	......	......	39	19	54	......	44	......	62	38	73	50	75	49
22	78	56	88	60	61	36	......	......	45	31	......	......	37	15	47	......	52	......	68	40	66	38	77	53
23	81	59	76	58	52	41	......	......	56	21	......	......	37	16	55	......	52	......	52	27	67	46	77	53
24	66	51	81	55	68	34	......	......	47	24	......	......	41	15	48	......	56	......	36	20	50	39	77	50
25	67	48	77	46	82	47	......	......	48	20	......	......	46	21	38	......	62	......	32	21	54	40	84	50
26	71	44	83	51	(*)	(*)	......	......	34	13	......	......	29	1	39	......	56	......	46	20	49	35	80	54
27	76	47	92	51	......	......	......	......	25	5	......	......	22	3	3	......	45	......	52	20	69	35	63	45
28	73	49	90	62	......	......	......	......	36	3	......	......	27	(‡)	17	......	63	......	49	30	74	38	68	42
29	81	49	76	50	......	......	42	25	50	14	......	......	20	......	26	......	49	......	51	21	61	42	70	43
30	90	60	62	46	......	......	28	9	55	37	......	......	21	......	......	......	41	......	74	32	47	35	63	50
31	81	50	74	43	......	......	26	—1	......	......	......	......	35	......	......	......	41	......	......	......	62	29	......	......
Range	48°. 0		49°. 0		......	......	......	......	60°		......	......	......	......	78°. 0		......	......	63°. 0		57°. 0		62°	
Monthly mean	67°. 9		66°		53°. 1		......	......	32°. 9		......	......	30°. 6		24°. 7		26°. 1		38°. 2		53°. 0		60°	

* Thermometers destroyed by fire September 26, 1879.

† Thermometers broken.

‡ Minimum thermometer broken.

Elevation of thermometers above ground, 16 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month. Observations incomplete.

Maximum, minimum and mean temperatures—Continued.

STATION, DECATUR, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	97	72	100	75	90	65	88	67	79	39	68	41	57	36	48	35	75	38	78	65	71	57	75	63
2	97	71	100	70	92	65	85	69	78	39	78	47	65	35	(*)	......	67	42	87	64	68	54	78	61
3	95	73	103	75	95	72	78	67	78	39	63	32	(*)	......	52	30	75	50	90	62	78	60	84	68
4	82	70	103	76	92	65	32	67	79	46	73	47	......	......	55	25	80	64	95	63	84	64	89	72
5	95	68	105	78	95	70	86	67	80	60	63	41	68	31	53	25	73	56	99	68	86	65	81	67
6	97	72	102	78	98	72	86	66	75	55	68	45	71	54	65	30	77	53	82	60	86	66	81	61
7	97	76	96	72	99	70	88	67	80	61	76	45	(†)	......	60	34	75	39	(*)	......	85	67	91	61
8	98	70	78	62	97	67	(*)	......	80	68	69	40	......	......	62	42	70	34	61	36	88	67	91	74
9	98	74	79	60	94	70	......	......	88	42	78	46	......	......	(*)	......	72	45	75	42	(*)	......	92	73
10	99	74	80	62	93	69	90	77	85	56	76	29	......	......	......	......	72	47	82	51	93	70	92	74
11	98	76	84	62	92	73	88	72	79	55	38	26	......	......	71	43	65	48	72	47	91	72	88	73
12	104	80	87	62	86	55	90	70	85	55	46	18	......	......	73	44	53	31	78	50	93	69	86	72
13	104	75	90	68	82	57	90	67	85	50	58	32	......	......	55	28	32	23	80	50	92	70	89	72
14	106	78	96	70	83	55	87	67	85	49	58	30	......	......	49	28	26	17	87	67	92	68	93	75
15	105	77	86	66	89	61	86	66	75	48	57	24	......	......	67	33	30	21	90	71	90	67	86	77
16	106	80	85	67	92	67	85	65	80	48	70	42	......	......	71	40	43	20	90	56	92	66	(*)	......
17	104	78	89	65	91	68	74	52	70	33	(*)	......	......	......	73	39	68	28	91	64	87	68	85	64
18	103	76	95	67	88	65	79	50	75	30	55	23	......	......	63	35	70	39	90	72	85	68	89	65
19	102	76	94	66	85	65	77	49	76	30	75	38	78	46	57	27	71	42	75	41	(*)	......	91	67
20	102	78	(*)	......	83	63	75	46	55	30	65	33	68	47	60	39	72	43	78	49	85	57	91	70
21	107	81	......	......	86	61	80	53	60	30	60	30	67	49	63	42	72	47	80	52	84	58	87	68
22	105	76	......	......	91	62	82	55	83	44	62	32	52	35	80	48	74	49	88	67	(*)	......	90	68
23	107	80	......	......	92	63	66	44	69	41	50	35	65	34	72	52	80	58	95	73	89	65	89	68
24	90	78	94	72	85	59	85	40	80	52	35	9	61	42	75	61	78	58	92	70	85	65	92	67
25	(*)	......	97	72	90	60	85	42	76	55	40	7	72	39	(*)	......	80	62	83	55	91	70	96	73
26	98	72	99	72	92	61	69	40	70	57	44	5	81	42	72	48	80	63	76	52	89	71	94	76
27	99	72	97	70	91	60	70	41	80	62	60	28	82	42	70	50	(*)	......	(*)	......	84	64	90	65
28	(*)	......	96	69	91	60	80	46	73	30	71	46	51	38	65	21	85	47	......	......	85	65	82	64
29	95	72	92	68	(*)	......	89	53	72	29	77	40	92	37	61	28	83	50	......	......	83	64	86	66
30	99	72	90	65	86	69	79	43	62	34	41	31	72	34	......	......	82	58	81	48	92	66	87	66
31	99	74	90	66	......	......	65	38	......	......	45	28	44	30	......	......	82	60	......	......	85	70	......	......
Range	......	......	......	......	......	......	......	......	59°		......	......	......	......	......	......	......	......	......	......	......	......	......	......

* Observer absent on repair duty.

† Observer sick.

Elevation of the thermometer above ground, 17 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, DELAWARE BREAKWATER, DEL.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1															43	30	49	41	55	39	59	40	78	64
2															36	20	48	35	53	41	70	49	67	57
3															50	34	55	38	66	49	73	56	72	58
4															40	27	67	51	70	54	67	54	75	58
5															44	26	73	56	71	50	59	55	68	62
6															49	33	57	47	56	49	78	54	79	64
7															47	34	46	41	50	42	66	53	80	66
8															40	27	50	41	46	37	66	50	69	61
9															48	27	41	39	50	34	85	59	67	57
10															40	26	44	33	59	41	77	64	65	57
11															47	34	46	34	53	38	80	64	71	63
12															58	43	38	33	46	32	73	60	87	68
13															66	46	40	32	61	39	60	56	84	69
14															63	42	43	40	79	52	58	51	77	67
15															43	37	42	38	75	54	60	49	67	57
16															50	33	48	40	70	51	75	49	67	61
17															54	39	48	37	65	51	80	59	75	61
18															62	48	41	33	56	44	80	62	77	60
19															54	30	43	39	64	47	66	58	75	62
20															36	25	52	38	63	48	84	61	85	62
21															46	26	46	36	62	47	78	65	86	68
22															47	36	53	35	60	45	73	61	83	70
23															50	36	53	38	61	48	71	63	77	68
24															45	32	46	32	53	46	80	63	83	70
25															55	36	41	25	50	46	87	68	89	72
26															60	48	43	32	71	50	85	70	87	73
27															57	42	59	41	60	52	89	70	84	71
28													*59	45	59	43	59	42	60	48	85	68	89	74
29													48	38	65	48	43	35	59	47	70	64	81	72
30													55	37			48	37	60	45	76	63	82	70
31													60	42			54	38			77	66		
Range															46°		48°		47°		49°		32°	
Monthly mean															41°.8		43°.1		52°.0		65°.8		70°.7	

* Station opened on January 28, 1880, as full reporting station.

Elevation of thermometers above ground, 13 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures.—Continued.

STATION, DENISON, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	97	72	97	74	91	66	86	68	58	43	65	41	51	36	48	39	52	37	75	61	69	53	71	62
2	98	75	99	74	95	67	77	71	64	38	73	50	35	50	52	33	51	41	80	62	64	56	75	62
3	99	75	102	76	94	67	78	70	65	39	60	37	70	60	46	31	78	51	86	62	76	61	87	63
4	87	73	103	76	91	65	82	68	70	43	74	45	65	57	51	29	80	63	93	61	84	60	92	74
5	96	72	103	77	95	70	89	69	68	60	60	44	66	59	50	28	70	57	98	61	89	65	85	73
6	99	73	103	77	96	69	84	68	62	55	66	42	72	58	54	28	78	50	81	61	89	67	86	62
7	100	74	98	74	98	73	87	67	80	62	71	48	70	54	58	34	61	42	61	42	87	66	92	65
8	101	77	75	64	95	67	82	71	80	57	63	42	73	53	62	43	50	40	60	38	87	68	94	73
9	102	75	77	62	93	68	87	74	74	45	72	44	69	52	64	38	67	48	72	48	84	70	95	72
10	102	76	82	63	92	69	88	74	78	66	63	32	69	45	64	48	62	46	84	51	90	71	93	76
11	103	75	84	63	90	72	87	72	76	57	37	26	68	50	75	60	55	48	71	47	95	70	94	74
12	103	79	87	64	78	61	86	67	76	52	41	20	52	38	73	50	50	35	77	46	94	70	93	73
13	104	79	87	67	83	55	84	67	77	64	49	33	53	32	51	31	35	27	79	60	93	71	94	74
14	106	78	93	71	84	55	83	67	70	62	53	31	62	41	50	29	33	20	83	66	87	70	96	76
15	106	79	85	69	89	58	84	68	68	52	54	24	62	43	64	33	32	23	88	71	88	69	87	73
16	104	80	85	67	93	63	89	68	76	49	66	43	70	43	68	46	36	25	90	57	90	68	85	66
17	99	78	85	65	92	65	74	55	70	46	57	26	67	43	73	58	45	29	90	70	88	65	85	64
18	102	74	91	65	91	66	77	51	52	33	45	26	74	48	67	35	62	40	87	75	89	66	87	64
19	102	77	95	70	88	66	73	48	65	35	70	44	70	59	51	29	64	39	77	44	82	64	87	67
20	104	80	95	71	84	66	70	46	52	31	60	34	69	46	52	39	67	45	77	45	76	63	88	69
21	107	79	93	70	84	61	76	45	58	30	62	31	68	49	63	46	68	46	80	53	83	60	88	65
22	105	80	91	72	89	62	81	52	69	42	62	33	50	36	80	50	71	48	86	68	87	64	89	65
23	108	80	88	71	89	61	66	48	65	42	46	30	60	34	76	52	77	51	92	72	95	66	89	70
24	94	79	93	75	85	61	64	40	76	47	30	11	60	44	74	63	78	57	89	73	92	68	92	69
25	96	76	96	72	89	65	64	38	71	57	24	9	61	41	70	55	79	61	81	59	93	71	94	71
26	92	73	98	72	91	70	69	43	67	63	42	11	68	44	71	50	78	59	75	53	91	69	92	71
27	95	76	94	71	90	71	72	48	75	50	52	28	64	49	70	61	65	48	78	51	81	68	82	69
28	89	74	90	69	86	71	80	53	50	33	68	47	49	36	62	21	76	46	69	58	80	66	83	64
29	99	73	87	65	85	73	85	53	54	30	76	35	67	39	40	29	76	47	67	55	81	68	81	67
30	98	73	90	64	89	73	67	49	60	37	38	32	67	36	......	......	76	59	70	46	95	66	88	72
31	94	74	92	68	......	......	54	44	......	......	40	33	43	32	......	......	80	61	......	......	81	70	......	......
Range	36°		41°		43°		51°		50°		67°		42°		55°		60°		60°		42°		34°	
Monthly mean*	85°.6		80°.3		77°.8		67°.7		57°.3		44°.2		54°.9		50°.5		54°.1		68°.0		75°.3		76°.8	

* Monthly mean of local observations.

Elevation of thermometers above ground, 17 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 a. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, DENVER, COLO.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	83	57	94	64	85	49	82	54	58	19	66	35	57	(*)	37	2	57	18	60	30	73	42	70	41
2	78	62	80	62	85	53	72	42	63	20	53	33	61	26	35	10	58	35	61	32	76	42	86	44
3	86	52	89	63	77	55	84	40	67	34	49	27	62	30	31	3	58	34	60	43	77	45	90	51
4	88	59	84	62	82	48	82	46	65	39	45	23	56	21	33	4	46	26	66	36	81	47	89	59
5	94	55	76	58	69	49	77	47	65	36	56	17	60	25	33	4	48	18	60	30	85	54	67	39
6	93	66	71	58	84	45	78	45	76	38	48	27	60	26	32	11	57	27	46	32	70	42	76	47
7	91	63	81	58	72	45	84	47	68	34	40	22	63	30	34	4	54	24	37	29	61	33	86	47
8	94	63	79	54	85	47	67	46	42	28	38	21	62	36	38	11	55	28	59	26	58	36	88	53
9	96	67	86	53	89	56	67	36	40	24	38	14	51	26	51	12	52	23	68	31	45	32	72	50
10	92	66	88	51	89	58	64	31	49	23	19	3	60	30	48	22	55	30	71	33	70	34	72	48
11	92	61	86	56	77	46	77	32	55	28	26	—7	36	17	48	32	46	2	74	35	89	40	85	49
12	96	60	78	57	76	41	84	36	59	28	30	—2	41	9	35	14	11	—8	76	41	84	54	84	54
13	98	65	76	54	74	38	81	49	42	27	44	5	61	19	39	10	12	—10	76	48	82	50	88	53
14	92	68	80	56	83	50	78	55	50	23	38	17	53	36	44	9	17	—10	64	37	78	45	85	49
15	80	64	80	54	75	47	66	44	50	27	52	22	56	30	51	24	19	—8	58	40	78	47	91	55
16	81	62	83	57	82	53	58	45	38	27	60	23	52	39	52	30	36	—4	74	33	83	50	86	56
17	86	59	89	56	82	48	64	33	33	12	28	15	63	33	33	14	39	11	73	39	86	53	91	58
18	81	60	91	56	68	46	70	36	45	11	61	15	63	37	27	—3	43	17	54	26	75	48	92	54
19	88	59	87	59	67	40	75	35	52	19	51	10	56	42	41	8	43	16	51	20	64	50	96	61
20	89	60	86	61	82	43	70	38	54	21	36	6	59	38	56	16	46	24	64	31	75	44	85	65
21	95	61	88	57	73	50	73	37	63	27	50	16	48	24	59	25	52	20	73	37	81	49	82	60
22	84	65	85	57	78	51	54	41	63	35	35	15	42	17	58	34	59	24	77	47	85	43	89	57
23	83	59	87	53	64	48	57	31	63	23	28	—12	42	29	59	34	66	27	64	42	88	51	92	58
24	80	57	93	56	70	43	75	28	57	27	1	—17	48	19	47	35	67	31	50	33	73	46	83	57
25	77	56	91	60	83	48	64	43	56	23	32	—11	61	32	49	32	71	32	50	22	58	38	80	52
26	84	55	94	55	80	52	58	26	36	25	57	—4	42	24	56	36	54	34	61	26	63	37	87	54
27	83	54	95	61	68	47	66	36	30	17	61	35	30	8	38	—2	54	29	63	32	65	40	74	48
28	89	61	89	61	82	52	71	38	41	15	54	28	31	—5	26	—8	73	24	51	34	72	42	74	49
29	92	59	80	64	78	46	61	36	56	31	34	13	19	—5	32	—4	73	39	64	31	78	52	82	47
30	93	56	77	55	80	46	38	24	66	33	37	17	21	—6	......	......	58	32	72	35	66	38	90	58
31	88	65	81	50	......	......	38	20	......	......	44	20	32	—2	......	......	48	26	......	......	46	34	......	......
Range	46°		45°		51°		64°		65°		83°		......	......	67°		83°		57°		57°		57°	
Monthly mean	74°.0		70°.2		62°.6		52°.1		38°.4		28°.4		36°.2		28°.2		35°.3		48°.6		58°.9		68°.7	

* Instruments not set.

Elevation of thermometers above ground, 45 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m., and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, DES MOINES, IOWA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	80	65	93	74	78	55	84	69	42	26	52	34	48	28	23	4	49	27	64	35	82	46	73	48
2	88	69	92	74	80	55	75	62	36	13	43	30	40	25	33	16	63	32	63	45	86	57	77	52
3	87	75	79	66	78	56	75	50	32	15	35	29	60	40	19	8	63	39	60	43	83	55	82	59
4	83	66	87	66	70	48	78	61	45	24	46	34	55	36	28	6	44	33	57	41	82	55	79	67
5	83	66	77	69	66	47	85	63	56	29	48	35	54	37	27	17	43	25	55	37	89	62	89	61
6	92	72	83	67	74	46	84	67	65	40	39	31	53	36	40	18	56	30	43	31	93	69	73	58
7	89	76	74	57	65	50	81	64	63	54	36	20	48	38	37	11	48	17	43	26	83	57	70	53
8	91	71	74	51	68	41	84	66	59	40	31	18	47	42	40	14	49	15	57	26	62	44	79	55
9	92	74	79	50	72	47	84	69	49	38	40	31	43	23	39	8	41	23	79	36	70	51	82	67
10	95	74	83	57	72	56	74	60	52	38	36	14	52	26	53	27	41	22	62	39	69	53	86	71
11	93	77	87	68	79	55	81	59	60	52	14	4	52	16	62	41	35	19	50	28	80	49	88	72
12	90	74	84	65	75	46	81	66	59	51	21	1	35	12	43	25	29	15	70	35	90	60	88	72
13	92	67	75	61	64	49	83	65	53	59	42	21	45	18	30	18	28	13	82	58	81	67	80	68
14	95	73	78	53	71	38	83	65	56	47	31	3	40	20	41	25	23	— 3	75	47	80	57	82	58
15	90	72	75	60	70	53	82	65	53	40	22	— 2	46	17	52	30	31	14	50	34	83	52	70	55
16	81	65	73	52	77	48	75	63	49	32	33	10	55	36	59	36	38	9	50	36	90	53	80	53
17	84	64	79	48	71	44	63	47	45	32	11	3	51	34	49	27	48	22	65	35	90	66	83	66
18	83	65	78	54	62	46	59	40	32	29	18	2	63	38	27	14	42	34	79	56	84	69	76	66
19	84	64	84	62	55	42	60	36	45	20	24	9	47	37	30	12	54	28	50	31	80	56	85	61
20	87	68	90	69	67	34	68	41	27	11	14	zero.	40	34	48	20	48	28	71	38	71	59	87	62
21	85	72	92	72	72	49	70	43	38	22	23	10	41	31	48	24	58	34	77	49	70	48	87	68
22	95	70	83	65	74	57	56	40	47	29	22	2	37	26	60	28	63	28	84	51	82	47	90	67
23	83	66	88	65	61	45	52	33	36	26	11	4	48	24	56	28	52	35	63	45	86	56	93	70
24	82	64	82	65	61	35	54	28	52	28	— 4	—11	47	31	68	48	52	30	47	44	92	70	85	65
25	84	64	85	59	66	41	57	37	41	28	13	—16	54	33	51	35	68	38	62	42	86	71	83	66
26	82	60	86	59	84	51	65	40	60	35	39	— 3	50	32	62	33	80	42	57	38	74	63	86	65
27	85	63	90	69	83	65	70	40	60	33	44	30	34	22	55	36	64	36	66	36	70	49	81	63
28	86	64	91	74	78	66	67	38	33	26	43	28	22	10	37	5	55	36	60	46	80	53	75	58
29	82	55	92	69	71	65	60	40	31	17	14	5	37	10	30	1	58	35	55	41	66	55	79	56
30	86	56	89	70	79	65	45	28	49	22	23	6	23	16	......	......	67	38	63	34	75	50	83	56
31	91	68	84	64	......	......	36	24	......	......	40	20	35	20	......	......	58	39	......	......	65	50	......	......
Range	40°		45°		50°		61°		54°		68°		53°		67°		83°		58°		49°		45°	
Monthly mean	77°.7		73°.4		60°.4		59°.7		39°.3		21°.4		38°.2		32°.3		38°.0		50°.5		68°.5		71°.8	

Elevation of thermometers above ground, 33 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, DETROIT, MICH.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	M ax.	Min.	Max.	Min.
1	81	62	91	68	82	67	84	63	30	21	47	31	37	21	29	12	32	21	56	37	63	33	62	50
2	86	65	91	68	72	64	83	65	33	27	49	39	44	33	25	11	44	29	52	41	70	50	68	49
3	87	68	83	69	72	64	70	55	31	22	44	38	52	29	26	16	47	38	56	52	81	54	65	53
4	78	60	82	68	72	57	72	47	34	17	38	34	52	35	24	14	53	44	63	48	78	54	73	58
5	78	54	84	67	70	47	83	61	36	25	59	35	38	32	26	11	47	33	53	38	80	58	73	62
6	82	60	80	64	73	55	85	65	47	28	56	40	50	37	30	12	45	32	42	32	67	50	74	59
7	79	69	84	64	68	52	85	65	61	40	43	33	39	33	31	20	48	27	34	26	85	49	67	55
8	86	69	71	54	60	49	73	67	69	53	33	30	42	35	41	17	25	11	43	25	81	63	70	54
9	82	63	69	50	61	42	79	66	66	44	51	31	55	39	31	13	37	16	57	31	76	64	72	59
10	81	65	74	49	65	43	82	67	47	37	55	32	39	30	45	18	30	15	60	30	67	58	84	64
11	89	66	81	60	69	47	79	65	69	45	32	18	57	35	46	27	33	22	33	24	71	50	91	67
12	80	62	79	65	70	55	84	65	66	52	22	16	35	26	50	39	32	15	49	24	74	48	90	72
13	84	65	76	65	70	51	68	62	67	46	29	15	36	22	89	29	31	18	71	40	57	42	82	58
14	92	68	73	59	59	50	73	56	61	55	34	26	39	22	33	26	31	24	74	52	58	36	60	50
15	94	72	60	57	62	46	76	60	56	45	30	15	35	27	36	28	33	20	64	39	60	40	67	52
16	83	66	69	52	65	48	76	56	45	38	34	10	45	34	50	29	33	25	46	37	79	49	72	53
17	72	58	72	48	66	48	75	67	39	33	22	14	53	38	54	41	33	17	50	32	82	55	78	53
18	76	55	75	51	61	49	56	46	36	30	18	4	45	35	52	23	40	27	57	40	85	60	79	57
19	76	54	75	55	61	40	55	41	39	27	26	14	50	36	22	12	39	32	66	41	82	63	81	58
20	82	59	80	58	62	44	64	39	27	17	27	16	37	30	30	14	40	29	58	37	71	58	84	59
21	87	63	84	64	62	41	60	43	25	12	28	12	36	28	35	27	46	22	69	45	64	55	86	66
22	74	69	84	69	70	48	65	53	37	20	35	21	41	32	45	26	52	36	67	42	66	52	87	64
23	78	66	82	62	73	53	56	34	37	22	35	15	32	28	36	31	51	24	42	36	78	55	89	65
24	77	62	75	56	51	41	41	27	33	17	36	27	38	28	47	29	27	16	47	35	81	62	88	68
25	79	63	70	55	60	34	50	26	40	29	27	10	45	30	52	43	36	15	56	41	84	65	77	68
26	84	68	71	52	62	41	58	38	40	23	10	—2	47	35	51	35	48	29	56	43	83	65	82	65
27	82	61	76	54	60	53	60	46	53	38	32	7	52	37	53	41	44	40	52	39	81	60	80	69
28	84	63	81	59	73	58	55	43	56	34	37	24	45	29	60	39	42	31	62	41	66	54	79	67
29	84	65	89	65	78	60	60	41	34	25	43	34	30	19	55	22	40	30	57	47	66	56	72	59
30	84	59	93	67	82	58	46	35	32	19	34	19	52	29	......	......	49	28	47	35	69	55	77	57
31	86	64	89	67	......	......	37	26	......	......	34	18	30	21	......	......	50	29	......	......	75	53	......	......
Range	40°		45°		48°		59°		57°		61°		38°		49°		42°		50°		52°		42°	
Monthly mean	73°.2		69°.6		58°.4		58°.9		39°.0		29°.4		37°.0		32°.3		33°.2		46°.1		64°.2		69°.1	

Elevation of thermometers above ground, 76 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, DODGE CITY, KANS.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	93	70	95	70	91	54	83	64	58	15	63	32	60	26	46	12	66	22	78	37	74	48	73	47
2	94	70	98	70	94	54	75	57	42	14	51	26	58	32	40	12	64	36	69	38	77	52	81	48
3	97	71	98	72	84	61	78	48	56	10	60	22	65	48	39	14	74	34	72	41	80	52	90	64
4	90	67	99	71	86	56	84	55	61	32	53	34	50	32	37	12	70	45	78	44	87	54	102	68
5	92	69	97	67	83	59	87	58	64	26	52	26	57	36	40	16	50	28	73	48	94	60	74	62
6	98	71	87	66	83	56	84	65	72	39	57	30	58	28	50	10	60	39	53	38	95	64	83	48
7	101	76	72	61	73	55	87	60	60	37	42	24	60	32	52	22	46	17	39	28	76	48	81	62
8	92	71	77	56	76	48	86	66	49	40	31	12	58	32	46	21	64	21	58	24	80	50	102	65
9	96	69	80	58	94	53	80	60	51	25	45	12	50	36	60	14	44	22	74	28	82	44	100	61
10	96	70	84	59	92	68	81	47	68	43	40	7	68	34	61	25	55	26	62	38	80	47	97	75
11	98	69	88	60	75	68	85	65	60	42	24	1	37	28	65	48	47	18	64	29	93	52	92	72
12	90	65	88	61	84	38	85	62	63	38	36	9	36	11	40	22	18	4	85	42	90	60	95	72
13	93	69	88	67	80	48	84	62	53	29	43	1	54	17	43	8	6	—3	88	56	88	61	96	70
14	102	72	76	62	83	50	83	62	56	27	30	19	48	25	42	20	20	—8	72	56	85	64	89	69
15	101	72	76	61	77	54	77	55	55	29	57	11	58	21	58	18	21	10	67	40	94	58	90	57
16	97	63	80	55	92	50	63	40	57	29	63	16	61	25	70	32	31	10	72	27	86	60	86	59
17	98	65	82	57	85	50	69	37	58	28	17	8	67	23	45	19	46	18	89	48	94	63	89	61
18	87	69	93	63	65	48	73	38	46	19	33	12	68	26	38	11	50	19	66	32	83	68	86	57
19	91	70	97	68	66	39	81	40	56	26	20	14	56	34	45	18	52	26	60	29	85	52	87	65
20	93	66	93	64	76	41	78	40	40	12	22	8	65	24	64	30	52	25	77	38	73	51	91	65
21	100	73	95	70	86	57	78	38	57	24	69	15	48	30	60	24	58	32	80	51	80	55	89	65
22	100	73	87	61	81	52	61	40	62	30	25	2	45	18	64	36	67	27	92	53	82	58	93	66
23	85	69	85	64	71	50	59	31	54	22	8	—4	51	16	70	36	72	36	75	52	98	64	88	63
24	84	70	90	63	70	43	59	32	63	32	1	—11	49	22	62	50	80	45	62	44	90	68	91	66
25	83	67	96	66	87	47	64	30	53	29	32	—13	52	28	58	30	76	46	62	30	78	66	86	63
26	86	60	99	70	95	64	60	35	66	38	44	12	43	26	67	28	76	42	61	28	74	54	92	61
27	81	65	99	71	93	62	74	23	37	24	57	26	34	18	44	4	57	34	67	41	65	51	95	61
28	89	65	94	70	76	63	76	31	38	7	70	28	24	14	34	—4	69	29	72	49	64	54	71	51
29	92	63	91	66	76	66	58	28	56	21	20	6	31	18	42	10	78	39	62	34	80	54	84	56
30	93	67	89	63	83	66	48	20	57	33	22	13	28	10	......	......	85	47	76	35	94	52	88	66
31	95	69	84	58	......	......	38	20	......	......	40	13	48	8	......	......	68	38	......	......	65	45	......	......
Range	42°		44°		57°		67°		65°		83°		60°		74°		93°		68°		54°		55°	
Monthly mean	80°.4		75°.6		66°.2		59°.5		40°.8		25°.3		38°.2		34°.4		40°.2		54°.8		68°.2		74°.7	

Elevation of thermometers above ground, 15 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, DUBUQUE, IOWA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	84	66	91	71	78	62	86	67	33	17	50	31	40	12	21	6	43	16	58	32	74	44	72	47
2	91	70	91	74	75	61	75	61	32	19	44	33	40	17	34	19	53	26	61	44	86	56.5	78	53
3	90.5	74	78	62	79	64	75	51	32	16	35	31	55	34.5	27	12	51	43	68	48	82	58	78	58
4	82	68	84	66	71	54	80	53	36.5	14	41	31	52	35	23	2	47	33	58	43	79.5	58	75	60
5	79	63	79.5	69	69	44.5	86	63	49	30	55	41	47	32	23	16	40	29	54	35	89	58	81	65
6	89	65	85	64.5	70.5	50	85	66	60	36	45	35	50	37	36	16	49	26	43	31	92	66	72	69
7	84	65	75	63	65	52	80	66	58	50	35	20.5	43	33	27	2	41.5	19	47	28	91	61	74	50.5
8	85	65	73	52	63.5	48	79	66	69	44	34	20	49	39	41	19	40	16	50	28	71	51	80	60
9	86	61	78	53	67	40	84.5	68.5	48	36	42	32	51	24	35	10.5	35	22	73	35	74	55	83	66
10	95	76	82	59	72	48.5	76	65	51	36	42	14	44	21	45	24	38	15	58	35	71	57	93	68
11	91	76	83.5	63.5	68	60	82	62	62	48	14	4	44	24	54	33	34	16	45	26	75	48.5	93	73
12	90	70	84	65	71	53	81	64	61	48	15	— 1	32	14	42	23	26	11	62	31.5	83	53.5	88.5	72
13	94.5	72	72	61	62	51	74	62	57	47	37	13	37	16	29.5	13	30	29	82	48	69	58	80	67
14	93	75	79	58	63	41	82	64	54	45	34	18	40	20	39	17	20	zero.	82	52	76.5	51	71	55
15	93.5	75	68	58	69	53	82	64	52	38	18	4	39	14	46	23	30	9	52	32.5	79	48	73	52.5
16	83.5	68	71	50	72	48	81.5	64	46.5	30	27	12	50	34	52	31	26	10	48	34	85	49	83	55
17	80	64	75	47	73	46	73	50	42	37	12	— 4	41	34	49	27	45	16	58	34	90	65	84	59
18	81	59.5	78	49	61.5	48	55	46	39	30	11	—12	55	31	27	11	41	33	71	54	87	67	81.5	61
19	83	60	76.5	61	59	38	58	37	44	24	21	11	42	32	26	6	51	32	60	34	79.5	60.5	87	61
20	90.5	66	88	65	67	36	63	41	24	14	21	6	38	30.5	36	16	45	28	61.5	35	73	58	88	60.5
21	89	70	90	69	67	46	67	40.5	29	17	25	9	41	35	38	17	57	31	74	51	70	48	90	64
22	90	69	84	67	72	53.5	60	45	44	26	26	3	37	31	52	26	58	28	64	47	80.5	47	91	68
23	81	69	88	62	58	47	49	36	35	23	20.5	2	35	23	50	29	48	35	50	42	69	52	93	69
24	73	60.5	77	62	57	36	51	27	48	19.5	19	— 2	43	25	59	38	46	27	47	39	92	65	88	70
25	84.5	63	78	53.5	64	39	54	34	38	25	2	—19	50	26	56	33	42	32	62	46	91	70.5	88	67
26	79	60.5	82.5	60	72	46	56	38	46	27	17	—14	51	36	51	29.5	56	36	50	38	80.5	66	88	64
27	85	60	86	66	83	61	65	38	57	37	38	17	38	28	42	31	52	40	61	38	71	50.5	82	69
28	84	63	88	69	81.5	63	57	41	37	25	38	17	28	14	37	18	53	36	65	44	81	51	75	61
29	80	58	88.5	70	72	66.5	51	40	28	18	30	20	37	10	22	5	55	33	52	42	67	53	77	56
30	87	61	88	65.5	78	67	45	31	37	24	24	15	37	16	......	......	60	32	55.5	36	78	52	84	56
31	87	66	86	64	......	......	35	24	......	......	29	16	34	13	......	......	52	39	......	......	67	52	......	......
Range	37°		44°		47°		62°		55°		74°		45°		57°		60°		56°		48°		42°.5	
Monthly mean	76°.2		71°.8		59°.8		59°.0		37°.7		20°.8		34°.4		29°.2		35°.6		49°.3		67°.4		71°.1	

Elevation of thermometers above ground, 32 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, DULUTH, MINN.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	80	55	73	64	76	57	59	48	30	16	33	23	37	11	7	—20	15	—8	39	26	83	40	62	42
2	83	65	75	56	71	58	67	51	28	14	25	18	33	8	16	1	25	—7	36	25	86	39	54	43
3	71	58	79	54	71	55	66	44	26	6	28	19	39	25	11	—4	47	22	38	30	74	42	51	40
4	77	53	83	61	72	45	78	48	30	10	37	24	37	24	11	—22	30	12	42	32	48	38	52	43
5	65	49	87	64	62	50	63	52	41	23	38	33	37	21	11	—12	32	14	36	31	71	39	59	45
6	74	53	76	63	64	48	65	48	47	35	36	22	37	21	9	—20	34	zero.	35	27	46	35	67	44
7	81	54	69	50	57	43	76	61	56	39	22	6	38	24	22	—12	32	—3	40	14	50	37	62	45
8	86	58	74	50	63	43	65	51	45	34	21	2	40	32	26	3	13	—3	50	17	57	40	59	43
9	91	66	77	53	64	42	58	52	41	30	34	18	38	7	15	—18	14	—4	65	35	62	38	52	45
10	79	64	86	60	64	46	68	48	42	30	34	9	38	zero.	36	—2	8	—17	47	26	57	41	53	45
11	79	60	74	62	62	57	55	48	45	37	9	—8	37	—1	36	21	12	—1	45	20	70	47	60	46
12	80	61	67	60	63	51	56	49	45	35	zero.	—23	3	—19	36	7	12	—18	62	26	53	43	65	43
13	86	63	73	58	56	43	56	47	50	38	25	—10	33	—15	18	—10	13	4	56	32	48	38	74	51
14	83	61	65	55	60	47	63	50	48	37	25	zero.	33	zero.	35	7	22	—8	38	27	56	37	54	44
15	82	64	65	53	66	51	77	53	44	33	2	—20	34	—7	30	8	18	3	45	21	67	40	64	43
16	79	57	75	49	59	48	66	55	37	22	8	—7	35	29	36	20	22	—8	42	30	76	43	68	44
17	75	53	78	56	55	42	63	45	32	18	—2	—21	36	27	36	7	20	—10	44	30	62	40	74	52
18	69	54	72	56	56	37	53	40	30	22	2	—15	40	28	7	—10	32	7	43	35	72	38	78	56
19	71	55	68	60	59	39	63	38	36	11	10	—4	34	20	10	—18	43	14	44	29	75	50	79	56
20	90	62	82	63	53	37	68	46	21	zero.	1	—17	27	20	32	2	40	8	52	30	56	37	75	60
21	75	59	75	65	54	47	60	43	27	10	17	—14	33	25	23	3	46	28	42	33	51	33	88	62
22	70	56	82	61	57	45	50	38	35	22	17	—3	32	22	30	15	55	25	42	31	45	35	87	64
23	71	56	75	58	51	38	44	32	23	8	4	—15	25	15	34	15	40	20	40	32	50	38	89	62
24	63	53	68	59	60	30	50	28	41	13	—4	—18	38	11	52	18	26	15	40	34	79	42	83	67
25	75	52	65	56	66	40	56	33	30	12	—10	—34	37	8	42	27	35	16	38	33	64	48	80	62
26	74	59	71	60	57	46	62	41	37	21	5	—25	38	22	30	20	39	31	57	34	72	46	72	58
27	80	60	82	59	55	50	53	41	34	25	12	—2	22	5	28	18	40	34	54	35	63	42	79	56
28	73	59	70	65	56	50	46	41	25	13	22	3	5	—15	18	5	39	27	43	34	53	42	77	57
29	80	52	87	63	67	49	43	34	21	5	zero.	—15	21	—13	15	—10	35	21	47	36	56	39	74	55
30	88	61	88	67	74	53	34	26	35	12	8	—23	22	2	......	......	37	23	55	30	61	45	69	57
31	88	69	78	65	......	......	26	17	......	......	22	5	12	—8	......	......	40	32	......	......	59	42	......	......
Range	42°		39°		46°		61°		56°		72°		59°		74°		73°		51°		53°		49°	
Monthly mean	67°.8		67°.1		54°.1		50°.8		29°.9		8°.2		22°.4		15°.3		21°.4		38°.3		51°.2		59°.7	

Elevation of thermometers above ground, 19 feet.

The daily means are obtained by dividing the sum of the 7 a.m., 2 p.m. and *twice* the 9 p.m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, EAGLE PASS, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	104	80	100	78	98	69	89	71	65	49	74	33	54	43	46	38	64	49	89	45	65	54	102	75
2	103	81	100	78	98	66	91	68	72	43	76	54	73	51	55	32	72	58	90	68	81	55	104	73
3	102	81	97	77	100	68	84	70	75	46	75	51	72	56	47	39	83	54	94	60	75	62	104	76
4	99	81	97	78	99	67	88	68	75	51	84	55	64	49	54	40	99	60	99	58	90	70	105	74
5	100	81	95	78	97	71	91	72	80	61	72	50	70	53	53	37	90	64	98	66	94	66	88	78
6	99	79	101	80	93	70	93	72	86	48	76	40	72	57	50	41	87	59	85	72	96	63	98	76
7	103	81	96	81	95	71	92	72	90	51	75	46	72	61	46	39	79	69	80	52	88	64	96	76
8	101	81	97	80	95	68	92	72	85	66	74	48	70	54	54	45	72	59	62	46	98	70	104	80
9	101	77	82	69	95	75	92	72	86	54	84	53	68	58	56	46	76	56	77	33	97	69	103	73
10	103	81	72	70	91	73	93	72	86	70	69	51	76	55	72	53	78	56	80	35	92	66	100	78
11	104	80	82	70	92	75	91	74	80	62	64	35	71	57	77	49	79	63	84	45	95	70	104	82
12	106	79	85	69	75	69	88	74	83	46	53	25	64	51	85	59	74	45	88	55	96	71	99	79
13	105	78	88	71	80	70	90	71	86	64	50	39	62	39	62	41	60	44	91	61	97	71	98	76
14	102	79	93	71	86	66	89	70	87	69	66	40	65	49	60	33	51	29	91	63	96	71	103	77
15	100	76	93	75	88	64	89	70	88	54	65	33	65	46	70	43	48	30	98	66	93	75	102	78
16	104	82	94	70	90	62	88	69	88	61	72	36	75	47	73	41	64	24	98	64	95	70	101	74
17	103	80	93	71	89	65	82	59	74	56	69	36	68	52	79	52	69	42	98	71	92	71	103	77
18	104	80	91	71	88	65	83	51	58	42	63	47	73	54	60	50	79	51	105	73	94	72	102	75
19	103	82	89	74	88	65	79	52	67	28	62	52	76	59	59	46	83	50	84	62	91	73	101	71
20	102	82	90	74	90	65	78	50	65	33	77	44	71	53	67	47	67	45	88	46	92	68	101	78
21	104	80	91	75	88	64	83	46	69	32	75	53	78	46	77	47	67	46	91	60	98	74	101	76
22	104	81	95	73	94	62	85	47	73	32	75	58	63	45	77	50	62	56	91	61	101	71	96	77
23	103	79	100	72	93	62	80	48	75	44	88	54	64	46	76	57	69	56	102	67	101	71	102	71
24	103	81	103	74	90	62	70	47	75	34	64	29	64	44	85	63	71	58	100	73	97	68	102	78
25	102	82	99	76	87	72	73	40	73	56	40	22	67	36	75	56	81	63	92	66	97	65	106	76
26	103	81	98	75	88	72	73	43	78	63	50	21	75	35	84	58	96	54	95	58	94	76	103	78
27	104	80	101	78	88	71	75	58	84	51	61	29	76	35	84	59	92	48	89	69	96	73	106	75
28	101	79	98	74	86	74	79	45	72	53	75	36	74	47	83	50	86	56	88	72	94	79	104	73
29	102	81	92	72	89	73	85	45	68	45	76	45	81	63	61	50	86	48	86	72	93	74	102	77
30	100	80	93	71	89	73	77	57	66	31	79	58	70	53	......	......	84	64	76	62	103	77	108	76
31	98	75	95	73	......	......	67	51	......	......	72	47	53	43	......	......	84	68	......	......	104	76	......	....
Range	31°		34°		38°		53°		62°		67°		46°		53°		75°		72°		50°		37°	

Elevation of thermometers above ground, 5 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, EASTPORT, ME.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	72	50	74	51	65	52	78	58	38	28	36	14	27	7	31	3	38	21	38	28	45	34	70	45
2	76	49	68	54	73	54	68	55	34	23	42	35	39	18	4	—12	26	14	41	25	52	35	62	50
3	83	56	85	55	64	54	70	53	36	29	41	30	32	12	22	3	39	17	44	32	45	37	58	46
4	79	52	77	59	57	52	58	49	31	25	44	32	39	17	22	15	46	37	44	39	58	42	63	43
5	64	47	70	56	56	53	55	46	31	24	32	22	37	10	28	14	40	22	55	40	50	40	66	43
6	67	47	75	54	65	54	53	42	33	25	41	31	38	10	33	17	27	15	50	37	61	41	68	47
7	64	47	73	53	67	51	63	43	37	33	53	41	38	25	20	8	33	21	37	27	55	35	60	45
8	55	50	66	52	59	54	80	54	46	37	44	29	35	24	30	11	35	4	34	20	51	38	59	43
9	71	49	57	54	65	53	67	52	52	44	29	20	35	31	31	— 1	20	— 1	40	23	53	41	66	43
10	73	55	66	53	66	51	52	44	55	38	42	26	39	22	23	— 9	35	18	44	34	54	42	72	46
11	75	57	69	51	64	51	48	42	43	37	50	39	27	12	24	5	20	4	46	29	72	43	65	47
12	75	55	78	55	62	49	51	45	44	38	39	23	40	27	41	21	26	7	29	17	64	46	71	49
13	79	59	65	53	66	50	55	45	42	36	23	16	31	8	43	36	20	6	44	23	46	37	75	53
14	68	56	65	55	61	54	57	39	46	37	32	22	14	zero.	37	13	29	15	42	32	47	37	60	50
15	79	55	64	50	61	52	53	44	53	46	36	30	36	13	26	12	30	14	41	34	56	39	66	49
16	77	58	62	49	54	49	60	48	52	43	32	19	32	24	29	17	28	21	51	38	65	39	66	44
17	75	50	54	50	59	52	56	45	45	34	25	14	35	32	36	18	26	18	38	28	51	40	72	47
18	64	48	55	52	64	49	53	45	34	29	14	— 1	39	35	44	36	27	13	41	27	59	41	71	48
19	65	50	55	52	60	50	56	34	34	27	18	5	37	30	45	7	36	26	46	30	53	40	75	48
20	67	50	66	53	60	47	42	32	38	29	35	10	31	25	24	6	35	28	47	39	57	43	68	50
21	67	52	70	52	57	47	57	33	31	11	12	—14	27	10	34	15	37	30	55	40	57	43	58	47
22	67	54	62	53	54	47	59	45	29	11	32	—15	25	5	33	22	38	24	51	37	54	43	62	47
23	61	52	67	52	58	52	56	50	43	29	26	6	42	25	35	26	38	28	45	35	60	44	62	49
24	72	55	73	54	57	51	52	32	35	17	31	16	36	22	29	22	34	26	44	32	57	43	63	46
25	71	54	67	53	54	40	34	26	40	18	28	5	28	17	31	19	26	19	48	32	65	46	64	45
26	65	49	61	51	54	37	48	28	34	22	5	—10	36	24	38	29	27	14	42	39	65	42	66	50
27	60	50	62	51	57	42	52	37	37	19	11	— 3	42	32	44	34	33	13	54	40	79	45	79	52
28	64	53	60	51	60	45	53	41	49	37	32	11	48	34	39	30	32	25	45	32	72	52	68	50
29	60.	52	66	51	61	50	50	40	50	34	37	32	34	7	45	38	34	24	47	35	61	45	67	51
30	64	52	64	50	72	52	54	41	34	17	35	— 3	38	2	......	......	32	21	46	41	62	42	71	52
31	71	52	75	56	......	......	43	34	......	......	24	—10	44	28	......	......	35	30	......	......	52	44	......	......
Range	36°		36°		36°		54°		44°		68°		48°		57°		47°		38°		45°		36°	
Monthly mean (local)	60°.2		59°.4		55°.1		49°.2		34°.9		23°.9		27°.4		24°.7		25°.6		38°.1		48°.1		56°.4	

Elevation of thermometers above ground, 32 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, EDINBURG, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.*	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	105	82	105	82	78	75	89	74	68	58	77	64	82	68	52	45	66	51	86	71	89	72	102	76
2	94	82	104	81	97	74	86	73	68	60	83	64	82	68	65	37	84	63	96	73	92	70	101	75
3	101	71	107	78	98	75	85	73	75	65	80	69	83	69	62	38	90	64	97	70	93	71	101	74
4	100	76	102	75	96	76	90	73	79	61	82	70	81	66	54	45	93	70	94	70	(*)	......	99	73
5	101	74	104	75	93	77	90	71	81	69	75	64	84	69	57	44	92	70	94	73	......	......	99	75
6	100	73	104	78	89	75	94	69	84	67	75	58	87	71	54	44	91	76	95	69	......	......	105	76
7	102	73	105	80	92	74	92	70	83	69	80	67	86	69	47	40	89	70	96	70	......	......	92	76
8	102	72	103	77	87	76	93	70	86	72	80	72	85	64	(*)	......	78	62	76	48	......	......	100	76
9	103	73	97	73	84	77	94	74	85	75	85	72	87	65	......	......	66	60	72	45	......	......	100	77
10	102	74	(*)	......	91	77	98	73	87	75	74	62	85	67	......	......	85	65	81	48	......	......	100	77
11	105	81	80	69	91	77	97	73	83	75	65	54	84	67	......	......	92	72	86	50	......	......	(*)	......
12	104	76	85	72	92	79	97	73	83	74	67	53	......	......	......	......	85	65	86	50	......	......	......	......
13	105	78	87	73	86	74	96	72	85	75	55	45	60	52	......	......	61	54	86	62	......	......	......	......
14	103	73	(*)	......	83	72	94	74	87	74	56	42	75	55	71	41	57	41	94	71	......	......	......	......
15	104	74	......	......	93	70	95	73	86	75	71	50	72	64	(*)	......	47	37	93	73	......	......	......	......
16	104	80	......	......	91	71	94	72	87	75	80	62	80	64	......	......	67	33	100	72	......	......	......	......
17	105	79	......	......	87	69	95	73	86	68	83	58	84	63	......	......	64	47	91	72	......	......	......	......
18	105	77	......	......	89	74	94	70	75	55	82	65	(*)	......	......	......	85	59	100	74	......	......	......	......
19	105	72	......	......	86	74	(*)	......	68	48	81	65	......	......	56	50	80	65	91	73	......	......	......	......
20	105	83	......	......	91	73	......	......	65	38	84	64	......	......	65	48	81	65	80	64	97	68	100	68
21	105	83	......	......	91	71	......	......	70	48	84	69	......	......	82	61	68	61	87	68	94	67	100	69
22	(*)	......	......	......	91	73	......	......	73	55	85	69	......	......	85	61	66	60	93	73	102	67	100	70
23	107	84	......	......	91	73	81	67	84	54	86	69	......	......	88	67	71	61	100	72	98	67	102	68
24	106	82	......	......	82	75	73	63	85	60	86	36	......	......	85	70	81	66	104	73	98	68	103	69
25	104	83	......	......	83	75	75	59	86	66	36	32	......	......	83	67	85	67	95	75	98	74	105	70
26	104	84	......	......	89	76	77	60	84	66	50	33	......	......	85	67	90	71	93	76	100	76	96	73
27	105	84	......	......	82	74	74	64	82	67	(*)	......	......	......	83	71	81	61	97	74	99	75	96	73
28	104	83	......	......	87	74	79	68	78	62	......	......	......	......	90	71	83	53	89	74	99	76	96	74
29	105	80	......	......	89	75	82	67	70	60	......	......	......	......	76	41	84	54	95	73	100	75	103	73
30	106	84	......	......	91	76	81	65	72	58	......	......	......	......	......	......	84	70	84	72	101	75	100	73
31	105	80	......	......	......	......	79	58	......	......	......	......	......	......	......	......	85	68	......	......	102	75	......	......
Range	......	......	......	......	29°		......	......	49°		......	......	......	......	......	......	60°.		59°		......	......	......	......

*Observer absent on repair duty.

Elevation of thermometers above ground, 20 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, EL PASO, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	103	66	98	67	98	60	94	67	68	37	68	35	46	40	60	38	69	41	78	56	......	‡	......	65
2	104	75	99	69	104	59	88	68	73	41	70	35	56	40	48	32	70	42	76	59	......	......	......	58
3	102	77	95	69	103	65	88	60	77	38	66	38	55	43	59	28	72	42	*	......	......	......	......	65
4	98	65	94	64	100	75	89	56	70	43	64	40	60	46	*	25	71	50	*	......	......	......	......	75
5	92	67	95	63	100	60	89	57	77	42	60	35	64	44	......	......	73	45	88	54	......	......	......	66
6	98	68	93	69	93	73	88	57	81	44	69	46	65	46	......	......	66	54	†	......	......	......	......	65
7	98	67	88	69	96	56	88	58	76	45	70	50	65	44	......	......	68	49	......	......	......	......	......	......
8	95	70	81	65	93	61	87	58	70	45	72	44	74	47	......	......	66	46	......	......	......	......	......	65
9	87	66	85	62	94	59	87	54	78	48	68	50	70	48	......	......	71	49	......	......	......	......	......	69
10	85	64	87	56	97	59	88	49	76	48	58	41	71	44	......	......	70	49	......	......	......	......	......	70
11	95	67	88	54	97	61	89	61	56	40	68	43	71	50	51	......	63	49	......	......	......	......	......	63
12	100	71	94	54	90	61	90	63	64	34	54	38	72	46	50	26	70	50	......	......	......	......	......	63
13	96	65	98	56	84	61	87	66	75	45	52	37	60	42	51	30	69	51	......	......	......	......	......	67
14	102	72	102	61	85	59	88	63	69	47	57	38	60	42	54	32	58	29	......	......	......	......	......	......
15	103	69	97	69	92	47	75	58	74	42	59	37	64	44	56	27	40	21	......	......	......	......	......	......
16	100	69	95	60	94	49	72	47	75	53	64	39	63	45	70	36	62	22	......	......	......	......	......	70
17	102	69	96	57	94	57	78	44	58	50	70	40	66	37	62	46	64	40	......	......	......	......	......	71
18	101	70	97	57	88	57	78	40	52	36	68	42	62	40	60	39	59	39	......	......	......	......	......	68
19	95	68	98	60	88	65	79	41	57	25	72	40	68	40	55	35	68	35	......	......	......	......	......	72
20	100	65	95	60	88	61	80	41	63	28	72	40	67	40	*	......	68	48	80	54	......	......	......	74
21	97	65	100	64	90	53	78	59	66	25	65	43	66	41	62	*	73	46	84	65	......	......	......	*
22	101	68	98	67	94	53	85	54	66	33	66	44	57	48	62	43	72	51	85	68	......	......	......	71
23	102	74	100	71	96	52	74	52	65	36	66	46	60	32	77	42	74	53	84	59	......	......	......	71
24	105	72	102	64	90	51	78	42	69	36	56	40	58	40	56	46	80.5	56	78	56	......	......	......	67
25	100	72	102	63	92	56	80	39	65	40	54	30	61	42	58	38	80	58	74	46	......	......	......	......
26	99	75	98	66	93	58	65	40	65	42	46	30	68	41	65	40	65	53	*	......	......	......	......	70
27	96	73	96	66	90	67	71	46	62	44	57	25	62	44	67	41	68	50	84	......	......	......	97	69
28	94	70	98	64	80	72	78	34	61	40	71	37	65	48	68	42	80	48	83	56	......	......	98	68
29	98	70	97	69	84	67	82	41	65	45	70	43	48	30	69	41	79	58	76	60	......	......	105	70
30	100	69	97	65	91	66	66	48	66	40	68	45	52	22	......	......	78	55	75	56	......	......	103	56
31	97	67	97	62	......	......	54	41	......	......	56	45	50	26	......	......	76	56	......	......	......	......	......	......
Range	39°		48°		53°		60°		56°		47°		52°		......	......	59°.5		......	......	......	......	......	......
Monthly mean	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......

*Observer absent on repair duty.
Elevation of thermometers above ground, 17 feet.

†Observer sick with small-pox.

‡Record incomplete.

Maximum, minimum and mean temperatures—Continued.

STATION, ERIE, PA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	78	57	92	66	85	69	75	65	40	34	46	30	42	30	32	15	33	24	52	37	54	33	64	50
2	90	66	89	73	81	66	83	64	39	32	50	42	42	35	29	15	41	26	60	36	69	53	68	46
3	87	70	81	74	82	67	66	59	35	27	50	42	60	30	27	22	51	40	62	56	74	59	66	55
4	80	63	80	71	71	63	67	50	35	26	44	39	62	41	27	21	59	45	67	48	73	60	75	53
5	77	60	79	68	69	55	79	57	40	26	58	37	49	35	31	16	57	35	53	42	78	62	71	65
6	79	59	82	65	74	53	77	65	46	35	55	45	51	39	31	22	42	33	42	34	68	54	81	70
7	80	63	84	68	72	54	85	70	53	34	51	40	46	37	34	22	46	30	36	29	75	50	71	58
8	79	69	70	60	63	53	74	67	69	51	44	37	52	40	40	18	30	20	41	28	83	60	71	57
9	81	62	66	59	61	53	72	66	68	53	49	37	55	42	42	15	37	17	56	33	86	60	74	62
10	77	67	72	52	62	47	77	62	55	46	59	43	43	35	42	14	35	22	62	31	80	61	82	70
11	87	67	76	65	61	43	76	67	69	46	43	28	64	40	48	28	34	22	38	26	70	55	83	70
12	80	66	83	64	76	51	75	63	70	54	30	24	40	29	59	42	29	21	41	28	65	49	82	67
13	82	62	81	65	72	56	71	59	66	49	32	20	34	22	45	32	38	21	68	41	56	44	77	63
14	87	68	74	64	62	53	68	58	69	60	39	30	40	23	36	28	37	31	78	57	53	41	64	56
15	88	68	67	60	66	50	74	62	61	49	38	24	37	34	35	29	37	30	68	47	56	38	65	60
16	85	72	62	55	66	56	74	60	50	43	37	17	50	36	48	29	34	28	62	40	71	49	72	58
17	72	62	69	56	65	53	75	67	50	39	40	23	52	42	58	40	32	24	46	38	77	57	74	63
18	75	62	73	53	61	53	70	54	42	32	36	21	45	39	56	29	44	18	60	35	79	63	77	59
19	76	59	72	59	60	46	55	44	42	32	36	24	55	39	30	15	47	35	81	43	84	63	78	63
20	80	61	76	60	62	48	62	40	38	20	36	22	40	31	34	19	45	30	60	40	84	64	79	64
21	82	67	84	63	61	45	65	47	26	18	37	11	39	30	39	28	40	25	70	48	72	65	79	69
22	83	68	89	72	69	54	66	53	36	19	44	25	47	39	45	26	47	35	71	45	71	58	81	68
23	80	68	79	66	70	60	61	40	38	31	42	29	41	30	39	30	47	28	47	39	75	58	84	69
24	75	67	75	63	63	45	41	34	36	29	46	34	40	30	48	25	31	20	46	39	84	64	87	75
25	78	66	67	60	57	42	49	34	42	36	27	20	47	33	59	46	30	16	65	42	82	66	83	74
26	80	69	71	59	62	40	56	35	42	34	21	5	51	34	51	42	48	28	60	45	87	70	79	71
27	78	66	75	56	71	48	66	47	60	42	35	9	52	39	56	43	47	42	52	42	85	67	83	72
28	82	66	76	57	75	62	51	46	62	41	42	30	45	31	62	51	42	32	62	40	70	57	82	71
29	80	69	81	68	78	62	61	43	40	29	51	41	36	26	60	29	40	30	64	48	71	55	74	65
30	80	66	79	69	78	60	50	41	41	24	41	22	55	36	......	......	43	32	48	36	77	60	76	63
31	85	64	83	66	......	......	44	35	......	......	42	21	37	27	......	......	46	32	......	......	83	57	......	......
Range	33°		40°		45°		51°		52°		54°		42°		48°		43°		55°		54°		41°	
Monthly mean	73°.3		69°.7		60°.6		59°.5		42°.1		34°.9		40°.0		34°.3		33°.9		47°.5		64°.8		69°.9	

Elevation of thermometers above ground, 31 feet.

The daily means are obtained by dividing the sum of the 7 a.m., 2 p.m. and *twice* the 9 p.m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, ESCANABA, MICH.

Day of month.	1879.											
	July.		August.		September.		October.		November.		December.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	75	61	80	67	75	60	64	57	32	15	35	25
2	78	65	84	67	67	58	70	57	33	20	27	22
3	74	61	76	55	65	59	67	47	26	14	24	18
4	73	57	78	61	65	53	65	43	30	11	35	20
5	73	56	85	57	70	48	68	55	34	20	41	33
6	70	66	77	60	64	51	68	56	48	29	42	34
7	77	62	67	52	53	45	67	60	49	42	34	19
8	85	62	64	44	53	42	64	60	54	41	26	14
9	82	60	72	46	59	34	63	60	53	33	37	23
10	79	65	75	57	62	37	75	58	44	27	39	19
11	80	65	72	64	66	56	60	53	49	41	19	9
12	78	63	74	63	62	52	62	51	45	39	15	3
13	87	65	70	56	55	44	63	47	47	39	30	zero.
14	85	68	68	51	56	40	65	58	43	35	31	21
15	89	67	65	49	57	47	68	58	44	29	24	10
16	79	60	68	43	58	43	69	60	40	30	15	3
17	67	50	70	42	61	40	67	56	34	25	11	— 1
18	72	46	72	47	57	40	56	39	33	26	5	— 9
19	73	53	70	55	54	35	53	33	40	16	15	2
20	79	63	71	64	57	33	56	41	17	7	12	— 3
21	74	63	70	62	59	48	58	44	26	9	19	— 5
22	76	54	74	62	63	52	54	39	30	16	20	2
23	67	56	69	54	60	36	40	31	26	15	16	— 4
24	70	51	69	51	52	32	42	26	32	11	19	9
25	72	60	70	52	58	39	48	27	31	19	7	— 5
26	75	56	68	52	60	48	50	40	34	15	7	—14
27	76	56	74	62	62	55	52	37	35	32	16	— 2
28	75	59	77	58	64	56	50	40	32	20	24	12
29	75	53	79	65	76	58	51	36	22	11	26	8
30	77	57	82	64	65	59	35	25	32	8	15	2
31	82	63	80	65	......	......	39	21	......	......	30	8
Range	43°		43°		44°		54°		47°		56°	
Monthly mean	69°		65°.8		54°.6		52°.2		30°.9		17°.4	

Day of month.	1880.											
	January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	32	14	12	— 4	23	5	44	30	54	36	66	39
2	32	21	22	zero.	31	— 2	47	31	56	39	61	46
3	37	16	19	8	37	29	42	33	71	47	61	45
4	40	25	14	zero.	35	24	49	36	64	43	62	48
5	37	17	13	— 1	28	24	37	27	78	44	63	53
6	42	28	10	—12	33	18	34	24	49	38	69	49
7	37	24	16	— 5	32	— 1	37	18	58	43	65	46
8	38	32	30	5	21	— 4	41	18	60	49	64	40
9	40	19	24	— 3	31	4	65	34	70	45	70	52
10	35	16	32	21	15	— 5	43	23	63	50	65	59
11	42	9	38	20	19	3	37	19	66	44	74	58
12	16	zero.	40	22	16	—11	45	23	66	47	71	59
13	28	— 1	22	13	26	— 1	51	31	60	44	71	48
14	39	11	28	6	24	5	60	30	62	42	60	46
15	31	1	33	12	22	— 2	45	30	65	42	69	47
16	35	27	37	21	24	— 6	30	27	69	50	78	52
17	35	32	38	32	25	—16	41	21	64	51	76	54
18	36	32	34	1	37	24	44	34	66	51	76	59
19	35	23	18	— 4	38	20	50	37	78	58	76	56
20	24	15	27	7	32	15	51	32	55	39	84	60
21	32	12	31	15	48	11	54	29	54	37	84	61
22	29	22	32	17	37	24	45	32	65	41	81	68
23	25	22	26	16	37	13	42	30	65	49	84	67
24	31	19	37	23	24	4	44	34	71	53	82	64
25	35	3	36	21	35	14	41	36	71	52	83	62
26	37	34	33	20	39	31	41	33	67	54	83	57
27	36	20	35	23	42	34	54	32	71	51	78	57
28	20	4	24	16	38	28	47	35	62	42	68	58
29	23	— 3	20	2	40	25	53	33	67	53	72	52
30	37	14	......	......	39	20	45	28	63	50	72	53
31	15	2	......	......	43	25	......	......	66	50	......	......
Range	45°		52°		64°		47°		42°		45°	
Monthly mean	25°.8		19°.9		22°.6		37°.1		55°		63°.7	

Elevation of thermometers above ground, 25 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, FATHER POINT, CANADA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	64.9	47.2	71.2	54.0	74.9	50.0	60.2	45.6	32.4	25.1	26.4	6.4	9.6	—12.4	12.6	—11.8	18.9	5.4	30.4	10.0	35.0	12.0	63.1	41.4
2	73.0	53.6	75.1	53.5	59.2	49.0	64.2	41.1	30.7	26.3	29.5	10.5	35.0	8.1	0.2	—14.4	19.3	0.8	39.9	11.8	41.9	20.6	58.2	38.6
3	66.9	55.0	69.7	53.0	56.5	47.8	64.2	44.9	28.2	15.3	21.7	11.4	19.9	— 6.4	11.8	—19.4	27.5	11.5	41.9	22.1	61.6	37.8	49.8	38.6
4	60.4	44.9	66.7	52.2	67.2	53.0	49.0	41.3	31.5	24.4	27.1	19.1	33.5	1.5	16.2	8.9	28.0	15.9	45.9	33.0	48.5	34.4	54.8	38.6
5	62.7	45.0	66.7	49.5	70.1	46.8	46.1	29.0	29.2	24.4	20.1	2.9	31.3	— 8.8	16.3	7.9	25.9	12.5	43.7	30.0	39.9	35.0	59.7	38.6
6	66.8	47.1	61.9	47.5	56.0	44.1	43.9	24.8	28.7	14.3	36.0	2.2	30.0	— 9.3	18.3	5.4	21.9	9.0	36.0	21.1	40.9	29.5	56.7	46.1
7	77.4	48.5	62.9	46.3	58.5	43.1	57.2	37.8	32.8	15.0	43.1	30.5	30.0	15.5	11.3	— 8.3	30.0	4.9	26.9	10.0	46.2	28.7	63.0	45.4
8	72.7	55.3	62.8	44.8	59.2	43.1	58.4	42.1	41.1	31.0	36.5	13.3	28.1	10.3	18.8	3.8	28.0	— 9.4	23.0	11.5	44.9	31.5	66.9	45.2
9	69.7	47.6	64.2	49.5	56.9	45.6	53.8	41.9	52.8	33.2	15.0	6.9	28.2	8.0	19.3	— 4.6	6.4	—17.5	34.9	4.9	44.8	35.0	55.0	43.1
10	65.0	46.1	61.1	48.5	60.4	41.5	43.9	35.1	53.1	35.1	36.5	6.4	35.5	9.5	1.0	—20.5	18.5	0.8	38.9	32.0	48.6	36.1	61.9	41.4
11	66.4	48.0	63.4	49.3	60.2	41.0	43.1	37.4	37.1	28.7	42.5	28.0	11.2	— 1.2	16.9	—11.9	3.4	—15.5	35.0	14.6	56.8	35.5	62.7	51.6
12	69.4	45.4	67.2	50.0	60.4	43.1	45.1	33.2	32.6	27.8	29.4	2.6	25.9	9.8	28.0	10.0	10.3	—15.9	19.9	7.6	49.8	32.4	66.7	51.2
13	71.0	52.0	55.5	46.8	45.0	49.0	49.0	40.2	32.2	27.3	13.5	— 0.5	12.3	— 2.3	28.0	13.5	11.3	— 2.0	28.9	7.9	44.9	36.0	62.7	48.5
14	67.4	51.4	70.0	49.0	56.5	43.0	48.1	37.4	47.6	29.2	25.1	7.2	7.7	—14.9	19.4	— 3.0	7.9	— 9.9	30.0	7.4	48.8	36.4	63.7	49.5
15	65.4	45.1	60.2	47.0	56.8	39.1	44.1	35.2	53.9	32.0	24.9	20.1	22.8	4.9	17.4	— 5.9	16.3	—10.4	39.4	20.1	52.8	32.5	67.7	43.1
16	58.7	50.3	60.9	45.1	64.2	37.6	53.3	38.3	38.3	31.0	24.9	7.9	22.4	— 8.4	24.9	10.0	23.9	0.9	35.5	23.9	60.7	32.5	65.4	37.1
17	52.0	43.8	58.3	45.1	56.8	47.2	47.1	35.0	36.0	28.7	15.8	— 4.3	31.8	18.5	21.9	— 5.4	25.9	6.1	30.0	22.1	52.8	40.6	72.7	44.5
18	53.1	41.4	54.3	45.1	53.7	45.1	59.6	40.3	30.8	19.9	8.4	— 9.4	31.2	22.0	43.1	15.5	23.9	7.9	35.2	23.1	53.8	34.5	72.7	50.1
19	62.0	44.3	54.8	45.1	54.2	41.7	59.7	33.0	28.8	23.1	8.1	—14.0	29.1	22.3	43.1	1.3	33.0	18.1	49.8	22.1	64.7	30.1	73.7	50.1
20	66.7	47.9	55.3	45.6	52.5	34.0	39.1	30.0	31.5	25.1	9.4	—12.4	28.9	— 7.6	17.0	1.0	29.0	11.0	46.9	35.0	64.7	40.1	67.7	57.0
21	67.7	52.0	61.9	45.1	52.3	40.1	44.9	25.1	30.0	12.0	—10.7	—24.2	9.9	0.4	22.1	6.5	30.4	18.1	47.1	30.0	48.5	36.7	63.7	45.3
22	65.7	48.0	56.6	43.7	55.8	34.0	45.5	37.6	20.3	7.6	— 0.7	—22.3	12.6	—12.4	22.9	3.9	35.0	9.0	47.8	32.0	42.9	36.3	57.7	43.1
23	61.4	51.0	55.2	40.1	52.5	44.6	66.7	37.4	34.4	17.2	6.4	—13.1	22.9	11.4	29.0	10.5	28.0	12.0	39.9	26.1	51.8	39.1	54.8	42.6
24	61.7	50.1	48.6	41.1	47.3	41.1	39.6	27.3	31.3	8.9	6.4	— 8.4	29.3	7.5	23.0	10.0	25.9	10.0	39.9	25.8	45.5	38.6	53.8	37.0
25	64.9	46.9	51.0	40.6	45.3	37.3	33.7	25.4	26.8	7.1	3.4	—18.5	20.1	— 2.1	35.5	— 3.6	25.9	7.9	43.1	30.5	52.8	38.6	54.8	45.1
26	66.1	47.5	57.7	38.5	52.1	28.0	42.4	27.3	30.0	16.0	—13.0	—30.9	27.6	14.3	37.9	33.0	20.9	5.4	44.9	31.5	67.2	35.5	64.7	45.1
27	59.7	45.6	57.7	42.1	52.5	42.6	45.5	34.3	21.0	12.7	2.7	—22.5	37.5	25.1	37.0	22.1	24.9	6.9	39.9	27.6	61.4	40.9	73.7	47.1
28	64.2	46.3	59.2	44.2	54.5	41.4	54.7	35.2	41.2	19.6	20.9	0.8	37.2	0.2	24.0	14.0	25.9	10.0	42.9	20.1	50.3	40.2	83.1	53.0
29	64.7	48.0	55.8	46.6	62.7	43.8	39.1	33.0	48.8	22.4	14.5	4.4	6.9	— 4.2	29.9	15.5	29.0	6.9	56.8	27.1	54.1	39.6	74.7	56.7
30	65.7	48.0	61.2	40.1	62.0	50.0	38.9	31.9	23.1	11.9	13.3	—14.7	24.9	—15.3	......	......	30.0	7.9	57.8	27.1	60.7	36.2	69.7	53.5
31	63.2	48.0	64.2	51.1	......	......	36.2	31.5	......	......	— 4.9	—29.1	36.8	10.2	......	......	34.0	9.0	......	......	55.9	43.0	......	......
Range	36°.0		36°.6		46°.9		41°.9		46°.8		74°.0		52°.8		63°.6		52°.5		52°.9		55°.2		46°.1	

Maximum, minimum and mean temperatures—Continued.

STATION, FLORENCE, ARIZ.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	104	62	112	82	110	76	92	63	82	54	74	41	66	43	48	33	75	31	78	41	91	49	104	55
2	102	63	102	73	109	74	97	62	83	53	66	37	65	36	54	28	74	37	73	45	94	51	107	56
3	106	61	107	74	111	78	94	67	84	48	70	38	65	36	52	29	66	41	77	47	95	52	106	59
4	108	63	101	71	106	74	95	67	80	56	65	38	65	34	51	23	64	41	84	46	100	53	102	64
5	107	77	107	78	106	57	90	69	82	44	65	33	68	37	54	23	66	44	91	49	96	53	102	56
6	106	82	100	71	105	57	96	63	81	43	69	35	60	39	56	26	68	47	86	59	87	54	104	52
7	110	77	97	74	105	63	87	54	77	48	69	39	73	49	63	27	70	36	79	44	90	45	107	54
8	107	80	102	76	106	65	71	54	71	41	69	39	69	49	67	40	73	34	81	44	93	46	106	63
9	86	77	100	72	106	63	75	39	67	48	60	37	67	37	70	35	77	42	83	60	96	51	103	64
10	91	71	103	71	104	63	84	41	67	45	59	27	63	35	64	39	64	43	90	56	99	55	97	60
11	99	77	108	73	106	62	89	47	61	42	61	25	61	36	59	36	70	38	92	52	96	54	100	54
12	101	74	107	73	106	58	97	49	64	39	61	30	64	29	49	31	74	41	91	53	90	57	101	55
13	99	74	107	71	105	61	90	64	65	40	63	28	72	39	54	29	65	39	81	51	78	51	97	53
14	105	75	109	70	102	70	66	49	65	35	63	32	68	34	62	26	60	36	73	45	83	42	105	52
15	104	76	111	69	103	65	66	41	70	39	69	31	75	30	69	33	57	34	72	47	92	42	108	60
16	107	76	106	81	105	63	72	42	70	41	71	35	73	32	68	33	62	32	81	42	93	48	112	62
17	107	74	110	76	103	62	80	42	68	38	72	37	75	34	61	34	62	43	78	45	90	47	114	65
18	106	76	102	77	103	61	89	59	(*)	40	73	37	73	48	65	30	61	42	61	40	93	48	110	73
19	107	74	107	76	105	63	86	65	......	......	73	42	73	40	69	35	65	30	73	36	101	51	101	81
20	109	73	107	78	107	65	87	55	76	49	62	43	71	38	73	38	71	31	82	37	103	56	102	75
21	108	79	105	78	105	70	87	53	77	44	63	51	67	36	74	50	75	33	84	55	102	56	104	72
22	105	80	105	76	104	64	87	50	77	48	58	43	70	29	66	43	79	33	84	48	102	58	107	69
23	107	80	106	74	104	62	87	53	72	43	48	39	65	33	63	41	80	37	72	48	102	62	108	72
24	110	78	106	69	102	63	88	62	73	36	42	26	64	25	62	34	82	41	73	35	100	62	108	65
25	111	79	110	70	100	64	87	52	69	36	52	19	67	30	62	32	77	57	81	39	91	58	106	65
26	112	84	114	74	96	62	88	48	71	42	57	27	64	40	67	31	64	46	87	43	87	48	108	60
27	95	82	108	83	76	65	80	52	57	36	54	38	58	34	69	35	78	34	88	45	91	45	109	61
28	105	73	104	83	82	61	85	63	64	28	61	48	54	32	69	33	82	37	89	46	94	50	111	64
29	112	81	103	79	86	62	83	56	72	30	59	47	42	31	67	33	81	43	90	49	100	54	109	63
30	114	83	106	69	90	60	79	58	76	34	51	41	44	20	......	......	75	39	92	57	102	56	111	64
31	116	77	109	70	......	......	80	57	......	......	63	30	43	29	......	......	78	35	......	......	100	56	......	......
Range	55°		45°		54°		56°		......	......	55°		55°		51°		52°		57°		61°		62°	

Elevation of thermometers above ground, 5 feet.

* Observer absent on repair duty.

Maximum, minimum and mean temperatures—Continued.

STATION, FORT APACHE, ARIZ.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	92	41	91	61	94	51	78	49	65	33	61	23	48	22	37	7	62	22	64	24	79	32	89	37
2	90	45	94	59	95	51	80	45	69	30	59	27	52	23	39	— 5	58	23	60	39	81	38	95	41
3	94	43	89	61	94	50	79	41	69	31	59	19	53	24	33	— 5	57	27	64	42	84	38	93	41
4	88	49	88	56	94	50	79	45	68	44	48	32	57	23	33	— 9	52	33	70	31	86	37	86	44
5	90	60	87	60	92	52	78	51	70	27	59	18	59	24	35	— 7	53	30	76	31	83	43	87	44
6	86	61	86	57	90	52	74	55	71	26	60	24	55	28	37	— 6	56	37	73	35	76	42	89	38
7	97	64	82	59	89	54	74	41	66	27	58	24	64	37	44	— 4	58	23	67	30	77	32	92	39
8	91	63	83	57	92	54	69	42	56	28	54	24	62	38	46	7	60	19	70	29	79	33	91	42
9	83	63	84	54	86	48	65	26	56	36	46	31	59	24	52	11	63	22	70	28	82	33	88	50
10	82	61	87	53	90	46	76	28	49	32	48	15	53	26	50	21	53	32	73	29	83	39	86	58
11	87	61	88	51	93	50	80	34	41	33	48	19	49	26	42	26	55	27	77	29	86	40	87	40
12	89	61	92	51	90	53	82	39	54	25	47	16	54	18	34	16	58	26	77	34	77	40	89	38
13	94	61	93	56	88	51	77	55	52	28	50	14	58	17	40	zero.	55	32	68	30	70	44	86	40
14	93	55	93	52	88	46	61	46	56	25	55	18	60	21	43	9	48	26	63	31	74	30	92	36
15	92	60	92	51	90	42	56	32	61	25	60	19	59	20	52	10	43	24	60	42	84	31	96	44
16	89	59	91	52	88	43	59	31	57	30	62	17	59	17	50	21	50	21	67	30	84	35	99	46
17	90	56	93	54	89	43	68	29	51	21	61	19	60	18	48	22	45	29	67	31	82	29	99	55
18	92	64	86	54	91	41	71	31	49	14	59	19	62	28	51	17	45	29	44	29	84	36	97	59
19	92	60	90	52	88	56	71	34	57	11	57	21	60	25	57	24	53	20	64	20	89	37	90	59
20	96	56	92	57	88	47	74	33	62	19	58	28	60	23	55	27	58	18	72	21	91	42	78	61
21	86	65	91	55	89	48	75	33	62	16	46	40	58	18	60	33	62	19	72	49	88	43	90	57
22	92	59	89	51	88	45	75	34	61	19	45	37	53	17	60	43	66	22	69	39	90	42	93	52
23	94	63	91	46	89	45	73	34	64	19	38	29	51	18	50	44	72	20	64	45	87	45	96	54
24	96	60	92	49	87	46	72	34	55	25	33	13	51	15	47	31	69	19	64	30	85	45	93	51
25	97	60	95	47	85	62	72	34	60	20	30	— 2	54	14	49	24	56	41	69	25	77	43	94	47
26	90	60	98	49	84	45	66	31	55	26	40	4	50	26	53	24	55	31	74	29	77	34	95	45
27	84	64	95	54	71	54	68	30	46	27	47	30	37	28	53	22	66	21	75	30	79	32	94	44
28	89	63	88	62	67	53	71	27	55	16	47	39	36	28	55	27	71	25	75	30	78	34	98	47
29	88	61	88	53	72	57	70	33	59	20	48	39	31	17	55	23	67	30	75	31	86	35	96	45
30	95	61	93	46	77	47	66	44	62	22	42	34	26	— 5	......	......	64	27	74	49	87	40	97	44
31	92	61	96	50	......	......	65	34	......	......	44	22	28	5	......	......	66	21	......	......	86	40	......	......
Range	56°		52°		54°		56°		60°		64°		69°		69°		54°		57°		62°		63°	

Elevation of thermometers above ground, 5 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, FORT BUFORD, DAK.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	74	51	70	53	95	52	68	41	29	6	15	10	43	5	32	11	30	—2	36	22	83	38	72	39
2	81	44	84	41	76	48	63	35	28	9	17	3	36	13	27	8	34	3	38	23	88	45	74	50
3	82	56	80	49	75	35	83	35	45	17	15	8	41	6	25	15	16	—6	39	16	73	50	75	44
4	85	51	92	47	80	45	86	37	53	23	17	zero.	27	—9	20	7	24	3	36	15	73	43	59	51
5	92	65	85	57	67	46	95	52	57	24	26	—9	25	—13	32	13	37	—6	37	12	82	46	65	50
6	83	51	73	45	64	34	67	43	62	32	19	—10	22	—19	28	8	25	—13	43	7	64	46	73	45
7	82	54	83	44	73	30	55	34	45	29	7	—14	17	2	38	4	23	—20	50	15	63	36	80	48
8	93	51	93	48	81	48	45	41	40	19	15	—3	32	—12	12	—12	15	—1	68	17	59	31	61	52
9	94	55	98	51	91	50	41	35	48	20	7	—6	5	—20	37	8	21	—5	66	26	58	32	72	50
10	82	61	86	53	64	39	57	32	43	18	zero.	—15	32	—14	39	11	22	2	55	23	67	35	77	45
11	92	61	77	52	72	39	64	36	52	20	2	—12	—3	—25	29	4	2	—22	70	27	83	43	63	51
12	88	60	78	43	66	42	72	40	45	29	10	—20	—3	—35	31	—1	zero.	—21	61	32	95	51	66	47
13	88	54	92	50	80	34	51	38	48	20	10	—18	44	—11	28	14	4	—23	37	17	82	56	71	48
14	78	49	82	54	80	47	56	40	44	23	zero.	—21	21	—12	36	5	14	—3	23	12	60	47	82	52
15	86	49	87	48	76	39	50	44	38	20	20	—5	44	21	31	10	10	—15	62	13	78	44	71	50
16	87	62	92	53	71	43	44	35	27	22	8	—17	40	29	17	—5	28	—9	67	32	71	46	75	43
17	82	65	81	60	54	39	62	27	34	20	—7	—29	47	30	zero.	—10	29	4	44	28	55	50	84	54
18	87	65	83	41	66	26	68	35	50	17	—7	—24	37	10	12	—22	39	9	35	15	66	47	86	59
19	88	60	86	48	74	33	74	35	37	9	—10	—15	28	3	29	—5	35	23	44	17	56	43	95	60
20	88	62	90	55	72	44	62	38	37	8	—5	—12	44	5	22	5	41	23	64	15	71	39	84	56
21	78	58	95	57	70	35	53	31	42	19	—5	—23	30	12	38	6	45	22	68	32	66	49	71	50
22	79	53	92	61	66	40	49	26	37	22	—13	—29	39	3	39	21	43	31	57	36	67	44	75	52
23	72	58	83	59	66	31	56	21	43	13	—25	—42	33	13	50	25	48	22	41	35	53	43	79	50
24	72	55	82	55	79	30	67	29	37	16	—21	—46	39	5	37	11	60	31	43	29	67	43	82	53
25	73	55	79	43	84	38	58	38	40	13	7	—21	41	15	45	11	68	31	50	26	58	48	91	55
26	77	51	88	42	71	47	59	35	26	10	37	zero.	22	—1	28	—9	46	31	62	23	63	46	75	53
27	69	52	87	61	82	40	60	38	24	zero.	12	zero.	—1	—17	—9	—17	46	24	63	28	70	38	68	45
28	79	48	89	70	77	51	54	34	20	4	zero.	—25	12	—20	10	—17	58	22	46	39	76	47	72	48
29	93	53	74	55	69	43	38	23	40	7	zero.	—25	12	—2	28	—9	44	35	62	25	63	47	83	45
30	93	59	70	50	67	36	23	11	28	11	23	—19	19	—10	......	......	40	21	80	37	58	40	80	55
31	92	63	88	42	......	......	36	15	......	......	40	zero.	29	11	......	......	38	20	......	......	59	37	......	......
Range	50°		57°		69°		84°		62°		86°		82°		72°		91°		73°		64°		56°	

Elevation of thermometers above ground, 6 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, FORT CUSTER, MONT.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	......	......	......	......	......	......	70	53	33	19	34	18	55	30	50	14	49	18	42	24	79	40	70	45
2	......	......	......	......	......	......	73	32	53	19	44	15	57	11	36	25	58	30	60	26	81	43	76	57
3	......	......	......	......	......	......	85	44	64	29	37	15	53	30	36	24	37	13	48	21	71	52	77	51
4	......	......	......	......	......	......	86	38	60	39	47	21	35	11	36	24	39	25	45	17	73	53	62	51
5	......	......	......	......	......	(*)	87	51	68	29	42	19	60	1	42	14	46	22	47	23	75	45	65	46
6	......	......	......	......	......	41	65	49	69	35	38	11	38	—2	50	29	39	—2	52	20	59	42	70	46
7	......	......	......	......	......	48	59	40	46	31	15	zero.	45	24	51	18	28	—11	54	24	62	37	73	47
8	......	......	......	......	......	56	42	35	51	20	22	—3	53	1	33	11	38	12	69	24	56	36	57	51
9	......	......	......	......	......	58	49	33	50	23	13	—2	33	—2	51	21	48	7	73	33	56	36	65	45
10	......	......	......	......	......	49	58	33	50	23	11	—9	45	—1	45	24	45	32	70	30	65	32	67	40
11	......	......	......	......	......	44	58	36	62	25	14	—19	8	—13	44	21	32	—8	79	35	82	45	33	50
12	......	......	......	......	......	38	69	39	47	33	45	10	25	—3	39	6	5	—12	74	46	84	53	66	47
13	......	......	......	......	......	35	65	37	53	23	41	16	50	21	44	25	19	—23	46	23	72	50	75	53
14	......	......	......	......	82	45	55	37	48	37	21	7	46	17	50	23	31	6	51	20	50	42	82	49
15	......	......	......	......	87	42	53	43	53	31	54	14	56	43	51	28	22	4	62	28	67	42	68	51
16	......	......	......	......	79	46	58	43	49	31	41	—2	56	33	48	7	40	2	61	36	75	42	75	48
17	......	......	......	......	70	43	68	34	52	22	1	—17	58	33	15	—6	35	7	51	31	64	53	85	57
18	......	......	......	......	66	39	70	39	64	19	5	—10	52	32	32	—10	49	11	43	30	68	48	94	66
19	......	......	......	......	73	38	76	34	45	30	—4	—10	42	25	34	3	48	31	52	22	69	46	94	59
20	......	......	......	......	71	43	74	38	58	20	—1	—10	51	31	42	15	48	22	64	27	73	42	74	56
21	......	......	......	......	72	41	56	41	54	24	zero.	—9	42	33	53	20	61	34	71	37	67	48	74	55
22	......	......	......	......	63	47	49	35	52	28	—5	—11	48	24	59	31	60	35	63	48	66	39	76	51
23	......	......	......	......	69	44	57	30	60	22	—8	—29	53	32	63	28	58	30	48	28	65	47	78	55
24	......	......	......	......	80	39	73	30	52	28	12	—36	52	29	43	31	64	32	37	27	50	44	82	52
25	......	......	......	......	86	47	56	40	42	19	32	12	56	26	50	32	67	33	48	28	57	38	87	54
26	......	......	......	......	80	63	66	30	26	4	50	25	26	1	32	3	50	32	59	29	60	38	83	62
27	......	......	......	......	80	49	69	48	10	—8	37	—13	8	zero.	3	—10	59	27	64	33	69	47	62	53
28	......	......	......	......	77	45	73	40	26	—4	—5	—13	6	—12	26	—17	67	32	49	39	74	47	75	46
29	......	......	......	......	60	43	40	26	43	18	7	—16	26	—14	39	3	63	32	65	28	60	47	79	48
30	......	......	......	......	68	31	36	15	56	34	32	—8	33	9	......	......	47	31	76	38	55	41	73	62
31	......	......	......	......	......	......	36	10	......	......	50	17	45	25	......	......	53	24	......	......	64	33	......	......
Range	......	......	......	......	......	......	77°		77°		90°		74°		80°		90°		57°		52°		54°	

*Observations commenced September 14, 1879.

Elevation of thermometers above ground, 6.6 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, FORT DAVIS, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	99	63	89	62	83	52	78	61	65	36	73	40	50	33	33	25	70	36	75	44	77	51	69	50
2	98	73	88	67	89	59	77	57	70	36	72	36	50	40	53	25	70	40	72	46	80	47	81	59
3	93	71	85	65	92	68	67	54	67	39	71	36	58	31	36	23	73	(†)	75	51	84	51	93	68
4	82	65	84	66	88	68	75	55	74	43	68	44	64	32	40	13	76	......	83	50	86	54	95	68
5	81	63	79	62	90	68	81	58	74	50	63	35	66	33	41	11	76	......	88	48	91	55	92	66
6	86	66	80	63	85	59	80	57	75	52	72	47	69	31	45	20	69	......	85	49	90	65	85	62
7	89	66	75	65	86	56	79	58	76	42	70	43	74	46	51	17	66	......	65	38	87	62	94	64
8	88	64	71	58	82	55	78	63	71	49	71	36	77	39	57	21	63	......	48	31	87	54	96	71
9	79	59	59	52	84	54	76	63	74	42	69	47	69	38	66	26	67	......	62	32	89	49	94	64
10	77	60	67	51	89	60	69	57	73	43	60	33	73	44	66	27	72	......	68	33	84	40	96	71
11	85	63	74	57	85	66	76	56	63	40	45	30	72	42	(*)	......	60	......	72	34	91	53	92	68
12	92	66	79	56	66	55	73	60	70	41	54	27	54	28	......	......	66	......	76	41	89	59	93	61
13	93	63	83	60	67	52	76	57	72	38	54	28	59	26	......	......	58	......	79	55	86	54	81	67
14	93	62	89	48	77	47	77	59	71	41	56	39	69	35	52	32	30	......	78	55	83	58	90	68
15	90	60	78	62	82	45	78	60	73	40	62	27	59	34	66	26	46	......	76	54	84	55	90	69
16	90	65	82	55	83	49	69	50	75	38	70	39	70	42	70	36	59	......	80	50	80	56	88	60
17	92	65	85	58	87	48	64	45	52	38	72	35	65	34	70	33	68	......	84	43	80	60	86	63
18	93	66	85	61	78	65	65	39	40	27	71	31	61	39	59	33	62	......	78	51	89	64	88	66
19	92	67	87	56	74	50	65	40	62	21	66	30	68	42	59	32	67	31	73	39	86	53	89	65
20	92	65	87	63	74	49	70	40	58	34	70	36	68	49	67	34	66	34	80	40	75	51	81	64
21	92	70	87	63	81	51	77	41	60	27	65	43	65	41	75	40	56	33	86	61	88	54	85	61
22	94	67	89	60	84	52	77	41	68	30	67	46	55	29	77	42	53	42	83	60	91	62	84	63
23	93	65	88	60	82	50	62	41	61	32	65	43	59	24	78	42	68	36	83	56	90	62	87	59
24	94	67	88	58	78	47	68	35	69	34	56	20	50	33	70	41	78	45	77	60	92	67	85	60
25	94	65	89	58	80	51	70	42	68	36	35	8	61	26	60	38	81	43	77	43	93	63	90	66
26	92	70	88	59	85	61	58	40	70	47	61	21	66	35	65	36	78	42	74	40	94	59	92	61
27	92	69	87	60	84	62	58	36	62	43	67	34	66	38	68	41	72	42	82	54	77	48	96	69
28	91	68	86	59	85	63	72	38	62	42	72	46	60	34	62	49	78	35	83	51	78	55	82	58
29	91	66	84	56	81	63	76	42	62	30	71	49	67	39	66	45	81	47	64	46	83	52	94	65
30	90	66	81	54	83	55	58	40	70	30	71	51	45	33	......	......	80	46	56	46	92	55	97	69
31	88	59	81	56	......	......	41	36	......	......	51	35	41	19	......	......	77	45	......	......	79	55	......	......
Range	40°		41°		47°		46°		55°		65°		58°		......	......	......	......	57°		54°		47°	

*Observer absent on repair duty.

†Minimum thermometer broken.

Elevation of thermometers above ground, 3 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, FORT ELLIOTT, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	......	......	......	......	......	......	......	......	......	......	*75	......	57	30	46	14	65	20	78	38	69	44	78	44
2	......	......	......	......	......	......	......	......	......	......	52	......	71	30	47	10	55	34	81	41	76	49	74	45
3	......	......	......	......	......	......	......	......	......	......	64	......	77	43	40	12	81	40	81	54	79	51	86	61
4	......	......	......	......	......	......	......	......	......	......	60	......	62	33	43	11	76	40	85	51	84	48	100	66
5	......	......	......	......	......	......	......	......	......	......	55	32	77	29	40	10	70	30	91	46	89	56	75	65
6	......	......	......	......	......	......	......	......	......	......	64	36	70	40	52	9	64	39	70	40	92	57	79	45
7	......	......	......	......	......	......	......	......	......	......	63	29	79	38	55	15	58	19	51	32	77	50	96	57
8	......	......	......	......	......	......	......	......	......	......	43	22	81	30	57	25	73	20	60	26	91	47	99	57
9	......	......	......	......	......	......	......	......	......	......	66	26	64	33	60	10	54	20	73	27	94	47	99	70
10	......	......	......	......	......	......	......	......	......	......	42	19	70	29	70	22	61	16	71	38	82	48	89	66
11	......	......	......	......	......	......	......	......	......	......	31	20	62	30	64	42	50	28	68	27	93	47	88	64
12	......	......	......	......	......	......	......	......	......	......	37	(†)	42	14	48	22	40	5	82	35	87	57	85	64
13	......	......	......	......	......	......	......	......	......	......	(†)	......	56	11	48	13	15	— 1	89	48	86	56	88	64
14	......	......	......	......	......	......	......	......	......	......	......	11	54	21	46	20	17	— 2	85	55	86	60	90	64
15	......	......	......	......	......	......	......	......	......	......	......	13	64	15	62	18	24	8	77	40	86	56	90	56
16	......	......	......	......	......	......	......	......	......	......	......	20	64	28	72	27	40	1	87	33	86	55	90	56
17	......	......	......	......	......	......	......	......	......	......	......	8	72	22	56	26	48	18	94	49	88	60	82	55
18	......	......	......	......	......	......	......	......	......	......	......	6	73	29	44	15	57	21	81	37	90	59	86	58
19	......	......	......	......	......	......	......	......	......	......	......	17	74	45	41	12	58	23	65	28	79	53	88	58
20	......	......	......	......	......	......	......	......	......	......	40	15	73	25	64	25	56	28	78	35	67	50	88	58
21	......	......	......	......	......	......	......	......	......	......	74	20	55	26	64	25	55	30	83	42	78	44	87	58
22	......	......	......	......	......	......	......	......	......	......	45	10	48	21	72	39	67	28	96	45	83	53	87	55
23	......	......	......	......	......	......	......	......	......	......	31	2	59	20	74	33	73	34	90	59	92	58	87	55
24	......	......	......	......	......	......	......	......	......	......	15	—10	62	30	72	43	76	44	78	42	87	59	90	60
25	......	......	......	......	......	......	......	......	......	......	31	—10	63	22	62	30	86	46	74	31	91	64	87	56
26	......	......	......	......	......	......	......	......	......	......	47	2	69	35	77	33	83	45	67	33	84	55	89	58
27	......	......	......	......	......	......	......	......	......	......	78	11	63	15	78	14	62	33	71	30	72	53	87	56
28	......	......	......	......	......	......	......	......	......	......	77	48	35	14	41	1	74	25	80	48	59	48	75	53
29	......	......	......	......	......	......	......	......	......	......	72	15	40	15	50	12	78	37	62	39	84	48	75	56
30	......	......	......	......	......	......	......	......	......	......	34	12	62	11	......	......	85	43	78	31	90	51	86	53
31	......	......	......	......	......	......	......	......	......	......	60	21	51	5	......	......	74	40	......	......	78	44	......	......
Range	......	......	......	......	......	......	......	......	......	......	......	......	76		77		88		70		50		56	

*Observations commenced December 1, 1879.

†Observer absent on repair duty.

Elevation of thermometers above ground, 6 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, FORT GARRY, MANITOBA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	75.5	51.0	77.0	55.5	77.5	44.4	62.5	28.4	22.5	7.4	6.4	-5.5	40.5	0.2	0.2	-35.3	8.0	-27.3	34.0	13.6	81.4	41.0	63.7	34.0
2	81.5	54.3	76.5	45.0	78.7	51.3	54.5	38.4	22.4	2.4	7.3	-4.5	23.4	-10.0	4.0	-4.3	28.5	-14.5	30.5	5.2	83.5	45.3	66.7	37.0
3	78.4	53.0	80.5	47.3	68.5	43.4	60.5	28.3	22.3	0.2	9.5	-4.5	39.0	3.3	2.4	-8.5	10.0	-14.3	32.0	15.0	66.3	46.0	76.5	48.5
4	77.3	54.0	84.3	53.5	77.5	37.0	70.5	34.7	31.5	6.3	24.5	-5.3	24.5	-14.3	4.0	-18.3	19.5	-22.5	27.5	7.6	68.5	34.0	74.4	49.0
5	84.5	53.4	83.5	51.4	61.5	52.4	81.5	38.4	36.4	20.3	12.4	-11.5	32.4	1.4	0.5	-34.3	7.5	-18.3	25.0	3.7	73.7	43.3	67.0	49.5
6	83.3	60.0	68.5	53.3	60.0	40.3	88.5	51.4	48.4	26.0	9.5	-5.3	-6.4	-21.8	-2.2	-30.3	4.0	-14.3	27.0	9.6	63.3	47.3	71.0	45.0
7	76.5	58.3	73.5	43.4	62.5	43.4	82.0	36.3	45.3	31.0	8.5	-6.3	-1.4	-14.5	4.0	-10.4	-11.4	-36.3	30.0	-3.2	66.0	41.5	73.7	44.4
8	86.4	53.0	79.5	44.3	69.4	35.3	53.0	29.0	30.5	18.5	4.4	-11.3	27.4	-14.3	2.4	-24.3	4.5	-23.5	47.0	11.1	76.4	39.7	76.3	49.5
9	90.4	57.3	87.5	52.5	72.5	40.0	68.5	40.5	30.5	14.4	8.5	-7.5	-3.2	-17.5	3.5	-23.5	-8.4	-28.3	47.5	30.0	63.5	47.4	73.5	54.0
10	88.5	59.0	84.7	58.5	66.5	50.3	58.5	26.5	44.3	17.3	4.0	-12.3	21.5	-18.3	20.5	-6.3	7.5	-33.5	37.0	17.5	64.5	41.3	79.7	54.7
11	92.5	64.5	67.3	54.5	70.6	48.4	54.5	31.5	45.5	29.4	-11.4	-28.3	-8.6	-24.3	29.5	6.4	-2.4	-18.3	39.5	16.5	70.0	35.4	66.7	56.2
12	93.0	65.0	68.5	52.4	58.5	37.4	56.5	28.3	37.5	29.0	-12.4	-35.3	-10.4	-31.3	8.4	-14.3	-3.5	-30.0	53.7	24.0	67.2	51.0	62.0	46.5
13	86.5	62.6	72.5	55.3	57.0	31.3	83.4	48.4	37.7	24.3	-4.2	-17.6	25.0	-30.3	7.3	-23.5	1.3	-23.4	32.7	15.0	71.5	52.0	63.7	41.5
14	81.5	61.0	77.0	54.4	60.5	35.0	75.4	50.0	41.0	16.3	-14.4	-30.5	-0.2	-23.3	16.0	-15.3	8.5	-23.3	31.5	14.5	74.5	51.2	65.1	48.3
15	76.5	54.4	77.5	51.3	66.5	41.3	54.0	46.4	28.5	12.5	-6.4	-36.3	22.0	-6.3	22.5	2.4	3.4	-18.3	34.5	1.7	74.2	57.0	74.3	47.0
16	76.5	53.3	82.4	50.4	58.5	42.2	52.5	42.0	23.5	8.4	-10.0	-22.6	20.0	2.5	22.4	5.2	2.3	-31.3	49.5	23.7	74.8	45.0	71.5	54.7
17	80.0	51.5	82.5	52.4	52.7	33.4	45.5	33.3	23.0	13.3	-13.4	-38.3	27.5	3.2	16.0	-16.3	14.0	-14.5	44.3	27.5	58.7	48.5	76.7	55.5
18	81.4	60.4	76.5	58.3	56.5	29.4	53.0	25.3	31.5	10.5	-15.4	-34.3	14.5	-6.3	-7.4	-24.3	23.4	-14.3	30.7	21.7	51.7	45.0	80.2	57.7
19	86.5	63.4	74.0	54.4	60.0	34.4	70.5	33.4	35.0	0.3	-16.7	-30.3	6.5	-24.3	10.0	-35.3	26.0	0.4	37.0	21.3	46.7	37.0	84.3	60.7
20	77.5	57.3	79.5	40.0	61.5	30.3	63.0	37.0	14.5	-10.3	-20.4	-42.5	15.0	-4.4	17.5	-3.3	31.4	-12.3	38.5	14.0	58.8	29.2	87.0	65.0
21	75.5	53.5	78.4	52.7	64.5	36.3	49.5	27.3	25.5	1.4	-6.4	-27.3	19.3	0.2	23.5	-13.3	30.5	10.1	46.7	23.0	65.7	36.7	79.7	61.0
22	72.3	55.4	72.6	54.4	51.4	34.0	44.0	24.4	31.4	6.3	-19.4	-35.5	9.4	-14.3	25.5	-4.4	40.0	9.1	48.5	19.0	59.7	44.5	84.7	56.0
23	79.7	58.5	68.0	50.3	49.5	21.4	45.4	22.3	18.0	-7.4	-28.4	-44.3	17.5	-10.3	36.4	-5.5	18.0	-4.7	53.7	28.0	71.7	40.3	79.0	56.0
24	72.0	54.3	68.5	54.4	67.4	22.3	51.4	18.4	30.0	8.4	-29.2	-50.5	18.4	6.5	29.0	-2.2	37.0	6.2	53.7	27.7	70.8	49.5	77.9	54.6
25	71.5	51.4	77.5	55.5	72.5	38.0	52.0	34.5	20.0	-1.4	-12.6	-41.3	31.3	4.4	8.5	-17.3	36.5	11.6	51.5	29.5	66.7	48.7	77.0	52.5
26	80.5	53.3	76.4	51.3	71.4	34.4	55.5	24.0	21.3	7.5	2.0	-30.5	10.4	-8.3	14.5	-10.3	36.5	22.5	48.5	30.3	56.2	38.0	78.4	58.3
27	74.0	56.5	76.5	45.3	72.5	38.3	52.6	32.0	18.5	9.4	-2.5	-17.3	6.0	-20.3	4.0	-24.3	36.0	28.0	56.7	29.3	57.0	31.2	70.2	50.5
28	72.5	49.3	78.0	52.4	68.5	46.3	47.5	24.3	18.0	-5.3	-9.4	-24.1	-9.4	-24.5	-3.3	-34.3	44.7	25.0	47.7	29.7	59.5	41.5	72.7	46.0
29	86.5	48.4	90.5	60.4	72.4	50.4	40.0	21.4	17.5	6.3	-18.2	-43.3	8.5	-28.4	2.4	-24.5	43.5	28.5	45.5	25.0	72.5	51.5	73.5	47.0
30	89.5	58.4	79.4	55.5	72.3	34.4	24.5	12.0	27.5	8.5	0.0	-33.3	4.2	-17.5	......	......	41.5	34.5	67.5	25.0	56.7	37.5	78.2	46.2
31	73.0	58.3	68.5	51.3	......	......	23.5	5.4	......	......	17.4	-9.3	-7.8	-22.3	......	......	36.0	24.5	......	......	51.0	31.0	......	......
Range	44°.6		50°.5		57°.3		83°.1		58°.7		75°		71°.8		71°.7		81°		70°.7		54.3		53°.0	

Maximum, minimum and mean temperatures—Continued.

STATION, FORT GIBSON, IND. TER.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	92	71	96	69	91	62	88	68	53	31	61	39	53	33	51	27	54	27	69	59	76	43	69	60
2	96	74	98	71	90	55	83	71	61	30	64	48	66	50	48	35	52	37	80	57	74	55	80	62
3	94	76	101	73	88	53	81	69	53	34	52	38	67	58	38	25	77	51	82	59	75	56	83	62
4	95	73	104	75	90	59	83	69	67	31	65	40	66	56	50	23	78	63	88	50	81	56	91	72
5	94	71	104	77	93	61	85	69	61	51	57	35	67	56	46	22	69	51	88	51	90	63	86	67
6	100	75	104	77	94	69	84	68	70	56	63	30	68	50	56	22	55	49	74	55	91	65	81	55
7	99	76	91	69	94	69	84	68	78	59	67	39	65	43	58	25	55	39	55	42	87	68	74	57
8	101	73	70	64	90	64	88	72	72	52	48	32	63	53	62	35	52	41	60	39	89	68	88	67
9	101	75	79	57	86	65	87	74	63	46	69	40	63	44	62	29	58	47	70	34	87	72	90	76
10	102	72	83	59	91	66	89	75	77	52	46	28	68	37	71	42	61	42	74	47	86	70	91	76
11	103	76	86	59	89	67	89	69	75	55	33	23	68	45	70	55	53	42	64	39	93	68	90	72
12	95	79	85	63	78	61	84	65	74	53	38	18	49	36	56	44	43	34	74	45	94	67	90	72
13	103	80	88	64	79	49	84	66	80	58	40	29	50	26	44	21	37	25	79	56	92	68	91	74
14	108	79	88	68	78	49	84	65	71	54	43	27	60	38	43	15	27	15	84	68	92	68	91	75
15	109	80	82	66	86	58	86	70	66	40	42	19	60	35	59	31	36	24	79	65	87	67	84	69
16	104	80	79	66	88	53	88	67	71	36	62	35	68	43	64	47	38	26	73	45	90	67	81	59
17	96	79	83	60	90	65	68	50	65	43	47	30	64	37	70	56	44	19	89	63	89	62	85	61
18	101	76	85	61	89	62	72	39	47	33	40	30	72	40	44	30	56	36	86	69	88	63	87	61
19	89	72	93	67	82	64	69	37	60	29	61	38	70	55	49	28	63	31	69	39	78	63	90	66
20	94	76	92	70	76	60	68	37	43	25	45	29	59	38	45	36	62	42	71	36	68	59	88	65
21	101	77	92	72	82	56	72	36	52	24	58	27	66	39	56	33	62	45	81	50	80	56	89	64
22	103	79	94	66	83	56	80	45	67	30	58	24	45	30	65	40	67	37	87	63	80	56	92	60
23	103	76	84	70	88	59	62	43	61	34	36	21	56	26	72	35	77	42	90	72	91	64	91	66
24	91	74	91	66	79	61	62	29	68	42	21	8	56	37	69	58	76	49	92	71	92	71	89	67
25	88	74	95	63	82	62	63	32	71	57	21	4	61	32	69	55	75	60	75	51	87	69	91	68
26	88	69	94	70	92	62	69	34	66	61	40	14	66	44	72	45	76	63	67	46	90	72	85	66
27	84	72	92	71	92	70	69	33	72	46	47	29	56	39	75	44	65	47	76	39	78	65	87	66
28	89	72	92	66	86	71	78	35	46	33	60	43	43	34	44	20	67	42	65	55	77	65	80	67
29	93	68	88	64	88	70	79	51	49	26	58	28	64	41	40	24	67	42	64	52	78	65	84	62
30	95	67	89	61	90	71	64	47	57	36	36	25	61	33	......	......	72	55	70	37	91	62	81	68
31	95	70	91	63	......	......	50	35	......	......	36	30	45	26	......	......	72	59	......	......	80	64	......	......
Range	42°		47°		45°		60°		56°		65°		46°		60°		63°		58°		51°		37°	
Monthly mean	85°.3		78°.3		74°.4		65°.0		52°.9		38°.0		50°.4		45°.2		50°.3		63°.9		73°.9		75°.2	

Elevation of thermometers above ground, 19 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, FORT GRANT, ARIZONA TERRITORY.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	94	65	98	73	97	70	82	60	71	44	67	48	58	36	41	22	62	34	65	40	78	50	91	62
2	93	63	98	68	96	76	87	60	73	43	63	47	60	38	50	23	62	43	64	45	82	52	95	66
3	98	62	92	68	97	72	78	60	75	45	66	41	60	36	41	20	60	39	67	45	85	52	94	66
4	96	67	93	66	95	74	81	60	72	54	54	40	60	39	42	19	60	42	78	44	90	53	86	67
5	96	68	88	68	95	69	82	63	78	42	61	33	64	38	43	19	53	41	80	50	85	58	87	64
6	98	68	86	62	97	67	79	58	79	50	67	41	59	44	44	20	52	40	73	54	80	58	89	63
7	93	67	84	61	94	64	80	58	73	47	65	43	66	49	51	30	60	35	74	44	84	52	91	65
8	89	68	85	62	94	64	75	52	61	41	61	46	68	49	58	30	64	37	64	43	82	49	89	65
9	76	65	82	62	91	64	74	41	60	51	51	39	66	44	63	31	60	40	69	49	84	54	88	66
10	80	62	83	63	90	65	82	46	55	33	51	29	62	45	57	44	61	41	77	43	88	54	86	63
11	90	62	88	61	96	62	87	55	51	35	57	30	61	36	51	28	62	39	79	49	87	55	85	57
12	87	62	98	59	94	67	84	60	65	35	53	32	57	32	36	22	64	37	77	55	78	55	88	63
13	93	68	100	60	85	68	77	63	60	41	52	30	65	32	44	23	59	38	72	49	72	47	85	64
14	93	65	103	61	97	56	69	53	62	37	60	32	66	37	56	25	53	38	66	41	75	42	90	61
15	98	64	93	64	94	60	63	39	69	38	61	36	63	38	61	30	46	27	69	41	84	50	90	62
16	97	64	95	62	98	63	65	41	69	47	69	41	62	39	60	35	52	31	72	41	84	53	98	70
17	95	67	91	64	95	63	70	42	57	34	68	39	65	39	57	37	54	33	73	50	83	52	96	83
18	91	67	92	62	95	66	73	49	53	37	66	38	68	47	62	31	49	31	50	31	83	53	96	75
19	95	67	91	68	94	67	73	55	64	31	65	40	64	40	65	42	52	30	65	30	85	57	83	73
20	96	70	94	66	94	68	79	48	63	43	58	44	62	40	58	44	66	35	75	41	89	63	80	64
21	97	68	93	61	93	66	82	53	63	35	52	44	62	37	63	44	66	36	75	47	88	64	84	56
22	94	70	95	63	94	68	79	50	67	36	52	41	61	34	63	47	69	37	74	48	88	63	90	65
23	93	68	93	68	93	65	74	57	67	43	43	32	57	34	53	42	72	43	70	44	88	64	93	67
24	95	72	95	69	93	69	74	48	67	44	42	28	57	31	49	37	69	50	60	39	86	63	91	70
25	92	71	100	67	90	62	78	49	67	44	42	21	61	32	55	33	61	51	70	38	81	59	93	70
26	95	69	97	71	90	64	70	52	61	43	54	28	55	38	60	31	56	33	78	49	79	54	94	69
27	93	71	97	70	73	55	70	47	50	34	63	39	46	33	59	40	72	32	78	50	78	53	93	68
28	94	71	93	74	65	54	73	51	60	30	52	45	49	27	61	35	75	46	76	49	78	51	96	68
29	94	67	93	67	78	56	70	49	61	38	54	41	35	23	60	36	72	48	79	48	85	55	96	72
30	96	69	97	68	83	56	65	48	67	40	54	37	39	17	......	......	68	44	71	58	87	59	96	68
31	100	68	97	69	......	......	70	45	......	......	55	32	40	27	......	......	67	41	......	......	88	61	......	......
Range	38°		44°		44°		47°		49°		48°		51°		46°		48°		50°		48°		42°	

Elevation of thermometers above ground, 7 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, FORT GRIFFIN, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	97	78	99	70	93	61	90	62	52	44	71	40	48	36	45	35	70	42	83	58	56	54	65	60
2	95	74	99	74	95	58	86	65	69	36	76	49	60	47	38	29	61	50	87	62	68	56	75	62
3	95	77	99	70	100	63	81	67	58	44	62	35	66	54	38	27	76	59	88	66	73	58	90	68
4	90	77	100	69	94	67	88	65	71	45	77	42	71	47	39	20	81	56	95	62	81	64	93	73
5	96	74	99	75	97	65	90	66	72	55	63	43	68	46	43	24	69	58	99	63	88	61	89	72
6	96	76	100	78	91	70	88	68	79	52	68	40	74	53	46	25	62	53	79	62	87	65	85	58
7	96	76	84	76	95	66	90	67	84	52	80	38	70	52	52	28	62	36	62	44	85	67	95	68
8	94	77	79	64	94	65	90	73	75	55	57	36	76	53	54	38	57	34	61	37	94	66	96	77
9	96	74	77	62	93	67	89	73	69	44	80	45	64	50	63	33	77	40	71	40	97	72	95	77
10	97	77	80	58	92	69	90	71	83	56	57	31	76	41	63	47	58	45	81	45	88	71	92	75
11	101	74	82	62	92	72	88	69	74	60	40	30	64	50	69	52	55	51	72	46	92	69	92	75
12	105	74	88	61	77	59	89	64	78	52	41	19	51	41	68	39	51	32	83	44	91	63	92	72
13	107	76	90	65	85	52	89	61	82	53	52	30	56	28	47	33	32	23	84	58	90	70	90	75
14	105	76	93	68	87	53	86	63	78	61	53	24	68	42	52	32	27	16	91	65	91	66	94	74
15	103	75	89	68	90	56	86	64	68	53	64	20	58	38	70	30	32	20	88	66	88	65	94	72
16	89	76	90	64	92	57	83	65	81	42	76	42	73	34	75	47	42	20	88	51	87	67	87	71
17	102	73	87	68	90	57	75	52	69	46	57	26	70	39	76	56	49	30	98	62	87	62	85	68
18	103	74	92	66	86	57	78	50	55	32	48	23	73	37	56	36	68	43	95	70	85	68	89	63
19	100	74	93	69	83	64	76	48	69	30	73	38	74	56	48	29	71	36	70	42	87	67	90	65
20	98	74	92	69	84	63	78	41	56	35	59	30	65	50	67	43	71	41	76	38	76	58	91	67
21	102	75	93	68	89	60	84	46	63	27	77	36	68	48	74	47	62	44	86	50	81	60	91	68
22	103	73	93	65	93	57	85	45	77	32	62	39	52	38	80	58	70	49	91	70	91	63	91	65
23	105	76	92	67	94	60	65	48	64	42	55	28	64	32	84	53	77	46	96	69	94	71	91	64
24	104	81	98	70	81	58	65	38	72	42	28	9	57	40	83	59	78	53	86	63	91	71	91	67
25	97	79	100	70	89	59	69	36	74	45	25	7	65	33	69	51	90	60	80	55	95	70	94	69
26	93	72	101	71	93	68	66	36	76	61	43	7	74	40	75	47	88	65	78	48	90	74	90	67
27	97	74	100	68	90	70	69	41	77	54	65	28	63	50	83	56	68	49	81	48	84	65	91	63
28	93	76	95	65	83	72	81	40	54	34	80	46	50	36	65	25	84	39	79	63	76	66	83	65
29	97	74	90	64	89	71	90	49	59	24	78	41	55	37	44	32	87	52	72	57	80	63	80	70
30	98	72	90	65	89	72	60	45	68	32	41	30	43	27	......	......	79	62	72	48	90	61	90	73
31	98	70	92	63	......	......	49	40	......	......	40	33	41	31	......	......	76	61	......	......	78	69	......	......
Range	37°		43°		48°		54°		60°		63°		49°		64°		74°		62°		43°		38°	

Elevation of thermometers above ground, 7 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, FORT KEOGH, MONT.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	80	50	75	61	94	57	70	52	31	15	21	7	43	20	38	15	40	10	38	24	83	34	72	38
2	75	53	87	50	79	55	70	39	46	21	32	11	33	20	35	12	42	18	55	30	86	40	82	46
3	83	55	82	57	79	40	85	49	56	21	30	8	40	10	30	15	36	10	30	17	76	52	80	58
4	90	57	94	55	81	48	87	39	59	32	32	9	33	5	29	15	36	17	45	18	75	48	65	49
5	92	68	90	55	68	50	90	48	62	26	38	11	30	— 5	40	8	44	15	42	20	82	48	67	49
6	89	58	94	52	71	37	60	43	64	29	12	zero.	13	—10	32	15	35	zero.	52	18	67	42	78	43
7	90	52	85	51	74	37	60	43	46	32	9	zero.	21	zero.	40	7	32	— 6	52	22	64	34	79	47
8	97	54	95	51	82	57	46	40	46	26	15	—12	40	— 8	30	5	30	5	70	25	60	39	64	49
9	100	65	97	58	96	49	47	35	48	23	10	—12	11	—17	40	3	38	zero.	73	33	57	37	70	45
10	89	57	93	60	70	48	57	35	47	19	— 1	—15	38	—10	38	4	40	20	65	27	74	28	73	44
11	98	60	85	60	72	44	59	41	60	19	5	—19	39	—18	38	15	— 3	—10	80	35	90	40	60	39
12	91	65	86	52	69	46	77	36	60	30	18	— 7	12	—10	30	— 4	5	—10	70	41	97	49	75	46
13	91	55	92	59	82	35	60	37	46	19	32	— 2	46	— 6	35	5	12	—24	42	24	78	52	73	50
14	90	52	85	58	82	41	60	38	46	23	6	— 2	34	— 2	45	5	22	— 1	40	16	56	45	89	53
15	93	52	89	55	83	42	58	45	47	24	28	—12	46	19	40	20	22	— 5	62	20	76	36	69	52
16	100	66	96	57	74	45	61	36	43	21	30	2	44	28	20	zero.	38	— 1	62	32	84	46	80	40
17	99	69	81	63	68	38	67	33	45	23	2	—28	50	28	8	— 7	48	10	49	33	65	56	94	57
18	86	61	87	55	68	34	67	35	56	19	1	7	46	20	20	—19	42	9	44	24	70	47	94	62
19	91	60	94	51	73	40	76	34	45	30	1	— 6	45	11	30	11	40	30	52	14	70	41	100	70
20	87	54	94	63	79	49	68	35	48	18	2	— 8	50	17	38	11	43	23	67	25	76	36	78	58
21	84	58	97	61	71	45	58	34	52	15	zero.	—10	40	21	48	6	50	30	73	30	64	50	85	49
22	84	58	91	69	60	43	50	33	50	30	— 6	—18	49	16	50	28	54	31	67	35	70	35	86	49
23	74	55	89	62	67	33	59	21	50	20	—19	—35	38	12	54	18	61	32	51	32	59	48	86	53
24	75	57	79	61	79	44	70	38	45	25	—15	—46	48	20	52	24	65	30	52	25	59	39	94	53
25	75	55	87	40	80	43	58	37	44	11	15	—19	42	19	42	25	72	29	46	22	56	45	95	60
26	82	50	93	55	80	43	60	29	22	9	42	10	28	— 2	38	— 4	48	31	62	29	65	45	82	61
27	79	53	97	64	80	41	63	43	22	— 5	42	zero.	12	— 8	— 4	—15	52	27	64	30	76	46	70	50
28	87	56	90	64	78	51	62	41	31	5	6	— 6	8	—12	20	—17	70	32	48	36	72	50	78	42
29	98	55	70	54	65	45	47	27	42	20	6	—25	19	— 9	33	— 5	53	31	70	25	61	49	91	46
30	96	61	76	53	71	35	29	19	40	21	16	—20	26	— 5	......	......	42	30	80	36	61	40	80	52
31	96	69	87	48	......	......	39	12	......	......	41	10	41	19	......	......	43	23	......	......	65	38	......	......
Range	50°		57°		63°		78°		69°		88°		68°		73°		96°		66°		69°		62°	

Elevation of thermometers above ground, 14 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, FORT McKAVETT, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	99	70	100	70	89	64	88	62	58	40	70	40	51	37	35	30	68	49	77	64	61	54	82	65
2	99	70	97	72	94	54	83	60	72	35	74	53	64	49	43	28	64	56	82	63	68	54	83	64
3	(*)	(*)	97	70	100	63	80	62	72	40	72	38	64	51	40	27	77	61	86	52	75	59	93	71
4	......	......	97	69	96	60	82	63	72	49	75	52	66	44	47	20	86	62	88	52	84	57	93	70
5	97	71	95	69	97	60	85	65	78	58	62	36	68	48	45	19	85	56	95	62	85	63	90	68
6	97	71	96	72	98	63	86	65	82	38	75	38	71	53	47	21	76	57	90	68	87	63	89	66
7	96	71	82	66	94	61	86	64	78	57	78	47	71	57	45	27	74	41	72	41	88	65	93	70
8	96	70	78	65	93	60	(†)	67	78	62	61	40	72	51	57	35	60	36	57	36	91	67	95	72
9	96	69	69	60	91	68	......	66	82	54	75	50	68	55	64	39	73	43	71	31	90	68	93	71
10	98	70	71	60	90	66	......	69	78	63	60	34	72	48	70	50	69	52	78	40	96	70	93	73
11	102	71	82	63	86	67	......	66	72	49	44	26	68	53	76	57	65	53	82	41	89	67	94	74
12	105	72	86	66	74	59	......	66	80	37	48	21	53	39	66	45	52	37	80	50	88	65	89	75
13	106	74	89	67	76	56	......	62	80	57	44	32	59	29	55	29	36	25	79	56	87	67	87	72
14	103	72	93	64	83	52	......	62	78	54	60	33	65	43	51	30	27	18	86	61	89	65	90	72
15	101	72	89	69	89	54	......	62	73	45	64	21	59	35	66	30	33	19	87	66	87	65	92	71
16	101	74	90	59	88	52	......	62	81	49	70	44	71	39	70	42	53	19	91	54	86	66	92	72
17	101	76	90	63	88	53	......	48	67	41	54	31	70	47	76	51	55	34	93	63	79	66	89	70
18	102	76	91	65	86	56	......	41	50	30	64	26	72	47	59	34	72	43	93	69	86	67	93	69
19	101	74	93	64	84	57	......	44	65	27	66	53	71	52	46	32	73	37	74	50	89	68	92	67
20	102	73	91	66	84	62	......	35	54	35	78	41	73	47	61	41	70	50	82	44	79	64	93	68
21	103	71	95	67	86	53	......	34	65	28	75	56	68	40	81	42	56	50	85	57	90	60	90	68
22	103	73	91	64	91	56	......	43	70	33	73	53	57	36	81	51	65	51	87	61	92	67	94	65
23	104	73	92	63	91	56	......	47	68	38	78	60	59	27	82	47	73	55	93	68	91	67	95	64
24	104	75	101	66	86	54	......	37	66	50	65	11	58	41	78	60	67	54	90	71	91	68	98	66
25	101	74	100	69	87	64	70	38	69	51	30	8	63	25	68	46	79	59	84	58	91	68	100	71
26	102	76	100	70	86	64	65	37	72	59	50	10	72	41	71	42	88	60	90	48	91	73	96	72
27	102	73	100	69	85	65	68	43	77	56	65	28	71	39	75	56	71	49	80	58	91	68	96	74
28	105	73	95	67	79	68	75	31	59	34	78	41	59	44	64	31	81	40	80	63	83	69	93	68
29	101	77	93	64	87	64	83	45	59	25	79	53	71	41	50	33	80	53	70	60	92	65	95	65
30	95	71	95	60	86	68	65	51	64	34	74	55	64	38	......	......	72	56	65	54	90	68	95	72
31	96	63	88	61	......	......	54	40	......	......	55	37	38	30	......	......	83	61	......	......	91	67	......	......
Range	......	......	42°		48°		......	......	57°		71°		48°		63°		70°		64°		42°		36°	

* Observer absent on repair duty.

† Maximum thermometer broken.

Elevation of thermometers above ground, 5 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, FORT SHAW, MONTANA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	*38	21	80	37	67	42
2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	23	13	72	39	73	43
3	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	15	7	65	41	70	39
4	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	35	— 4	66	45	54	45
5	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	42	18	69	41	68	40
6	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	50	16	51	38	69	45
7	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	62	19	59	37	69	48
8	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	68	31	53	35	66	49
9	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	74	36	53	34	51	42
10	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	76	23	61	22	57	39
11	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	75	35	62	40	53	45
12	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	49	23	62	44	71	41
13	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	24	16	55	39	78	43
14	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	49	11	40	33	79	45
15	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	57	32	60	32	73	41
16	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	38	28	69	34	79	39
17	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	40	24	69	41	87	45
18	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	47	22	68	41	96	47
19	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	54	25	73	41	78	53
20	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	58	28	69	37	68	41
21	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	68	30	58	45	71	41
22	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	57	38	63	42	75	45
23	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	38	27	61	39	86	48
24	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	45	26	60	40	89	48
25	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	58	21	51	41	89	50
26	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	63	28	67	35	61	53
27	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	60	34	75	45	72	40
28	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	55	34	72	54	82	39
29	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	76	31	55	40	82	44
30	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	80	32	62	36	79	57
31	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	66	35	......	......
Range	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	84°		58°		57°	

* Observations commenced April 1, 1880.

Elevation of thermometers above ground, 6.5 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, FORT SILL, IND. TER.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	88	73	97	69	90	63	87	65	57	38	70	41	44	33	50	30	60	33	84	59	61	52	64	56
2	88	72	100	76	95	57	85	69	68	33	59	41	61	44	51	33	53	44	87	64	66	56	80	55
3	90	75	99	78	92	62	81	65	62	33	61	31	67	54	40	28	75	53	88	54	74	58	82	65
4	89	74	100	71	89	67	87	60	71	41	72	40	67	48	45	22	81	52	93	54	82	64	90	72
5	88	73	100	74	93	63	90	68	74	47	56	40	62	52	45	22	64	50	96	50	88	64	87	73
6	94	74	99	75	95	63	86	69	73	56	63	34	66	42	53	24	56	50	76	56	90	67	81	62
7	94	75	93	73	95	67	88	68	82	55	65	35	65	48	55	26	54	28	56	44	80	68	92	63
8	93	76	73	63	94	57	88	71	70	45	46	29	70	40	58	36	54	34	62	40	94	67	94	72
9	94	76	79	57	92	66	87	73	71	34	74	33	66	46	62	29	54	39	73	56	97	68	92	72
10	96	73	83	56	92	73	88	68	83	52	41	27	66	38	66	39	55	37	84	47	93	69	90	73
11	97	76	83	60	91	61	87	67	76	57	31	22	57	44	70	60	55	42	73	41	93	69	88	72
12	92	74	84	61	76	52	88	64	74	45	40	17	48	32	53	32	43	24	82	46	90	71	85	70
13	102	75	90	66	84	46	89	66	78	43	47	24	52	23	36	24	26	16	83	58	93	67	85	72
14	101	71	92	70	83	52	88	68	76	45	46	23	58	33	47	23	22	10	90	62	90	65	93	73
15	101	77	89	63	91	53	83	69	66	40	51	20	58	32	60	30	26	18	85	68	89	63	88	73
16	99	75	84	65	88	55	81	60	80	45	63	33	68	36	71	41	37	17	84	44	88	67	83	63
17	96	71	85	64	88	57	73	50	57	38	43	21	66	40	70	40	47	27	96	56	87	62	82	62
18	100	70	90	67	86	54	76	45	52	29	42	25	71	39	43	29	58	33	86	69	88	67	84	61
19	102	76	92	69	78	58	74	45	68	25	66	29	75	55	49	27	66	33	69	39	83	60	84	64
20	100	81	92	65	80	58	77	41	49	27	36	28	65	41	56	40	62	42	76	41	76	58	86	67
21	100	75	91	67	86	60	83	45	61	27	66	27	63	39	65	37	65	44	83	52	80	56	87	64
22	103	76	91	65	91	62	78	48	74	34	56	24	64	35	77	48	72	45	93	62	86	63	86	61
23	105	79	91	65	91	58	62	43	66	39	31	17	60	30	79	51	78	47	93	67	90	66	87	61
24	93	76	94	65	74	53	65	36	72	42	17	2	51	40	79	60	80	53	93	60	86	67	90	66
25	96	73	92	68	88	51	68	40	70	46	32	4	60	32	76	46	88	59	76	54	90	69	93	67
26	92	69	98	69	92	60	68	36	71	62	43	8	69	37	75	42	87	62	71	46	88	66	94	71
27	90	70	96	71	90	69	70	38	70	43	66	20	53	33	77	33	67	46	80	48	69	65	90	64
28	88	68	90	63	82	71	82	44	47	30	75	40	41	27	35	17	78	38	70	58	65	60	80	64
29	93	67	88	63	85	72	82	41	55	26	62	24	43	32	50	29	80	49	66	54	81	59	84	63
30	98	70	88	61	85	73	60	40	63	30	31	19	43	31	......	......	80	57	72	42	89	60	83	64
31	96	70	91	60	......	......	49	40	......	......	35	28	45	27	......	......	71	58	......	......	78	52	......	......
Range	38°		44°		49°		54°		58°		73°		52°		62°		78°		60°		47°		39°	

Elevation of thermometers above ground, 5 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, FORT STEVENSON, DAK. TER.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	76	59	75	54	82	48	77	36	20	10	20	1	(*)	......	26	1	21	—5	30	21	83	42	61	37
2	75	52	74	44	67	48	67	37	18	9	12	0	......	......	26	6	33	6	37	20	85	43	77	46
3	72	57	76	50	69	33	83	31	33	15	14	7	......	......	18	5	8	—3	30	17	75	48	74	46
4	81	51	84	47	79	37	80	35	47	18	14	11	......	......	20	4	26	—2	26	13	64	44	67	53
5	86	64	85	56	64	48	85	48	49	15	23	—9	......	......	27	3	29	—6	40	15	74	46	67	51
6	86	61	66	47	60	36	79	56	50	30	23	—5	7	—1	9	1	32	10	30	10	68	50	64	45
7	79	54	73	43	62	32	58	36	49	30	—2	—15	9	—2	33	—2	8	—22	40	20	64	39	74	52
8	89	54	79	47	72	40	50	41	34	20	6	—6	30	—9	5	—11	10	—10	64	26	66	38	72	55
9	85	62	91	51	77	50	51	40	44	18	3	—1	—4	—17	26	zero.	8	—11	62	30	54	42	67	51
10	80	62	83	52	62	49	62	34	43	20	—1	—9	25	—10	35	1	10	—2	40	25	56	33	75	44
11	87	57	69	51	71	35	59	39	52	20	(*)	......	10	—15	30	7	—2	—16	50	24	76	31	62	55
12	93	64	64	48	65	42	58	31	43	30	......	......	—10	—31	11	—2	zero.	—18	62	35	89	55	64	50
13	87	61	77	45	66	32	84	51	50	18	—12	—15	35	—19	34	9	5	—23	37	20	88	63	72	48
14	80	57	77	55	81	44	62	40	46	23	(*)	......	13	—5	32	5	15	—15	20	10	80	52	70	57
15	84	48	79	48	63	37	50	44	30	24	......	......	42	13	25	13	5	—13	53	5	75	50	70	54
16	81	56	82	49	73	38	44	41	28	22	......	......	37	20	20	3	15	—15	62	26	80	54	74	52
17	80	60	85	48	57	40	55	34	26	18	—4	—24	40	23	—5	—10	30	zero.	50	32	(*)	......	78	55
18	89	59	75	50	57	26	70	34	50	23	—7	—13	33	12	(*)	......	42	15	30	20	......	......	81	57
19	81	61	83	50	62	32	71	35	20	5	—8	—14	17	4	......	......	25	16	40	20	56	43	86	65
20	85	62	83	50	71	38	63	38	30	3	—8	—14	28	9	......	......	45	15	51	18	60	35	70	60
21	82	62	87	59	62	36	59	34	38	20	—9	—20	22	12	......	......	51	23	64	30	72	46	78	54
22	70	56	87	59	59	33	47	28	32	18	—15	—26	26	—4	34	23	42	29	48	34	64	46	81	58
23	71	58	89	59	64	24	47	24	(*)	......	—23	—36	30	8	50	20	40	17	36	33	65	44	80	49
24	72	59	86	60	70	25	56	30	......	......	—26	—46	21	zero.	39	9	48	30	35	32	65	42	80	56
25	74	55	79	42	78	39	55	34	......	......	—5	—35	43	15	36	9	58	25	45	30	55	50	90	50
26	73	50	82	41	70	49	56	26	......	......	(*)	......	18	3	25	—3	40	31	54	29	58	42	82	60
27	68	51	84	52	77	40	58	37	......	......	......	......	—6	—17	—8	—14	35	28	60	30	65	41	67	46
28	79	45	90	69	78	51	55	33	11	5	......	......	—3	—24	—5	—15	40	22	44	35	78	50	65	48
29	85	53	77	55	62	45	42	28	29	5	......	......	12	—3	11	—15	52	35	48	29	64	48	78	46
30	96	60	74	50	68	33	20	17	29	17	15	—26	17	—9	......	......	32	25	77	36	55	44	70	56
31	81	61	81	46	......	......	48	11	......	......	27	—2	14	1	......	......	36	20	......	......	60	36	......	......
Range	51°		50°		58°		74°		......	......	......	......	......	......	......	......	......	......	72°		......	......	46°	

Elevation of thermometers above ground, 7 feet.

* Observer absent on repair duty.

Maximum, minimum and mean temperatures—Continued.

STATION, FORT VERDE, ARIZ.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	95	48	(*)	......	100	61	84	56	74	39	64	31	55	30	37	14	69	27	76	37	85	41	92	49
2	95	56	......	......	99	62	89	56	75	41	62	38	55	30	42	10	66	29	68	47	88	47	98	49
3	100	51	......	......	98	66	87	50	69	41	58	31	55	30	40	19	63	39	72	47	88	46	95	50
4	100	52	......	......	99	62	87	50	74	39	56	34	52	28	38	15	58	42	78	42	90	47	93	53
5	102	72	......	......	96	59	75	57	72	35	57	27	56	29	45	15	60	36	81	42	88	51	89	55
6	99	70	......	......	98	57	82	57	72	37	60	29	48	31	45	17	65	30	81	45	81	57	95	45
7	101	71	97	72	98	58	79	51	72	35	60	29	58	31	45	18	62	28	75	37	79	38	95	45
8	98	70	98	68	96	61	68	53	60	37	60	30	58	42	48	22	67	26	78	46	85	42	99	55
9	98	73	99	68	99	60	74	37	57	41	63	34	59	27	52	26	69	27	78	40	88	48	91	69
10	95	71	100	65	95	59	79	37	51	41	52	20	58	30	52	33	68	40	79	36	89	51	85	66
11	98	70	102	61	98	59	82	40	56	37	50	30	54	30	48	32	65	31	84	38	88	48	90	46
12	98	75	104	66	100	60	86	42	61	38	57	22	56	24	45	28	63	41	83	42	82	50	89	49
13	101	63	103	66	98	56	79	59	59	42	56	22	54	24	50	22	60	37	71	48	72	50	88	50
14	100	71	104	65	95	62	68	48	58	32	62	25	60	24	50	25	51	33	67	38	82	37	95	48
15	99	73	104	65	97	56	65	35	65	32	60	27	63	27	54	24	50	27	65	45	84	37	97	53
16	92	67	104	66	96	55	69	37	62	35	60	25	58	26	58	32	55	25	73	42	84	40	103	51
17	89	64	101	63	98	57	79	35	57	34	61	25	63	27	54	36	53	34	64	44	82	45	103	57
18	96	62	97	71	97	59	82	39	59	34	64	26	63	34	59	25	56	37	54	37	87	43	103	63
19	100	55	98	67	97	55	80	45	66	29	64	27	65	31	64	25	60	32	64	29	90	50	96	68
20	100	67	99	64	92	55	82	40	68	30	64	37	61	29	65	25	61	30	74	36	96	53	93	65
21	102	66	100	61	95	55	82	40	68	29	57	46	62	26	65	37	68	37	81	51	94	52	96	64
22	94	78	98	65	94	58	82	41	62	29	53	34	62	27	65	34	73	32	74	50	97	53	97	59
23	104	70	99	55	95	55	82	42	64	29	50	32	61	26	61	34	78	32	70	50	92	55	96	60
24	102	67	100	61	95	55	80	42	62	29	40	18	59	22	54	27	73	32	64	35	91	59	97	59
25	105	70	101	63	92	56	80	42	64	28	39	6	60	22	59	25	72	39	76	35	81	49	98	57
26	107	74	104	62	89	55	75	45	60	34	40	10	59	43	62	27	62	42	80	36	78	44	100	54
27	92	75	101	72	65	62	75	43	51	29	44	32	50	37	62	29	71	29	80	38	88	50	102	55
28	100	67	95	66	77	53	77	37	53	25	57	40	40	31	58	30	76	32	80	37	86	44	102	57
29	103	74	95	55	80	57	79	48	56	26	53	41	36	12	62	25	73	32	79	41	95	46	101	55
30	103	72	96	54	82	56	75	42	59	28	47	27	29	8	......	......	72	39	78	55	93	51	104	58
31	......	......	100	57	......	......	75	42	......	......	56	32	38	15	......	......	73	31	......	......	91	51	......	......
Range	59°		....		47°		54°		50°		58°		57°		55°		53°		55°		60°		59°	

Elevation of thermometers above ground, 6 feet.

*Observer absent on repair duty.

Maximum, minimum and mean temperatures—Continued.

STATION, FREDERICKSBURG, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	95	60	94	69	95	75	87	60	80	40	70	24	67	45	67	35	72	35	72	60	65	52	88	70
2	95	59	94	67	98	75	86	60	72	38	72	35	77	40	58	30	67	34	84	60	65	52	83	69
3	85	59	95	68	100	74	87	65	74	38	75	40	68	42	57	34	74	33	88	52	68	47	85	69
4	90	58	93	67	100	70	85	60	(*)	......	(*)	......	66	42	60	34	87	35	93	50	86	47	87	67
5	92	61	92	69	100	74	86	60	85	48	......	......	(*)	......	60	40	86	34	94	52	85	48	87	67
6	92	58	94	68	92	75	85	71	84	40	......	......	76	42	52	34	79	39	90	52	81	41	85	65
7	94	57	90	67	93	75	85	60	76	43	76	40	70	46	50	34	(*)	......	75	44	83	45	86	69
8	95	61	95	68	92	70	85	60	85	45	76	35	74	45	57	37	......	......	62	37	82	44	85	70
9	93	68	77	69	87	70	(*)	......	83	40	76	40	81	48	62	38	74	34	70	35	81	39	90	69
10	93	58	78	58	85	70	......	......	82	43	70	30	75	40	67	50	64	30	75	38	86	34	87	70
11	96	60	80	58	85	70	87	50	79	40	70	28	70	40	77	52	63	28	85	40	86	55	85	70
12	98	63	84	56	75	70	85	60	80	42	55	20	65	33	75	50	62	25	84	35	87	45	84	70
13	95	66	84	58	80	70	85	70	82	40	65	20	63	30	64	35	50	27	75	35	80	40	86	70
14	100	64	88	68	86	69	(*)	......	80	40	70	35	65	40	58	36	36	20	85	49	87	45	87	67
15	95	64	85	68	87	65	......	......	85	44	68	33	70	34	64	31	37	18	92	48	85	56	86	69
16	97	64	92	68	90	55	86	59	84	42	70	36	74	43	70	30	57	20	91	50	86	64	91	67
17	99	61	90	67	90	59	86	50	74	46	76	40	78	44	73	29	52	20	90	50	82	64	88	68
18	100	64	86	68	88	69	(*)	......	75	30	60	30	73	38	65	35	74	28	90	50	82	65	85	65
19	95	64	85	67	90	65	84	58	74	30	70	40	70	39	56	25	75	40	90	51	85	60	86	62
20	95	64	86	68	90	70	(*)	......	67	30	80	43	72	45	60	40	71	40	91	52	83	60	87	64
21	97	64	90	(†)	90	60	......	......	70	25	80	45	78	39	85	40	58	46	79	45	90	60	86	63
22	101	65	96	......	92	65	86	40	70	27	76	44	69	35	85	40	70	52	80	45	86	61	92	67
23	100	68	98	......	94	65	75	50	72	36	75	40	65	30	80	45	75	54	95	66	85	60	90	60
24	98	69	101	......	95	60	75	43	71	40	67	16	66	38	77	38	73	52	85	60	86	62	89	60
25	96	68	101	......	85	74	72	35	70	44	35	10	70	30	72	40	73	56	83	50	86	64	92	67
26	98	77	100	......	85	70	71	36	71	45	48	20	70	33	73	46	86	56	86	50	90	65	92	67
27	97	74	96	......	85	60	76	36	77	27	62	30	82	35	75	50	73	52	77	48	90	56	93	70
28	96	68	96	......	80	50	82	39	76	25	72	35	70	39	74	35	80	42	80	45	80	62	92	69
29	96	68	95	74	85	60	85	39	60	25	78	45	73	36	59	35	81	47	77	47	85	66	90	70
30	92	68	94	75	86	65	82	41	65	30	76	40	66	40	......	......	79	47	77	47	87	68	90	67
31	96	69	93	70	......	......	80	39	......	......	67	42	50	33	......	......	68	55	......	......	88	69	......	......
Range	44°		......		50°		......		......		......		......		60°		......		60°		56°		33°	

*Observer absent on repair duty.

†Minimum thermometer broken.

Elevation of thermometers above ground, 17 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, GALVESTON, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	91	81	85	73	89	76	79	72	58	46	66	54	67	60	53	45	64	54	76	67	71	56	89	79
2	91	82	90	79	89	75	81	74	64	52	72	62	68	62	49	40	71	62	75	70	72	64	88	80
3	90	79	91	80	90	77	83	74	68	55	73	67	71	61	53	40	74	66	79	71	75	65	88	79
4	90	81	91	82	87	77	83	74	72	61	72	66	70	62	50	40	75	67	77	70	78	70	89	79
5	91	81	91	80	87	76	86	75	74	67	69	57	74	66	51	45	77	69	77	69	80	69	89	79
6	90	80	90	81	87	77	82	75	79	67	67	53	74	67	53	45	77	68	79	70	80	70	87	79
7	89	81	91	82	85	76	83	76	78	69	72	64	74	66	55	41	77	70	79	65	82	72	89	78
8	91	81	91	82	86	79	86	78	78	70	74	67	73	64	59	48	72	61	67	46	82	73	89	80
9	90	81	90	78	83	78	86	78	79	72	75	67	74	66	58	51	64	57	69	54	83	74	89	80
10	91	82	80	71	84	75	84	78	79	71	75	54	74	64	64	55	72	59	71	53	84	74	87	77
11	91	81	80	72	85	78	85	77	79	71	55	47	74	66	72	61	75	69	77	57	85	74	82	75
12	91	81	78	72	84	75	83	76	80	72	52	36	75	59	69	58	72	63	71	64	87	76	85	77
13	91	81	81	72	80	72	83	76	79	72	53	40	60	47	60	45	63	54	77	66	85	73	88	79
14	92	82	86	73	82	71	82	75	79	72	52	42	69	55	64	49	55	44	78	69	83	68	88	80
15	91	83	86	71	81	71	83	75	80	73	56	45	69	64	60	46	46	40	78	71	82	72	88	79
16	90	78	83	74	81	70	86	74	79	71	68	52	71	63	66	55	48	37	79	71	79	73	91	78
17	88	72	85	74	82	72	86	73	78	62	72	60	72	64	70	61	58	39	79	71	82	73	85	73
18	86	80	86	76	83	72	75	64	62	51	66	49	67	61	74	55	74	57	79	72	83	73	88	74
19	90	80	87	77	86	73	73	62	57	45	71	62	72	61	57	48	67	53	78	68	84	75	89	77
20	90	80	86	76	86	73	69	56	59	49	72	65	74	66	63	54	67	57	76	59	79	70	88	77
21	90	78	87	75	84	69	72	61	63	51	72	64	73	66	68	60	62	58	79	68	84	69	85	75
22	90	79	83	71	84	71	74	63	66	50	73	66	68	55	72	61	64	56	80	72	85	73	84	69
23	91	79	89	74	81	72	79	63	71	57	74	67	59	50	73	63	68	59	80	73	85	76	78	69
24	90	81	89	79	83	77	66	53	73	64	70	37	60	55	73	64	70	60	81	73	86	77	82	68
25	90	81	90	80	83	76	67	51	74	65	37	28	59	49	71	60	73	65	80	74	86	78	87	78
26	89	81	88	80	83	75	67	62	76	68	42	24	65	50	72	61	76	68	78	70	87	77	87	77
27	89	80	86	77	84	76	72	58	75	69	61	40	72	58	72	66	72	63	76	72	88	78	88	80
28	91	81	84	74	85	76	73	61	73	55	68	60	72	65	76,	53	73	60	81	73	87	78	88	73
29	92	81	87	75	85	77	75	60	58	43	71	61	72	64	59	49	73	59	78	63	88	79	87	74
30	91	70	88	73	83	76	78	60	56	47	74	62	73	59	......	......	73	65	74	64	88	79	88	78
31	87	76	86	77	......	......	73	58	......	......	67	61	59	51	......	......	75	66	......	......	90	80	......	......
Range	22°		20°		21°		35°		37°		51°		28°		34°		40°		35°		34°		23°	
Monthly mean	84°.4		81°.3		79°.3		73°.2		66°.4		59°.7		64°.6		58°.2		63°.7		71°.4		77°.7		81°.5	

Elevation of thermometers above ground, 36 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m., and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, GRAHAM, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	98	77	99	73	92	64	90	64	54	39	71	43	45	34	(*)	......	......	......	......	......	......	......	......	......
2	97	76	100	76	94	58	88	68	67	32	78	46	63	45	......	......	......	......	......	......	......	......	......	......
3	98	78	100	76	100	60	80	67	65	44	61	32	68	55	......	......	......	......	......	......	......	......	......	......
4	93	75	101	75	94	63	87	65	74	45	77	39	68	47	......	......	......	......	......	......	......	......	......	......
5	97	74	102	76	97	67	88	68	72	62	60	40	69	49	......	......	......	......	......	......	......	......	......	......
6	100	76	100	77	99	73	89	68	80	60	67	35	75	51	......	......	......	......	......	......	......	......	......	......
7	100	77	88	74	99	66	91	69	83	59	80	38	73	51	......	......	......	......	......	......	......	......	......	......
8	100	78	88	64	97	62	92	74	76	55	55	35	77	44	......	......	......	......	......	......	......	......	......	......
9	102	76	79	61	95	68	92	74	76	41	79	41	65	45	......	......	......	......	......	......	......	......	......	......
10	102	76	83	60	93	71	91	71	82	57	58	29	76	37	......	......	......	......	......	......	......	......	......	......
11	105	79	83	62	94	74	88	69	76	55	39	24	67	52	......	......	......	......	......	......	......	......	......	......
12	108.5	83	80	63	79	58	89	64	76	48	41	16	52	36	......	......	......	......	......	......	......	......	......	......
13	108.5	82	90	68	85	47	90	62	83	55	49	36	56	22	......	......	......	......	......	......	......	......	......	......
14	106	76	92	70	88	48	89	65	78	58	53	20	70	40	......	......	......	......	......	......	......	......	......	......
15	105	77	89	70	93	53	89	67	70	48	59	18	61	40	......	......	......	......	......	......	......	......	......	......
16	99	77	88	65	94	52	84	66	81	41	73	41	73	36	......	......	......	......	......	......	......	......	......	......
17	101	73	86	65	92	55	72	52	70	41	52	22	68	31	......	......	......	......	......	......	......	......	......	......
18	103	73	91	68	87	56	80	47	57	30	42	17	75	29	......	......	......	......	......	......	......	......	......	......
19	103	78	92	70	83	64	75	42	69	25	74	29	73	57	......	......	......	......	......	......	......	......	......	......
20	102	81	92	68	86	63	76	37	55	30	57	32	69	45	......	......	......	......	......	......	......	......	......	......
21	103	78	92	70	89	56	82	36	62	22	75	30	67	47	......	......	......	......	......	......	......	......	......	......
22	105	74	93	64	94	57	86	41	75	26	67	32	53	34	......	......	......	......	......	......	......	......	......	......
23	107	79	92	66	93	55	66	48	67	31	49	23	64	25	......	......	......	......	......	......	......	......	......	......
24	104	79	97	67	84	56	64	35	73	41	24	8	61	42	......	......	......	......	......	......	......	......	......	......
25	97	77	99	70	92	58	67	40	74	46	14	6	64	28	......	......	......	......	......	......	......	......	......	......
26	95	74	101	77	92	68	68	34	75	61	42	2	74	41	......	......	......	......	......	......	......	......	......	......
27	99	74	98	69	92	71	71	36	78	51	68	29	60	43	......	......	......	......	......	......	......	......	......	......
28	96	75	95	69	84	72	78	32	47	29	80	46	47	30	......	......	......	......	......	......	......	......	......	......
29	100	75	90	66	93	72	89	42	55	19	78	40	60	37	......	......	......	......	......	......	......	......	......	......
30	100	70	91	69	90	69	65	45	64	30	40	26	42	32	......	......	......	......	......	......	......	......	......	......
31	99	68	91	63	......	......	55	40	......	......	35	30	41	30	......	......	......	......	......	......	......	......	......	......
Range	40°.5		42°.0		53°.0		60°.0		64°.0		78°.0		53°.0		......	......	......	......	......	......	......	......	......	......

*Office closed.

Elevation of thermometers above ground, 6 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, GRAND HAVEN, MICH.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	80	58	82	63	76	64	76	63	34	30	44	40	40	26	22	9	34	23	48	36	58	40	62	50
2	79	64	83	73	67	63	75	63	34	26	47	40	41	32	28	13	49	30	49	40	61	48	65	48
3	84	70	76	69	66	60	67	49	33	22	43	36	48	31	30	20	54	46	60	45	66	50	70	54
4	73	62	76	65	62	51	71	44	35	24	40	31	48	36	24	17	54	40	50	41	74	53	73	60
5	75	60	79	65	67	42	76	65	34	29	58	40	47	34	32	22	47	32	45	37	68	55	75	62
6	83	60	78	59	65	57	77	63	47	29	58	52	46	37	32	16	42	32	41	31	80	53	74	55
7	76	65	74	58	60	51	79	63	57	47	41	32	45	36	30	16	42	18	37	28	79	59	62	51
8	75	67	64	55	57	50	71	65	67	56	36	30	48	38	40	24	26	9	42	32	74	52	71	50
9	74	67	69	48	57	42	75	63	67	46	50	29	57	37	27	13	39	18	53	37	67	55	74	59
10	81	68	74	49	65	38	75	68	47	33	50	32	39	29	38	24	30	14	47	29	65	49	75	63
11	77	70	76	61	70	46	80	64	60	46	32	19	56	32	50	25	38	24	35	26	60	49	80	67
12	79	63	74	62	67	62	75	66	56	47	24	22	32	24	47	36	26	10	48	24	66	46	76	66
13	82	65	70	61	62	49	71	63	58	45	25	19	34	23	36	25	35	14	61	43	65	50	69	61
14	85	68	70	63	60	45	75	65	57	52	30	18	40	32	33	22	33	20	66	49	65	41	65	53
15	86	71	68	56	62	44	74	62	52	41	30	23	40	19	44	32	34	21	53	40	61	40	73	49
16	81	69	67	47	65	51	78	63	48	38	25	22	48	40	53	31	32	22	47	32	68	45	72	56
17	69	57	68	48	65	54	72	57	41	33	23	18	48	38	57	39	35	21	50	31	73	57	73	57
18	69	54	72	46	58	50	58	44	43	27	24	15	40	35	39	16	46	32	60	44	78	60	72	53
19	74	57	76	50	59	44	50	36	43	35	23	14	44	35	21	9	42	35	64	40	69	57	76	55
20	77	58	80	59	59	40	56	33	25	14	25	13	37	34	41	12	37	28	54	39	64	56	77	57
21	81	60	81	70	62	38	60	36	27	17	15	7	38	32	39	26	47	27	61	43	63	49	76	58
22	77	68	76	68	64	46	64	44	42	27	30	14	39	30	38	31	47	35	62	43	62	49	80	67
23	75	67	74	60	62	51	49	34	42	28	27	16	32	28	40	28	44	26	45	39	69	54	81	69
24	78	63	78	52	53	40	43	31	46	30	32	23	40	28	56	32	31	16	50	35	78	60	80	68
25	77	60	70	54	57	30	48	31	46	29	23	16	47	31	54	36	40	25	54	39	83	66	73	67
26	77	66	69	49	62	37	56	35	37	24	14	6	52	43	58	34	45	34	52	40	80	62	78	67
27	75	64	72	59	66	52	58	50	58	36	37	14	50	37	48	38	47	37	53	36	67	56	75	67
28	78	66	77	60	74	62	52	46	53	30	37	32	37	20	45	36	44	33	62	42	65	52	72	64
29	73	64	78	69	71	63	51	45	30	23	38	28	30	12	36	22	42	29	61	38	69	50	72	60
30	78	55	77	66	72	64	42	36	42	25	28	16	45	29	......	......	47	31	43	36	62	50	72	60
31	80	70	79	57	......	......	36	33	......	......	34	15	30	19	......	......	59	33	......	......	63	50	......	......
Range	32°		36°		46°		49°		53°		52°		45°		49°		50°		42°		43°		33°	
Monthly mean	72°.9		68°.5		58°.2		57°.8		39°.4		28°.9		37°.3		32°.2		34°.2		44°.8		61°.2		67°	

Elevation of thermometers above ground, 23 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, HALIFAX, N. S.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	72.9	51.3	82.5	56.7	70.2	53.9	79.6	53.1	40.8	31.7	38.2	17.3	30.3	7.8	30.4	20.0	39.7	25.0	29.6	24.0	45.4	31.8	76.3	50.1
2	71.3	46.4	82.7	59.1	67.2	53.9	69.5	48.0	38.7	27.8	43.4	34.9	37.6	7.9	20.3	—2.7	25.5	16.6	46.2	19.8	46.0	29.4	70.0	51.3
3	88.0	47.5	87.0	58.0	74.1	55.0	66.8	46.5	32.0	28.0	42.3	34.9	34.2	6.0	30.2	—0.1	34.4	12.5	50.0	24.8	46.3	35.0	59.0	46.0
4	79.0	52.2	76.3	60.0	67.9	54.0	62.4	44.5	37.8	29.0	50.0	33.3	39.5	5.5	37.8	18.0	45.4	31.9	43.0	33.7	62.6	29.5	60.8	42.4
5	66.7	46.3	78.1	55.5	66.5	56.2	60.4	40.8	32.8	26.0	34.4	25.7	38.5	10.5	28.6	18.0	37.7	29.2	49.3	36.0	45.0	37.7	64.8	40.9
6	64.9	41.0	73.7	57.5	71.8	57.6	53.1	36.9	32.0	23.9	38.0	26.9	36.2	6.4	36.4	20.0	29.9	18.2	50.3	31.1	52.0	40.4	61.4	47.0
7	66.6	41.4	75.2	53.9	70.9	58.0	55.8	32.9	39.1	18.9	54.8	37.6	40.2	22.4	21.5	11.2	31.8	15.5	37.0	22.0	50.8	33.9	55.4	43.8
8	64.0	46.9	73.0	52.0	68.2	53.0	63.8	50.4	41.8	22.4	46.6	32.8	39.8	18.9	29.0	8.6	35.0	11.7	33.0	18.0	50.3	29.2	58.0	45.3
9	64.3	51.5	62.0	57.0	71.0	54.0	67.3	53.5	48.6	41.1	33.5	23.0	35.3	19.7	36.2	5.2	19.5	3.0	40.7	22.5	52.3	38.5	56.4	45.0
10	76.8	55.4	66.1	55.7	68.4	50.3	54.1	38.8	61.9	40.5	35.6	21.8	41.8	29.4	16.7	—3.4	32.5	12.0	45.1	29.2	51.7	36.8	77.3	42.6
11	77.9	51.7	74.7	50.2	69.0	51.0	48.2	35.9	41.1	29.8	50.4	35.2	29.8	19.0	30.5	13.0	23.0	2.3	47.1	31.1	66.8	32.0	74.8	49.5
12	66.9	49.5	80.8	55.0	69.5	47.1	56.7	36.7	41.2	31.7	47.3	31.9	37.1	16.0	40.7	13.0	23.3	0.0	34.7	20.0	51.6	41.0	72.0	52.5
13	82.0	49.1	76.6	56.0	70.9	47.0	57.8	36.7	41.3	30.9	32.2	17.0	34.8	15.0	45.3	36.0	21.0	5.9	43.7	18.0	46.8	35.7	76.2	50.0
14	76.5	54.0	75.1	56.8	67.1	46.0	49.2	36.5	42.1	25.4	30.0	15.9	15.0	3.5	37.0	17.2	26.7	9.1	48.4	30.8	46.7	34.3	61.9	49.8
15	82.1	55.4	68.7	52.1	68.9	49.9	52.0	36.2	54.7	41.8	41.4	29.5	31.5	3.4	28.1	12.3	29.0	18.0	39.0	30.0	52.0	34.2	57.7	44.0
16	85.4	58.0	70.4	45.7	65.4	47.0	59.0	40.0	54.4	36.1	36.2	21.9	34.1	22.3	24.9	20.0	26.1	14.0	57.0	33.0	62.4	32.5	70.3	40.1
17	82.7	51.4	60.1	50.2	70.3	57.5	59.3	39.8	46.3	35.0	27.5	18.3	36.0	33.0	30.0	15.4	25.0	14.0	33.8	28.8	54.6	36.2	74.0	43.5
18	62.6	47.8	61.1	55.5	67.0	48.2	57.9	39.8	36.4	28.9	22.0	3.2	36.0	30.4	42.9	23.1	30.2	8.0	34.2	28.0	63.0	36.6	77.2	45.5
19	62.8	45.0	65.0	52.9	68.6	48.2	59.1	37.9	37.2	28.6	21.6	3.6	34.3	29.8	45.0	16.8	35.0	18.1	54.8	26.0	46.3	22.0	83.7	48.1
20	69.9	46.5	60.5	52.8	66.5	51.0	46.2	32.2	38.7	28.0	37.0	3.9	34.4	21.5	19.0	6.6	30.3	19.0	49.4	36.0	59.3	39.3	78.2	52.0
21	73.0	49.1	77.9	49.0	66.8	47.3	56.4	29.8	35.9	20.5	25.0	—8.0	39.2	15.3	37.2	11.9	36.3	13.7	61.8	35.0	70.0	43.0	63.9	51.2
22	70.0	49.8	69.0	56.0	62.0	47.0	57.8	41.2	23.0	13.7	30.8	—9.4	25.1	11.0	38.8	24.0	45.4	24.0	58.0	30.3	74.1	47.3	64.5	49.4
23	69.0	52.0	64.9	57.0	61.0	54.7	63.0	50.2	43.7	22.1	38.3	17.5	42.8	17.0	34.0	19.4	40.3	26.3	43.0	32.1	73.3	46.1	57.3	47.4
24	76.0	58.5	75.1	55.5	63.8	57.0	59.2	34.0	42.9	21.0	34.5	15.0	38.4	31.1	28.9	23.8	36.4	25.1	47.0	25.5	66.5	51.0	58.1	46.0
25	76.5	52.3	68.5	56.0	60.1	37.9	36.6	26.3	41.3	16.3	34.8	12.0	33.3	20.0	43.4	25.0	36.9	25.3	54.5	27.8	61.0	40.0	77.3	42.8
26	71.1	48.0	66.4	54.8	55.7	33.0	48.4	23.4	37.3	27.8	12.3	—5.0	37.4	16.8	35.6	30.0	26.7	14.0	44.1	32.2	53.7	39.5	59.5	43.1
27	61.9	53.1	66.5	51.3	57.7	35.3	56.0	33.0	30.0	21.0	16.0	—3.8	39.7	20.0	48.8	33.0	31.0	8.9	61.3	40.9	58.8	40.0	83.1	56.0
28	71.3	53.8	65.0	49.3	64.5	39.2	57.2	43.4	44.8	28.9	35.1	13.2	47.0	34.0	40.2	30.5	34.5	17.8	49.0	31.0	88.0	43.3	78.7	56.0
29	66.3	53.1	59.1	53.5	65.2	48.0	53.7	45.0	54.3	44.4	43.0	34.1	39.1	8.4	47.3	32.0	33.4	14.3	51.2	27.1	66.5	52.3	72.5	56.0
30	73.4	56.0	61.5	52.3	67.0	54.2	56.5	41.8	49.5	19.3	38.0	6.3	32.0	4.4	......	......	32.5	19.9	48.8	36.5	66.7	43.3	86.3	53.0
31	74.5	59.3	63.1	53.0	......	......	45.0	37.7	......	......	20.0	—6.6	44.0	29.9	......	......	34.9	27.2	......	......	55.0	46.5	......	......
Range	47°.0		38°.0		41°.1		56°.2		48°.2		63°.8		43°.6		52°.2		45°.4		43°.8		58°.6		46°.2	

Maximum, minimum and mean temperatures—Continued.

STATION, HAVANA, CUBA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	87.0	79.0	89.0	80.0	89.0	80.0	87.0	80.0	82.0	76.0	78.0	70.0	78	72	78	70	81	70	77	64	84	76	85	78
2	88.0	80.0	89.0	80.0	90.0	82.0	86.0	80.0	82.0	75.0	79.0	72.0	78	71	88	69	80	71	81	66	85	77	84	77
3	87.0	79.0	88.0	82.0	86.0	79.0	85.0	79.0	81.0	74.0	78.0	71.0	78	72	81	73	80	69	84	70	86	76	86	80
4	85.0	79.0	88.0	81.0	86.0	79.0	82.0	76.0	79.0	75.0	78.0	69.0	80	75	74	71	81	71	81	71	83	78	86	79
5	86.0	80.0	87.0	82.0	88.0	77.0	80.0	75.0	81.0	75.0	77.0	68.0	78	72	79	70	81	71	82	73	83	74	87	78
6	88.0	81.0	88.0	82.0	87.0	80.0	87.0	77.0	83.0	74.0	77.0	70.0	80	72	79	70	82	71	82	72	83	74	86	78
7	88.0	81.0	90.0	82.0	89.0	79.0	86.0	77.0	83.0	76.0	79.0	68.0	80	70	80	70	(*)	......	82	73	83	74	86	77
8	89.0	80.0	90.0	82.0	87.0	79.0	87.0	79.0	83.0	75.0	78.0	69.0	78	72	80	71	......	......	83	71	84	73	83	77
9	89.0	81.0	90.0	83.0	87.0	78.0	85.0	79.0	83.0	76.0	80.0	71.0	79	70	78	70	......	......	83	74	83	73	83	77
10	89.0	82.0	90.0	83.0	87.0	79.0	85.0	78.0	84.0	76.0	79.0	70.0	78	70	80	72	......	......	79	70	81	75	84	77
11	89.0	82.0	90.0	83.0	88.0	81.0	86.0	79.0	84.0	76.0	82.0	73.0	78	71	81	71	......	......	77	71	81	73	85	78
12	88.0	81.0	89.0	82.0	88.0	81.0	84.0	77.0	83.0	75.0	81.0	74.0	79	72	80	70	......	......	78	70	82	74	86	77
13	89.0	81.0	89.0	81.0	88.0	81.0	84.0	78.0	84.0	75.0	82.0	73.0	78	73	84	70	......	......	79	72	83	73	86	80
14	89.0	82.0	89.0	83.0	89.0	80.0	82.0	79.0	83.0	75.0	83.0	72.0	78	71	84	70	83	73	81	72	83	72	87	81
15	90.0	82.0	89.0	83.0	85.0	79.0	85.0	78.0	83.0	73.0	79.0	70.0	78	73	(*)	......	86	74	82	70	83	74	88	82
16	89.0	82.0	88.0	81.0	85.0	79.0	85.0	77.0	81.0	74.0	79.0	72.0	78	73	......	......	88	75	84	74	80	76	87	81
17	88.0	80.0	88.0	81.0	86.0	78.0	86.0	76.0	81.0	76.0	80.0	72.0	77	73	......	......	88	77	83	75	80	74	87	82
18	89.0	80.0	88.0	82.0	87.0	78.0	84.0	77.0	83.0	77.0	79.0	72.0	79	71	......	......	83	75	84	74	82	75	88	80
19	88.0	80.0	89.0	81.0	87.0	78.0	84.0	76.0	79.0	71.0	79.0	71.0	78	72	......	......	83	75	83	75	84	75	86	81
20	90.0	82.0	91.0	80.0	90.0	78.0	86.0	76.0	72.0	69.0	78.0	71.0	76	67	......	......	83	77	84	75	82	76	86	80
21	92.0	81.0	91.0	79.0	91.0	80.0	86.0	77.0	73.0	67.0	79.0	71.0	77	67	......	......	83	76	84	75	81	75	86	75
22	89.0	82.0	92.0	80.0	91.0	80.0	87.0	78.0	73.0	70.0	79.0	70.0	79	68	78	71	83	76	84	74	83	75	83	76
23	90.0	81.0	92.0	80.0	88.0	79.0	87.0	78.0	75.0	70.0	81.0	73.0	82	70	76	71	81	77	83	73	82	76	85	76
24	90.0	81.0	85.0	80.0	87.0	79.0	86.0	78.0	76.0	71.0	80.0	72.0	83	73	79	72	81	76	83	74	82	75	88	78
25	90.0	81.0	89.0	80.0	86.0	80.0	84.0	78.0	78.0	72.0	80.0	72.0	83	73	80	68	81	75	84	76	83	75	87	80
26	89.0	80.0	91.0	79.0	86.0	79.0	86.0	77.0	79.0	74.0	79.0	71.0	78	73	78	69	82	72	85	75	85	76	87	80
27	88.0	79.0	91.0	78.0	86.0	79.0	86.0	76.0	79.0	72.0	77.0	71.0	77	70	77	69	83	71	83	76	84	76	87	79
28	90.0	80.0	89.0	78.0	84.0	77.0	83.0	77.0	80.0	70.0	78.0	71.0	74	66	80	70	81	70	84	75	82	76	88	79
29	89.0	80.0	86.0	77.0	86.0	78.0	81.0	77.0	80.0	71.0	79.0	70.0	76	64	79	69	78	73	85	75	84	76	88	80
30	84.0	78.0	86.0	77.0	88.0	77.0	80.0	75.0	79.0	69.0	79.0	71.0	78	67	......	......	75	70	84	76	85	78	88	80
31	90.0	78.0	91.0	78.0	......	......	83.0	75.0	......	......	80.0	72.0	79	69	......	......	77	69	......	......	84	78	......	......
Range	14°.0		15°.0		14°.0		12°.0		17°.0		15°.0		19°.0		......	......	......	......	21°.0		13°.0		13°.0	

* No report received.

Maximum, minimum and mean temperatures—Continued.

STATION, HENRIETTA, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	93	73	97	70	89	65	88	64	55	43	68	42	45	33	45	39	(†)	......	......	......	......	......	......	......
2	92	72	98	74	93	58	87	68	63	37	72	43	63	45	51	34	......	......	......	......	......	......	......	......
3	92	72	98	76	93	63	83	67	61	38	57	32	67	55	46	32	......	......	......	......	......	......	......	......
4	87	73	97	76	93	62	85	65	71	44	73	42	67	50	46	25	......	......	......	......	......	......	......	......
5	89	70	98	76	93	66	87	67	75	58	58	40	67	49	44	25	......	......	......	......	......	......	......	......
6	93	74	99	77	95	68	87	68	75	61	62	37	65	50	50	24	......	......	......	......	......	......	......	......
7	94	72	90	73	97	69	87	71	(*)	......	75	42	70	51	55	24	......	......	......	......	......	......	......	......
8	94	77	73	61	94	62	85	72	......	......	49	32	70	45	56	36	......	......	......	......	......	......	......	......
9	96	75	78	59	92	66	89	72	67	39	75	36	65	48	62	32	......	......	......	......	......	......	......	......
10	96	75	82	61	93	69	88	70	84	59	46	29	69	39	67	43	......	......	......	......	......	......	......	......
11	99	76	82	63	89	64	87	70	75	56	35	22	64	47	70	62	......	......	......	......	......	......	......	......
12	101	73	86	63	74	57	87	67	70	46	(*)	......	48	34	70	39	......	......	......	......	......	......	......	......
13	105	76	86	66	85	49	88	68	78	49	......	......	55	27	40	25	......	......	......	......	......	......	......	......
14	103	76	90	70	83	53	86	68	76	53	......	......	62	39	47	30	......	......	......	......	......	......	......	......
15	102	75	88	66	90	57	83	71	69	42	......	......	56	33	65	35	......	......	......	......	......	......	......	......
16	97	76	84	66	90	58	83	64	78	45	68	42	68	37	(*)	......	......	......	......	......	......	......	......	......
17	99	73	86	65	88	60	74	49	71	39	49	21	68	35	......	......	......	......	......	......	......	......	......	......
18	101	73	90	65	86	59	77	47	51	29	39	23	71	40	43	31	......	......	......	......	......	......	......	......
19	101	78	90	67	81	63	74	46	65	30	65	31	72	56	46	24	......	......	......	......	......	......	......	......
20	99	78	91	67	82	65	75	44	65	28	47	26	65	40	57	39	......	......	......	......	......	......	......	......
21	101	76	91	66	87	59	78	43	59	27	62	25	66	44	64	41	......	......	......	......	......	......	......	......
22	103	75	91	66	92	60	83	51	71	36	60	24	50	33	75	50	......	......	......	......	......	......	......	......
23	104	78	90	66	91	60	64	46	(*)	......	37	21	60	31	76	49	......	......	......	......	......	......	......	......
24	99	78	94	69	80	54	63	38	......	......	21	5	55	42	76	62	......	......	......	......	......	......	......	......
25	96	76	95	68	89	57	65	38	70	50	24	5	61	32	67	48	......	......	......	......	......	......	......	......
26	96	74	98	71	92	66	67	37	72	61	40	9	69	41	72	48	......	......	......	......	......	......	......	......
27	90	72	95	69	90	71	70	40	74	46	62	27	53	44	76	45	......	......	......	......	......	......	......	......
28	92	72	91	66	83	71	77	43	46	29	73	47	45	29	45	20	......	......	......	......	......	......	......	......
29	97	69	87	63	90	71	85	47	54	24	73	31	52	36	39	29	......	......	......	......	......	......	......	......
30	98	70	87	65	87	71	(*)	......	60	35	34	25	44	32	......	......	......	......	......	......	......	......	......	......
31	96	70	89	63	......	......	50	(*)	......	......	36	30	43	29	......	......	......	......	......	......	......	......	......	......
Range	36		37		48		......	......	......	......	......	......	43		......	......	......	......	......	......	......	......	......	......

*Observer absent on repair duty.

†Record incomplete.

Elevation of thermometers above ground, 4 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, INDIANAPOLIS, IND.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	87	64	91	69.5	78	66	81	60	43	23.5	53	34	45	30	33	18	42	24	61	39	61	40	66	55
2	90	72	91	71	74	63	86	68	40.5	27.5	56	41	54	45	32	17	55	31	67	52	73	50	73	55
3	90	72	93	73.5	71	63.5	74.5	64	38	21	55	43	64	49	32	19	62	42	71	57	75	54	77	54
4	87	76	86	71	74	59	82	62	37	18.5	48	40	60	53	25	14	70	55	67	56	72	55	73	57
5	85	66	85	72	72	52	85	67.5	50	33	64	46	59	48	38	19	67	40	62	50	78	66	83	66
6	91	66	81	71	73	59	85	64	57	43	57	40	63	52	42	20	52	34	59	36	82	60	76	66
7	89.5	73	83	72	70	52	78.5	68	67	53	49	39	54	50	40	22	49	39	45	32	84	63	76	58
8	87	73	73	60.5	68	48.5	78	68	74	55	40	37	61	52	49	25	47	28	50	32	86	67	81	62
9	84	72.5	72	53	63	46	82	65.5	68	53	63	38	66	39	44	28	53	29	60	36	73	63	79	63
10	94	71	78	53	69	44.5	83	68	66	45	63	33	51	31	54	31	39	31	56	32	74	66	88	70
11	96	78	81	61	75	49	84.5	66.5	71	62	35	20	65	37	56	35	48	30	41	27	74	58	89.5	70
12	90	76.5	82	62	69	59	86	66	72	58	22	17	40	28	57	48	37	27	53	29	78	53	91	73
13	91	72	83	66.5	70	52.5	83.5	64	75	50	33	19	37	20	50	30	40	24	72	43	73	57	88.5	71
14	92	71	80	67	64	47	81	62	69	61.5	37	30	44	24	35	25	39	28	74	58	73	45	83	68
15	96	73	70	60	66	48	83.5	62.5	62	50	33	22	45	29	44	21	37	25	70	57	72	46	77	61
16	94	75	68	55.5	70	52	76.5	65	56	41	47	22	55	37	55	34	34	26	66	42	80	51	77	57
17	80	67	72	59	70	51	72	57	49.5	38	38	21	57	38	59	44	38	21	62	38	83	56	80	60
18	80	62	75	54	69	55	57	48.5	42	34	31	13	59	34	58	27	53	32	83	54	84	63	82	61
19	82	59.5	78	55	62	43	52.5	41.5	45	31	39	25	60	47	29	18	49	38	74	49	84	64	83	62
20	89	61	83	59	65	48	62	36.5	26	21	35	29	58	39	39	20	48	36	63	43	82	66	85	65
21	89	68	86	64	69	43	66.5	48	32	20	40.5	24	52	38	41	32	52	30	71	51	66	56	85	65
22	84	74	89	68	72	50	67	54	45	26	39	30	52	33	58	32	56	40	76	56	75	55	86	66
23	91	74	82	73	75	54	60	38	42	30	40	26	41	31	50	34	58	38	66	56	80	53	90	69
24	84	67	75	64	59	47	47	32	44	25	40	18	50	31	64	36	42	29	68	56	85	63	88	69
25	88	68	74	57	61	38	53	31	49.5	36.5	20	5	48	34	62	50	37	31	72	57	84	69	83	69
26	86	72.5	74	53	67	41	60	36	54	32	20	5	55	36	65	45	51	35	64	44	85	67	85	68
27	82.5	66	76	57	68.5	55	64	46	59	53	40	18	61	39	65	48	60	43	59	46	83	65	83	70
28	85	64	80	60	75	58.5	57	46	59	36	48	29	51	34	61	34	44	36	64	46	74	58	83	68
29	86	67.5	82	62	76	60.5	65	45.5	36	28	56	38	43	31	36	22	52	30	63	50	70	59	76	63
30	83	65	85	63	80	59	51.5	38	39	23	39	34	59	32	......	......	55	33	52	40	69	63	80	59
31	89	58	87	65	......	......	45	30.5	......	......	41	33	37	22	......	......	61	40	......	......	83	58	......	......
Range	38°		40°		42°		55°.5		56°.5		59°		46°		51°		49°		56°		45°		37°	
Monthly mean	80°.0		70°.3		62°.7		62°.6		45°.8		35°.9		45°.7		39°.0		42°.0		55°.5		69°.1		74°.1	

Elevation of thermometers above ground, 47 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, INDIANOLA, TEX

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	93	78	89	78	91	76	82	73	55	46	66	56	66	59	50	42	66	49	76	67	72	58	91	77
2	93	80	89	78	94	76	83	73	67	51	77	61	75	59	49	38	76	61	80	70	75	65	92	78
3	91	77	89	80	92	75	84	71	67	55	78	65	77	62	55	38	78	66	83	70	75	68	92	77
4	90	79	92	79	92	76	83	75	73	61	78	65	72	60	50	42	78	68	87	70	82	66	91	77
5	88	76	95	78	88	76	83	75	80	69	70	56	78	67	50	43	79	68	82	69	78	68	90	78
6	92	77	95	80	88	76	84	73	82	67	73	54	78	66	51	43	80	68	84	71	80	69	93	78
7	92	78	94	79	86	73	83	75	81	67	78	61	77	66	51	41	80	69	79	71	83	69	91	78
8	93	80	93	80	83	72	88	76	82	72	78	70	77	63	57	47	70	53	73	46	86	69	91	78
9	92	78	94	73	85	74	88	78	82	73	79	70	76	64	56	49	65	54	68	51	86	71	91	79
10	94	78	80	71	82	74	84	77	83	73	73	50	77	64	62	52	77	62	73	47	86	72	93	77
11	94	79	77	71	80	74	84	78	82	73	56	46	78	66	75	62	79	67	80	53	85	73	90	77
12	93	79	77	72	80	73	83	77	83	72	52	36	72	55	74	64	71	54	73	60	86	72	82	75
13	94	78	83	71	82	71	83	75	82	72	49	41	58	48	64	43	56	48	81	64	84	72	89	75
14	92	78	91	75	82	70	82	68	82	73	55	41	71	53	65	47	49	32	80	69	83	72	90	77
15	96	79	94	71	82	71	83	76	85	72	60	45	72	64	64	43	41	32	82	71	81	72	92	76
16	96	78	86	72	83	71	87	72	83	72	71	49	75	65	73	51	51	33	84	72	80	72	90	76
17	97	79	85	74	82	72	81	69	84	58	75	57	73	62	73	62	55	39	84	72	80	73	85	78
18	96	80	86	72	83	73	77	62	59	48	62	46	72	62	69	50	74	51	81	72	81	73	87	74
19	94	79	86	76	86	72	75	56	61	45	71	56	76	62	55	48	65	55	77	67	87	73	86	76
20	96	79	86	76	87	72	73	57	63	48	76	65	77	65	63	52	63	57	78	57	80	68	88	75
21	98	79	87	78	85	69	75	61	67	45	77	65	80	63	71	58	63	55	79	67	83	71	85	74
22	98	78	89	75	86	73	77	61	70	46	77	66	67	52	77	58	62	58	83	71	83	72	89	73
23	96	78	97	75	84	72	77	60	69	55	78	67	65	50	78	63	65	59	82	73	86	72	86	70
24	95	80	97	77	81	76	68	54	77	62	72	26	63	55	77	64	68	59	84	72	88	73	85	69
25	92	80	89	78	81	74	67	52	79	64	30	21	63	50	69	57	80	64	83	74	88	76	91	77
26	95	78	93	79	83	73	67	58	79	68	41	24	69	47	78	58	79	66	84	73	89	77	89	78
27	95	78	89	78	87	75	72	60	78	67	63	37	76	56	77	66	72	65	78	70	88	76	90	79
28	95	78	87	75	86	75	76	58	73	52	74	55	74	64	80	46	74	57	83	72	90	77	92	79
29	94	79	86	75	84	76	77	52	61	43	76	65	77	64	59	42	72	56	83	63	90	77	89	74
30	94	79	89	76	82	76	79	63	62	48	77	56	74	53	......	......	72	64	74	63	91	77	90	74
31	90	78	92	74	......	......	70	55	......	......	69	58	53	43	......	......	75	65	......	......	91	77	......	......
Range	22°		26°		23°		36°		42°		58°		37°		42°		48°		41°		33°		24°	
Monthly mean	85°.2		82°.2		79°.7		73°.2		66°.9		59°.8		65°.1		57°.7		62°.3		72°.7		78°.0		82°.9	

Elevation of thermometers above ground, 29 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, JACKSBORO, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	97	66	102	70	92	64	92	68	55	41	70	41	64	34	63	32	75	36	84	64	73	45	75	61
2	97	72	103	70	94	60	87	67	69	37	79	45	75	34	60	30	68	44	89	65	70	56	85	62
3	95	75	102	75	97	60	81	67	66	42	79	32	69	56	53	26	79	44	90	64	80	61	90	69
4	90	70	101	75	96	63	87	68	75	42	79	45	68	50	70	23	83	54	97	62	79	60	92	73
5	92	71	102	76	97	68	91	69	77	42	72	41	72	48	64	24	73	57	100	65	89	65	90	72
6	95	70	102	77	95	70	88	68	79	45	70	40	75	53	67	23	75	52	83	61	90	65	90	57
7	95	74	96	74	99	69	80	66	83	45	78	45	75	55	64	24	75	35	70	40	81	67	95	57
8	99	75	82	64	96	65	88	71	83	46	70	35	75	50	64	28	55	35	70	36	93	67	95	75
9	100	73	82	60	95	70	93	73	75	39	79	41	68	48	69	35	73	42	70	39	98	65	95	72
10	100	72	82	60	95	70	92	68	84	59	56	28	75	42	70	44	74	40	84	47	98	70	95	70
11	104	76	85	62	93	73	89	69	75	60	50	26	67	48	72	52	63	50	76	43	95	70	93	73
12	105	73	88	65	81	58	89	67	80	52	50	20	63	35	75	45	61	30	80	45	93	66	91	70
13	106	79	90	67	83	52	89	64	85	60	64	34	58	27	70	28	33	20	83	59	94	70	90	72
14	107	77	93	70	87	56	90	64	80	56	58	27	69	40	65	28	52	15	92	65	92	67	96	74
15	106	76	89	67	92	59	88	66	73	53	55	21	61	39	75	32	31	19	92	68	93	67	85	75
16	100	79	86	66	93	58	86	66	81	48	73	42	69	42	75	44	44	18	92	52	95	67	89	69
17	105	75	87	63	90	61	77	51	65	40	67	22	70	37	75	55	56	27	95	65	93	63	85	65
18	105	74	94	66	90	60	80	46	60	30	50	22	80	43	67	34	75	42	97	71	87	52	88	62
19	103	77	94	67	82	62	75	45	68	30	75	40	75	56	64	23	75	39	75	41	85	64	92	62
20	103	78	94	69	85	60	75	40	62	30	64	30	75	45	67	39	72	40	81	42	80	57	(*)	......
21	103	77	94	69	90	60	83	45	65	28	69	30	67	47	67	42	72	45	82	54	89	58	......	......
22	106	76	93	67	95	60	86	52	78	35	65	30	63	34	80	51	75	48	90	68	90	58	......	......
23	107	82	91	65	93	62	66	46	77	35	61	23	70	32	79	53	81	48	97	71	93	68	......	......
24	105	75	96	70	85	55	65	35	77	42	26	6	68	43	75	59	79	57	90	65	94	68	......	......
25	96	74	100	72	93	58	66	38	76	55	33	4	66	32	83	50	85	61	80	52	97	72	......	......
26	93	72	100	72	95	67	70	37	75	61	50	4	74	39	85	45	84	66	80	48	97	72	......	......
27	98	74	98	70	92	69	71	40	80	49	72	26	67	44	77	58	84	47	80	50	85	63	......	......
28	93	73	93	69	86	71	83	46	51	30	76	45	62	32	67	29	87	42	77	62	85	63	......	......
29	98	72	90	66	91	71	91	49	65	24	78	38	70	36	65	27	86	47	70	56	85	63	......	......
30	99	70	90	65	89	71	65	44	75	30	73	25	70	35	......	......	80	65	75	46	97	64	......	......
31	100	70	91	62	......	......	54	40	......	......	67	30	67	28	......	......	85	65	......	......	81	72	......	......
Range	41°		43°		47°		58°		61°		75°		53°		65°		72°		64°		53°		....	

Elevation of thermometers above ground, 6 feet.

*Station closed.

Maximum, minimum and mean temperatures—Continued.

STATION, JACKSONVILLE, FLA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	85	75	88	78	87	74	86	73	73	60	60	51	75	55	75	61	82	64	78	52	70	58	93	74
2	82	73	90	75	90	75	84	73	71	58	71	56	71	53	75	59	70	62	77	58	74	67	94	75
3	85	68	90	75	89	78	83	72	70	54	73	53	75	54	65	48	81	62	82	63	70	67	83	73
4	87	73	90	74	86	75	81	72	57	44	77	57	76	55	57	43	81	64	83	66	74	67	81	73
5	94	73	95	73	86	74	83	73	69	42	71	58	73	60	58	42	84	66	89	69	82	67	83	72
6	96	76	96	77	83	76	80	75	75	54	73	59	69	63	53	44	86	69	89	70	81	63	88	70
7	92	74	95	77	87	73	84	73	76	59	71	51	77	61	56	43	82	66	80	66	83	64	90	74
8	99.5	74	95	79	89	74	85	74	78	65	73	53	76	59	60	54	83	64	80	54	83	68	93	75
9	101	78	92	77	89	72	85	72	77	71	76	57	76	59	60	53	84	69	54	46	81	70	96	76
10	102.5	81	82	70	88	72	85	68	80	68	77	57	76	59	71	48	72	64	68	49	80	71	91	73
11	104	82	85	69	81	72	84	70	80	65	78	64	76	57	72	47	84	66	79	52	83	69	91	74
12	102.5	82	85	68	81	67	81	71	82	63	66	58	72	64	77	54	85	67	63	47	75	70	95	74
13	102	79	88	71	85	67	82	72	82	64	62	58	70	56	79	64	85	70	74	42	75	70	100.5	79
14	94	72	92	71	81	72	83	73	82	67	77	62	56	49	68	62	84	70	80	56	80	70	100	79
15	92	73	95	76	83	71	79	74	82	69	70	58	67	51	65	53	85	67	83	60	80	66	99.5	80
16	93	76	96	76	84	68	81	74	83	68	60	44	64	51	67	45	85	66	84	66	75	63	95	77
17	95	75	89	73	86	61	85	75	81	69	65	38	67	54	73	55	73	63	87	67	79	60	80	72
18	95	78	94	75	84	71	85	73	81	65	67	41	70	53	77	64	78	59	86	65	82	59	83	73
19	91	74	94	77	81	72	84	73	65	43	71	52	70	45	76	62	83	66	89	68	83	64	84	72
20	87	74	98	77	83	71	76	68	58	40	72	62	72	46	62	55	69	59	87	72	84	68	84	70
21	87	76	88	78	79	70	78	65	58	34.5	73	56	71	59	63	52	67	57	89	68	85	70	79	69
22	88	74	90	76	84	73	85	69	61	38	75	57	75	59	65	49	61	55	79	69	81	72	84	69
23	91	73	92	77	79	72	81	70	65	37	78	60	67	52	74	53	72	49	83	66	83	71	91	73
24	92	76	93	77	82	71	73	63	64	44	78	62	55	47	71	50	76	53	90	69	83	69	88	71
25	92	78	93	78	82	69	67	63	68	51	79	61	52	48	78	54	70	52	91	69	83	69	88	73
26	93	77	87	76	75	65	71	61	72	54	69	41	75	52	78	60	70	57	91	70	84	69	93	77
27	98	77	86	74	79	61	71	63	76	58	56	36	64	55	78	58	80	62	89	69	83	68	96	77
28	94	77	81	71	79	67	71	59	78	63	72	47	72	54	80	60	73	63	85	68	85	68	96	78
29	94	77	81	73	81	71	73	54	73	54	77	53	72	60	81	62	67	52	87	72	84	68	96	77
30	90	74	77	72	86	74	76	52	59	47	76	57	73	62	......	......	61	49	84	69	90	70	91	74
31	85	73	83	74	......	......	78	53	......	......	77	56	77	61	......	......	71	43	......	......	95	74	......	......
Range	36°		28°		29°		34°		48°.5		43°		32°		39°		43°		49°		37°		31°.5	
Monthly mean	83°.4		81°.3		76°.8		73°.4		63°.5		62°.6		62°.1		61°.3		68°.3		71°.9		73°.9		81°.0	

Elevation of thermometers above ground, 37 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, KEOKUK, IOWA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	84	65	92	72	82	69	85	69	40	25	55	37	42	26	32	14	48	26	57	39	74	47	70	54
2	91	70	96	76	81	61	80	68	41	21	50	34	44	38	39	19	59	33	66	50	79	57	76	56
3	93	73	94	76	82	62	73	63	36	18	41	33	62	40	30	15	63	47	73	52	78	58	78	57
4	84	68	95	69	74	54	83	65	45	21	47	34	58	42	33	10	70	44	69	53	77	57	75	64
5	87	64	84	71	75	52	86	67	60	44	57	43	53	40	35	25	47	32	65	41	83	59	82	69
6	91	70	83	71	75	53	86	68	64	37	46	36	53	45	44	24	53	33	52	34	88	66	75	62
7	94	79	77	66	69	57	76	66	67	52	39	26	52	39	38	16	46	24	48	29	88	68	76	57
8	92	75	72	56	68	47	85	66	72	47	34	23	52	48	52	25	44	18	52	31	75	55	80	59
9	93	74	79	57	72	45	87	71	53	41	58	31	56	83	39	16	45	32	69	39	75	61	83	62
10	98	79	83	61	73	53	80	68	57	40	51	24	51	27	54	32	35	24	59	39	74	58	88	74
11	97	80	86	68	82	59	83	66	68	56	24	11	59	29	60	40	40	29	44	32	74	58	89	76
12	90	76	86	72	74	54	80	69	65	51	26	7	36	21	52	29	32	21	62	36	79	57	91	75
13	94	71	85	68	67	54	83	64	67	46	34	19	42	26	31	21	35	24	78	54	80	61	90	74
14	97	73	77	63	68	44	82	65	59	47	40	18	47	27	43	24	29	12	81	64	72	56	87	69
15	97	73	74	62	73	54	84	66	56	45	26	3	43	21	50	31	35	16	65	44	73	51	69	57
16	90	76	73	57	83	51	83	65	50	37	44	23	58	40	59	36	33	15	50	42	83	53	78	58
17	83	71	75	52	77	51	71	52	46	38	23	10	51	36	59	30	45	25	67	38	87	64	79	64
18	83	64	80	57	67	54	57	43	41	31	21	3	63	36	30	23	46	35	78	61	85	69	77	62
19	88	62	79	60	57	48	60	41	49	27	31	19	56	41	29	16	53	31	62	35	75	62	82	65
20	88	67	89	67	67	44	61	39	27	17	24	8	42	35	38	20	48	31	68	42	73	61	84	64
21	89	74	89	73	72	44	67	41	39	23	31	14	48	36	46	27	61	82	74	52	72	56	88	66
22	95	75	87	73	73	54	67	45	47	31	29	13	36	29	57	34	60	34	81	61	78	54	89	70
23	85	70	88	71	62	51	52	37	38	26	25	12	46	27	53	34	56	40	75	54	83	65	90	73
24	81	63	77	66	60	43	53	32	55	25	15	— 2	53	33	65	43	50	28	79	47	88	66	84	72
25	89	66	79	59	63	42	57	32	45	33	10	—10	55	41	60	47	50	40	67	47	84	72	86	68
26	83	65	83	59	78	50	63	36	60	34	29	1	57	44	65	45	66	42	55	43	84	68	88	71
27	85	63	89	68	84	68	69	42	63	39	42	28	57	34	67	37	63	41	65	43	68	57	84	69
28	89	68	86	69	81	70	63	43	41	27	48	30	34	24	61	15	54	38	62	52	75	55	76	65
29	81	64	88	66	75	68	60	47	32	19	48	18	39	22	32	9	53	36	60	46	68	57	82	62
30	86	63	86	65	82	68	51	33	43	25	33	12	45	24	......	......	61	36	58	38	74	56	85	63
31	90	65	89	67	......	......	44	30	......	......	37	28	41	21	......	......	57	45	......	......	68	58	......	......
Range	36°		44°		42°		57°		55°		68°		42°		58°		58°		52°		41°		37°	
Monthly mean	80°.8		75°.4		64°.2		62°.1		42°.9		27°.1		41°.4		36°.7		40°.1		54°.8		69°.6		74°.7	

Elevation of thermometers above ground, 46 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, KEY WEST, FLA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1,	88	80	89	79	88	78	87	79	81	74	76	70	76	72	78	71	81	71	78	65	89	77	87	77
2.	89	78	88	80	88	79	87	78	81	74	76	69	78	71	81	71	80	72	79	70	84	77	87	76
3.	86	75	90	80	87	77	82	74	79	74	79	69	79	72	75	67	80	72	80	72	88	77	92	76
4.	87	77	90	80	91	79	84	75	78	72	76	69	79	71	68	64	81	73	82	73	90	77	89	78
5.	91	80	93	80	88	80	81	77	79	70	79	70	78	71	78	67	84	73	84	71	89	77	87	77
6.	90	80	93	82	90	80	87	78	81	72	79	70	79	71	83	72	82	73	84	72	83	76	86	73
7.	90	80	93	82	89	78	86	80	79	72	81	70	78	71	76	71	81	73	83	73	83	70	88	77
8.	90	81	88	81	90	81	86	78	82	73	80	72	79	72	79	70	82	74	85	72	83	74	91	78
9.	93	80	90	80	91	79	86	73	82	74	79	71	80	71	79	72	84	74	84	73	89	74	89	79
10.	93	81	90	81	89	80	85	79	81	75	80	72	77	72	76	71	84	74	79	69	89	77	89	79
11.	91	82	91	82	88	81	85	78	81	75	80	73	78	71	79	71	83	74	77	67	86	70	88	79
12.	91	82	91	81	85	78	83	73	82	75	80	68	78	71	80	72	83	75	78	69	86	75	90	78
13.	92	81	92	82	87	78	80	72	81	74	82	75	76	72	82	73	83	75	78	68	89	75	93	79
14.	92	80	93	82	89	80	79	75	82	75	83	75	77	68	82	73	83	75	80	72	89	78	93	81
15.	92	82	91	81	89	76	82	77	84	75	82	73	77	70	76	69	82	75	81	71	88	76	95	81
16	90	82	93	79	88	79	85	78	83	75	78	73	76	70	74	67	85	75	81	72	77	74	93	83
17.	94	80	93	83	87	77	86	78	81	74	79	72	74	69	80	69	87	75	85	73	78	72	89	81
18.	91	81	92	81	85	74	87	78	80	75	78	72	74	69	81	72	84	74	83	74	82	74	92	80
19	94	81	91	81	82	76	84	77	77	68	80	72	76	68	81	71	85	75	83	74	83	75	92	80
20.	91	77	88	74	88	78	87	75	68	60	81	71	77	68	79	71	87	74	84	75	89	75	90	77
21	89	75	89	81	89	81	86	78	68	61	76	72	76	69	80	72	84	73	85	75	82	75	88	75
22.	91	82	88	78	90	81	85	77	69	64	80	71	78	69	78	71	86	75	86	74	84	77	86	77
23.	90	81	89	82	90	81	86	79	71	65	82	72	82	70	76	66	85	74	83	75	83	77	89	78
24.	91	82	91	82	90	81	87	78	71	65	81	74	83	74	78	68	80	73	83	75	84	77	90	81
25	91	81	89	78	91	78	83	77	74	67	81	73	82	74	79	69	78	72	84	75	82	75	90	81
26.	90	79	89	75	87	76	78	73	76	68	78	70	77	72	79	70	75	69	84	75	84	76	90	81
27.	91	81	85	76	85	75	85	73	78	70	75	68	74	70	79	69	81	72	85	75	79	75	91	81
28.	89	76	86	75	82	73	84	78	80	71	80	70	76	68	81	71	81	74	85	76	84	75	90	81
29.	90	80	88	75	87	75	83	73	78	70	80	72	76	65	79	70	77	70	84	77	84	78	89	80
30.	88	80	87	79	86	78	78	72	76	71	80	72	79	69	......	......	73	64	89	76	86	77	89	80
31.	87	77	88	75	......	......	81	75	......	......	79	71	82	69	......	......	75	63	......	......	86	78	......	......
Range	19°		19°		18°		15°		24°		15°		18°		19°		24°		24°		20°		22°	
Monthly mean	84°.4		84°.7		82°.5		79°.8		74°.0		74°.2		73°.1		73°.1		76°.3		76°.8		79°.1		83°.4	

Elevation of thermometers above ground, 42 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m., and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, KINGSTON, CANADA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	73.5	51.5	81.9	67.0	75.9	67.1	70.2	60.2	51.0	21.8	44.0	24.6	37.5	5.1	30.1	− 5.8	34.1	22.0	50.6	28.7	40.6	28.3	59.6	47.8
2	77.6	62.0	80.8	72.0	78.0	63.3	74.1	58.3	41.1	24.8	39.1	22.6	44.0	22.7	10.3	− 8.1	37.0	20.6	52.4	28.4	55.1	39.5	65.4	43.4
3	78.7	61.6	80.5	69.0	76.7	62.7	68.0	52.4	46.0	23.6	36.6	19.6	34.8	4.7	19.1	3.2	44.9	25.6	56.3	41.7	67.3	44.2	62.0	46.6
4	82.4	61.5	76.7	56.4	69.9	58.0	62.5	44.8	32.3	12.8	34.7	19.3	46.0	33.7	20.3	9.7	44.7	33.4	57.6	42.3	71.1	47.8	62.3	44.8
5	77.3	54.9	76.5	61.0	68.4	50.3	66.5	55.9	35.6	17.7	34.3	15.6	39.4	17.7	32.0	13.7	44.6	29.7	49.0	33.7	67.8	50.8	72.0	54.8
6	73.3	60.0	82.3	61.0	75.3	52.4	67.6	52.8	45.8	26.1	48.7	31.7	42.7	16.7	32.8	13.7	33.5	25.0	43.3	25.7	58.6	44.7	75.2	60.1
7	69.1	60.4	80.8	54.9	68.3	53.9	72.9	56.1	46.0	22.6	44.0	37.2	39.0	23.6	23.3	7.3	39.9	25.3	44.0	18.7	60.4	41.1	74.7	53.4
8	81.3	63.8	73.0	53.1	65.3	51.4	70.9	59.5	53.8	45.8	36.6	20.3	43.0	29.1	41.4	8.3	39.1	2.6	40.1	21.7	70.0	50.0	77.0	50.8
9	74.3	58.9	72.6	48.8	60.4	46.8	72.3	59.5	60.9	47.8	38.7	16.7	43.9	25.2	36.1	− 2.9	31.7	1.8	43.0	29.3	79.0	53.9	76.7	52.0
10	76.5	63.4	69.8	55.1	61.1	43.8	72.9	62.4	47.0	38.5	49.0	28.7	41.3	19.6	22.5	− 2.9	32.8	9.4	45.8	34.3	69.2	52.9	79.1	60.0
11	74.5	63.5	73.9	57.9	62.8	43.6	74.0	55.9	52.4	34.2	49.0	26.3	43.6	17.7	37.4	4.8	20.8	7.0	39.0	19.7	65.4	52.0	72.1	64.0
12	84.1	61.5	77.3	57.8	71.5	46.9	67.3	61.9	50.9	40.5	36.2	15.0	44.1	16.7	46.9	33.5	25.7	11.0	42.4	17.0	67.0	43.6	71.0	58.4
13	78.9	64.0	78.5	61.5	67.0	56.9	64.3	41.6	46.1	35.7	32.1	17.4	26.1	10.7	42.4	27.1	28.7	10.0	52.6	33.7	66.8	40.8	72.0	53.9
14	86.5	64.4	78.1	56.9	55.4	47.0	63.2	41.3	56.1	38.5	31.5	24.7	41.1	22.1	39.0	13.7	39.0	13.3	45.1	30.8	58.7	35.7	67.3	50.9
15	81.5	67.8	77.3	47.7	60.9	40.1	65.8	49.6	59.4	40.8	34.0	23.7	44.0	23.1	36.1	11.7	32.3	12.0	59.0	30.8	61.0	37.5	77.0	55.2
16	79.4	66.6	58.5	49.1	65.8	56.5	68.0	56.9	52.0	39.7	31.9	17.6	46.2	29.2	41.0	17.7	31.9	19.6	45.0	33.3	65.1	47.8	80.1	57.3
17	72.4	56.2	59.0	49.7	65.0	50.1	75.6	54.9	47.0	30.7	28.9	− 3.2	44.8	34.7	43.1	22.6	35.7	16.7	46.3	34.9	72.0	54.4	79.0	60.0
18	76.3	55.9	64.1	53.7	56.4	48.8	65.3	55.9	37.0	26.4	22.5	− 5.2	42.0	32.0	55.7	29.9	37.8	12.8	45.4	34.0	63.0	53.8	74.5	56.9
19	76.7	53.7	75.4	54.7	60.9	41.1	56.3	38.7	42.3	19.1	19.1	− 3.9	38.9	31.6	25.3	11.2	42.7	16.1	60.7	42.9	73.6	55.6	79.0	59.4
20	76.9	55.0	73.0	62.0	60.9	45.8	59.2	36.7	36.6	6.9	18.0	− 5.2	32.5	12.0	27.4	4.8	40.9	19.7	51.7	37.4	74.8	51.9	72.6	58.1
21	77.9	61.3	72.5	62.0	60.7	39.6	60.8	49.4	20.3	2.8	− 4.1	−21.2	25.3	6.7	35.0	20.3	34.3	13.3	58.4	39.7	68.4	54.4	78.4	61.0
22	70.0	62.0	78.3	66.5	64.0	44.9	61.2	54.3	42.0	6.9	41.0	− 9.2	36.4	6.5	37.8	16.7	45.6	12.7	52.7	37.3	67.0	51.6	71.0	57.7
23	69.9	63.4	75.9	62.8	66.0	56.5	59.0	37.7	42.0	17.3	28.1	16.7	43.4	25.7	37.4	11.3	43.7	22.7	46.6	28.7	70.4	49.4	77.8	60.0
24	71.3	56.9	74.7	56.0	66.5	38.6	45.0	25.4	38.5	14.5	42.4	16.4	32.4	16.4	23.0	0.4	31.5	5.5	53.1	33.1	75.0	54.9	83.6	59.7
25	69.3	53.5	73.9	52.1	66.3	32.5	44.3	20.0	45.3	32.7	25.1	− 2.2	37.0	23.7	42.4	21.9	32.7	5.5	52.7	33.4	75.4	57.9	79.4	66.3
26	73.9	58.9	72.2	55.3	57.2	41.3	56.2	41.1	40.4	26.0	16.6	− 6.1	42.5	31.7	41.6	31.2	42.4	16.1	53.1	40.8	77.0	60.0	78.5	66.9
27	77.1	66.0	73.2	56.5	63.5	43.8	57.4	48.6	43.2	21.3	31.0	− 0.2	45.0	34.7	47.7	27.7	41.6	19.0	51.8	37.5	73.0	58.4	78.5	65.0
28	77.9	61.0	72.7	57.6	65.2	50.0	56.4	42.4	50.7	29.7	37.3	21.7	43.6	29.7	48.0	30.7	37.6	25.7	54.0	34.7	70.3	51.9	77.0	68.0
29	75.3	67.3	69.4	60.1	68.0	56.5	56.0	41.0	49.2	16.7	44.0	29.7	30.1	3.3	43.8	33.8	43.5	23.9	54.2	39.5	70.5	44.7	73.5	58.9
30	78.3	59.0	72.7	57.1	69.0	60.1	52.1	34.8	28.7	10.0	35.1	−11.5	42.9	5.4	......	......	47.6	28.4	47.1	31.7	66.0	54.9	74.6	61.8
31	79.6	63.2	76.4	60.0	......	......	47.0	26.6	......	......	25.8	−13.5	44.0	24.7	......	......	52.6	30.7	......	......	64.2	54.9	......	......
Range	35°		34°.6		45°.5		55°.6		58°.1		70°.2		42°.9		63°.8		50°.8		42°.0		50°.7		40°.2	

Maximum, minimum and mean temperatures—Continued.

STATION, KITTYHAWK, N. C.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1.	80	69	88	73	83	70	79	65	56	51	52	35	54	46	59	40	68	49	58	42	60	48	90	72
2.	83	68	92	77	78	70	83	63	54	47	61	42	64	41	49	36	50	47	61	48	70	50	76	60
3.	88	68	90	74	87	75	85	67	53	38	68	50	56	50	61	40	61	47	71	60	72	59	66	60
4.	90	70	91	74	86	72	73	67	42	33	68	54	68	48	46	35	73	60	82	57	67	58	76	56
5.	84	68	95	76	82	70	77	67	45	36	60	56	60	51	45	32	80	61	79	58	63	57	77	62
6.	70	66	94	77	87	67	81	69	63	36	61	58	63	50	45	37	66	51	75	53	85	57	82	68
7.	81	65	94	78	87	72	83	69	59	51	60	51	57	49	55	35	56	50	65	45	70	62	82	71
8.	92	70	92	72	89	72	83	69	69	57	65	46	50	47	49	40	55	46	47	38	89	63	81	66
9.	88	75	78	64	76	67	86	70	74	54	58	51	49	47	58	42	51	43	45	38	82	67	68	64
10.	85	73	70	63	70	61	82	70	77	57	71	54	53	49	58	44	51	41	60	39	81	64	76	65
11.	99	74	73	62	70	65	73	68	79	58	69	53	55	50	51	40	59	43	55	44	84	68	80	70
12.	90	72	75	68	70	59	72	67	79	62	54	43	68	47	62	49	50	44	50	33	73	62	96	71
13.	75	70	83	71	79	60	72	62	74	61	54	45	59	32	73	59	50	47	68	45	77	59	90	70
14.	73	70	90	71	71	64	72	62	78	64	64	52	48	43	68	53	56	45	76	48	61	55	85	71
15.	85	71	90	72	70	60	79	61	79	64	65	45	51	46	54	44	51	45	78	55	57	48	84	70
16.	95	73	82	73	82	67	81	59	71	62	48	38	48	43	54	39	73	50	78	63	73	45	73	65
17.	97	75	85	73	88	67	80	63	65	57	60	43	52	41	61	39	62	43	84	56	88	59	69	65
18.	76	71	77	70	82	68	80	66	67	45	51	45	52	45	69	50	53	42	58	53	91	64	71	65
19.	76	70	82	65	77	67	71	60	49	36	61	47	55	39	62	40	59	46	75	55	88	67	72	65
20.	74	70	75	69	72	68	65	59	44	26	67	48	65	48	40	30	56	43	72	51	84	66	80	64
21.	83	71	82	69	70	65	69	60	35	23	55	47	52	48	47	32	50	43	56	49	81	66	89	63
22.	84	65	83	71	70	64	78	67	46	25	63	49	65	48	55	43	64	41	64	50	82	65	92	69
23.	91	73	88	74	68	64	72	63	60	27	59	50	56	46	60	43	66	41	76	54	79	66	83	71
24.	91	76	84	76	77	62	64	47	51	35	68	53	50	43	45	41	58	39	81	53	83	65	98	73
25.	88	78	91	76	68	58	50	42	58	33	73	48	49	43	63	40	41	31	58	51	89	72	90	72
26.	90	77	81	65	64	57	57	49	54	43	50	30	51	45	74	56	50	35	84	56	93	70	95	76
27.	88	75	67	65	67	62	67	56	61	47	45	28	59	50	60	49	62	47	72	56	90	71	97	76
28.	82	75	68	65	71	64	68	53	69	49	55	37	55	48	69	48	63	51	58	53	91	70	99	77
29.	82	74	72	64	70	65	69	51	65	42	67	52	49	47	77	60	51	37	70	53	81	69	97	73
30.	87	71	80	65	70	65	70	54	45	35	66	50	60	48	......	......	46	35	72	54	85	71	83	71
31.	85	70	80	69	......	......	63	54	......	......	56	48	65	57	......	......	50	38	......	......	91	72	......	......
Range	34°		33°		32°		44°		56°		45°		36°		47°		49°		51°		48°		43°	
Monthly mean	76°.4		75°.5		70°.0		66°.7		52°.4		53°.5		50°.4		49°.5		50°.0		57°.9		66°.1		74°.1	

Elevation of thermometers above ground, 4 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, KNOXVILLE, TENN.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	89	65	76	68.5	81	69	88	62	48.5	38.5	53	28.5	59	45	40	31.5	55.5	39	71	48	68	37	85.5	67
2	91	65	82	69	87.5	69.5	90.5	64	59	38	54	28.5	69.5	46	40	31.5	57.5	40	69	50	72	43	72	61
3	93.5	64	90	71	81.5	68	90.5	69	45	28	54.5	38.5	70	43	43.5	17.5	51	43.5	76	53.5	73.5	49	80	52
4	93.5	70.5	90	70	84.5	61	90	65	47	18.5	60	46.5	70	47	37.5	25.5	70.5	48.5	83	55	78.5	53	79	56
5	89.5	71	93	73	84.5	60.5	88.5	64	52	24	68	39.5	66	46	43	21	76	58.5	83	54.5	80	60	82	58
6	94	68.5	90	71.5	85.5	59	86	64	58	28.5	63	43	65	54	49	25.5	63.5	49.5	71	55.5	85.5	57	77.5	63
7	93	71	86	73	87	59.5	79.5	68	72	37	60	33.5	65	55	52.5	29.5	67.5	49.5	56.5	42.5	87.5	58	85	65.5
8	93.5	68.5	82	71.5	78.5	60.5	78	66.5	73	55.5	66	36	57	53	55	26.5	56	46	45	33.5	88.5	60.5	85	60
9	95	71.5	75.5	63	74	50	84	68	76.5	58.5	66	48	64	51	58	33	59	49	57	30	85	61	88.5	62
10	97	78	75	54.5	79	50	85	66	78	56.5	71	49	66	49	63.5	31.5	65.5	45	70	35	85.5	63	92	70
11	98	76	76	53	78	56	85	62.5	79.5	55	49	33	72	48.5	65	32.5	67	51	57.5	37	88	64	96	70
12	100	74	84	60.5	80.5	55	85.5	61.5	76	56	43	27	68	38.5	64.5	53.5	55	38	54.5	29.5	83	61.5	93.5	71.5
13	93	71.5	82	62	71.5	61.5	85	65	78	63.5	46	25	47	30	70	47.5	55	43.5	72	35	85.5	58	93	72.5
14	90.5	71.5	86	65	77	57.5	85	60.5	80	61	46.5	41	55	29	49.5	34.5	54	41	76	49	80	57.5	92	72
15	95.5	70.5	80	67	78	48.5	86	58	73	58	47.5	33.5	50	30	49	32	51.5	41.5	75	60	78.5	53	89.5	71.5
16	96.5	70	82	68	80	59	78	65	66	50	52	26	60	28.5	59	29	58	35	77	56.5	82.5	51.5	72	62
17	93	72	73	64	85	56	**78**	67.5	68	41.5	54	36.5	52.5	35.5	65	34.5	45	32.5	76.5	57	86	53.5	81.5	56.5
18	82	70.5	79	59	87	50.5	70	56.5	57.5	38	48	40	60	41	64	38.5	59	36.5	87	56	87	59	83.5	61.5
19	85.5	69	86	61.5	83.5	55	57.5	50	48	31	67.5	45	64.5	35	44.5	30.5	58	45	77.5	59	88.5	62	85	59.5
20	88	66	90	63.5	80.5	59	62	45	41.5	24.5	60	50	63.5	50.5	54	28	59.5	36.5	66	48	88.5	64.5	86.5	62
21	89	64	88	67.5	80	57.5	64	51	35.5	19	62	51	63.5	37	52	37.5	63.5	40.5	76	51.5	76	64.5	88	61.5
22	89	65.5	87.5	68	84	57	65	58	45	19.5	65.5	55.5	52.5	39	61.5	27.5	65.5	45	78	52.5	80	62	92	63
23	94	74	78	70	82.5	62	64	45	57	36	68.5	54.5	44	32.5	61	45	68	38	74	57	86.5	61	93	65
24	82	73	88	70	78	56	52	37	53	27	71.5	60	46.5	25.5	65	31	58	38.5	83	65.5	78	66.5	80	73.5
25	89	71.5	82	61.5	72	48	55	35	58	33	53	17.5	47.5	25.5	71	35	56	34	83	60.5	87	62	85	70.5
26	82	71.5	70	54.5	75	43.5	63	31.5	62.5	44	29	11.5	52.5	29.5	69	53.5	64	37	74.5	60.5	87	62	85	70.5
27	90	73	78	50	75.5	45	54.5	38	64	40.5	34	18	65	43	65	49	75	48	68.5	45	88	64	89.5	70
28	88	69	79.5	56	80	46	68	41	63	51	51	27	65	35	75	52	58.5	42	72	45.5	81	68	82	66
29	76	68	83	56.5	83.5	46.5	72	35.5	52	32	59	40	71	40.5	61	39	55	36	65.5	55	79	67	79.5	64.5
30	80	68	85.5	58	88	53	66	47	46.5	26.5	64	53 5	64	43	......	......	58	36.5	62	46.5	81	69.5	83	66
31	84	65.5	90	63.5	......	......	53.5	42	......	......	68	48	53.5	38	......	......	68	32.5	......	......	88.5	66.5	......	......
Range	36°		43°		44°.5		59°		61°.5		60°		46°.5		57°.5		43°.5		57°		51°.5		44°.	
Monthly mean	79°.5		73°.2		68°+		64°.4		49°.7		47°.5		49°.9		45°.9		51°.3		60°.9		71°.6		75°.6	

Elevation of thermometers above ground, 72 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, LA CROSSE, WIS.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	84	66	83	69	76	60	79	64	33	19	44	31	43	18	15	— 5	36	5	59	35	78	49	69	48
2	81	69	82	66	78	62	73	59	30	22	43	31	40	24	33	15	52	17	50	40	83	54	72	54
3	86	76	74	61	76	63	76	49	23	13	35	29	51	35	15	5	53	44	50	41	82	62	75	59
4	81	61	84	67	67	49	74	55	30	10	43	35	50	35	22	— 1	44	32	47	40	80	60	72	60
5	81	63	84	63	65	48	82	62	47	30	44	39	46	29	21	zero.	37	25	45	35	78	64	77	64
6	80	67	87	62	67	52	82	67	59	40	39	32	44	36	17	6	50	28	39	31	87	63	72	59
7	80	65	74	57	58	49	81	68	69	47	33	14	47	36	30	— 1	43	13	38	29	85	58	74	53
8	84	63	71	52	59	44	78	67	47	41	30	19	49	41	35	15	40	12	47	29	69	50	75	56
9	84	66	76	55	67	41	84	68	47	35	39	29	49	20	30	1	35	14	71	43	63	52	77	64
10	91	71	86	58	72	49	79	60	49	36	38	10	45	16	36	23	37	12	60	34	65	55	78	66
11	84	73	86	66	65	59	73	56	54	47	10	3	45	15	46	35	35	10	40	25	70	48	88	72
12	87	71	77	66	67	54	75	64	48	43	9	— 5	32	6	40	15	20	6	62	34	72	58	88	75
13	90	74	73	57	56	50	75	61	50	46	36	8	37	10	20	7	22	13	77	51	67	51	78	64
14	91.5	76	74	61	61	47	80	66	52	44	32	18	40	17	36	16	17	— 1	72	42	75	53	67	51
15	83	72	71	56	63	54	80	66	48	38	18	3	44	12	42	25	20	7	45	30	76	52	72	52
16	76	65	71	48	65	49	80	68	44	33	18	8	48	38	52	30	20	1	44	33	80	54	77	58
17	76	60	76	49	65	48	68	48	38	31	8	— 7	41	36	45	22	41	12	60	37	81	65	83	62
18	78	63	77	57	55	45	52	46	36	28	6	—15	53	35	22	6	40	33	65	48	82	68	79	67
19	82	63	77	62	59	43	58	39	42	22	14	— 1	43	32	22	zero.	47	35	62	35	77	60	82	62
20	88	68	76	65	63	39	64	45	22	8	12	— 1	38	30	37	18	40	27	59	37	67	51	85	64
21	89	74	87	67	60	47	67	45	29	15	25	4	40	33	37	14	48	34	73	46	64	43	88	66
22	93	72	81	67	69	54	58	45	43	26	26	— 1	36	29	45	27	56	30	63	44	70	48	89	70
23	80	66	84	64	56	45	46	37	33	21	12	— 9	32	23	50	29	50	34	47	42	64	52	90	73
24	74	58	79	62	58	36	50	32	42	22	11	— 9	37	19	56	40	49	29	45	38	80	62	80	69
25	80	67	78	56	66	40	53	36	36	25	— 4	—26	48	20	49	30	42	32	54	43	86	69	81	68
26	76	63	76	57	69	48	60	43	36	27	17	—15	49	34	40	31	52	32	49	40	80	67	87	65
27	82	63	86	57	80	62	62	43	36	34	36	15	34	20	37	31	49	40	59	42	67	50	83	68
28	77	66	88	69	72	52	52	42	35	24	24	9	20	— 1	32	15	50	36	63	49	78	51	71	61
29	81	59	90	73	74	67	51	41	28	16	24	10	34	— 6	18	5	52	33	53	42	70	55	67	60
30	88	65	89	68	73	68	41	33	39	26	22	3	35	9	......	......	60	35	52	40	75	53	82	58
31	88	68	85	67	......	......	37	22	......	......	28	19	32	4	......	......	52	44	......	......	68	51	......	......
Range	35°		42°		44°		62°		61°		70°		59°		61°		61°		52°		44°		42°	
Monthly mean	74°.9		71°.3		58°.6		58°.6		35°.2		17°.7		33°.1		25°.9		33°.1		47°.1		65°.8		70°.4	

Elevation of thermometers above ground, 37 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, LA MESILLA, N. MEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	103	54	99	64	101	55	92	56	71	32	69	25	54	42	43	31	69	26	78	43	83	51	88	55
2	102	60	100	63	104	55	92	51	76	36	73	34	57	42	55	24	71	36	74	47	87	49	95	59
3	103	70	95	66	105	59	85	46	79	39	70	27	64	33	50	28	74	30	75	45	91	45	101	64
4	102	67	99	61	99	65	87	50	78	43	63	35	64	32	42	21	71	43	82	43	95	49	98	60
5	95	68	93	61	100	59	90	50	80	36	64	28	62	32	50	20	70	38	87	44	93	50	95	62
6	98	69	98	66	96	63	86	54	82	32	71	26	65	34	50	17	61	48	88	43	88	49	97	53
7	98	65	93	66	98	54	85	45	77	33	70	33	67	38	54	17	65	42	80	48	87	56	98	55
8	96	68	88	66	95	60	85	52	77	39	70	28	73	36	58	22	66	36	68	38	86	51	97	56
9	82	63	86	57	94	56	78	48	75	38	60	38	74	40	65	25	72	34	71	34	89	46	96	63
10	87	62	88	56	99	54	88	41	75	42	60	22	72	34	58	32	69	48	78	33	91	54	97	63
11	99	65	91	53	99	55	90	51	60	34	51	29	67	34	64	33	64	42	82	35	96	46	95	56
12	100	68	95	51	91	59	89	57	70	28	55	21	67	30	51	27	70	37	85	46	88	49	97	59
13	92	64	98	52	88	59	85	61	70	29	57	21	64	26	56	20	69	44	82	45	85	47	97	54
14	102	66	104	58	90	47	85	60	68	33	62	25	68	28	57	27	55	29	79	49	86	44	99	58
15	102	65	98	65	92	42	70	51	75	35	66	22	68	29	59	20	50	24	75	44	93	45	104	53
16	101	71	95	59	94	49	72	37	75	33	63	24	70	30	60	20	58	26	80	45	95	68	102	66
17	103	69	96	59	98	55	75	42	62	39	72	21	70	29	68	30	61	38	84	39	93	56	100	67
18	104	68	97	55	96	53	78	37	53	22	72	23	64	37	65	28	58	32	66	44	94	48	99	65
19	95	65	100	56	88	50	79	39	65	20	69	25	71	35	57	36	66	28	70	33	95	48	97	74
20	99	67	102	58	87	58	83	39	63	23	68	26	71	34	62	42	72	34	81	35	90	59	91	67
21	96	65	101	61	93	50	84	37	70	23	64	43	71	28	68	40	75	38	82	54	97	60	89	67
22	100	71	100	66	95	49	87	39	70	25	63	36	63	28	70	47	70	38	85	56	99	61	95	62
23	104	65	101	60	95	48	75	44	71	26	59	34	66	22	74	40	78	39	80	49	99	55	101	62
24	106	67	104	56	89	51	75	38	73	27	60	28	57	33	54	39	80	45	68	44	94	59	102	63
25	102	71	103	55	91	53	79	37	72	30	50	17	63	20	59	26	80	43	75	31	93	59	101	63
26	100	72	100	61	92	51	70	42	66	29	53	16	63	27	66	33	62	44	84	38	92	54	100	61
27	98	69	97	61	85	59	70	37	58	41	57	25	63	26	68	30	73	30	85	47	90	57	103	57
28	101	69	97	61	73	62	77	33	65	23	62	40	67	23	68	38	81	33	83	41	84	52	99	59
29	100	66	99	62	81	57	84	38	67	26	65	32	50	31	68	29	80	42	78	44	91	48	104	63
30	103	65	99	61	90	49	72	48	70	25	62	40	50	22	......	......	78	37	80	50	96	47	103	56
31	99	66	97	63	......	......	52	46	......	......	65	36	55	22	......	......	75	36	......	......	92	52	......	......
Range	52°		53°		63°		59°		62°		57°		53°		57°		57°		57°		55°		51°	
Monthly mean	79°		78°.1		74°.6		61°.6		48°.6		44°.4		45°.5		42°.8		52°.2		61°.1		71°.5		79°.6	

Elevation of thermometers above ground, 5 feet.

The daily means are obtained by dividing the sum of the 7 a.m., 2 p.m. and *twice* the 9 p.m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, LAREDO, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	107	79	100	79	99	76	88	67	73	40	74	45	76	65	56	39	72	45	87	49	74	63	97	78
2	104	78	97	77	96	75	90	68	74	51	75	60	81	63	63	34	82	50	91	54	76	60	100	78
3	103	75	96	76	98	80	89	68	75	46	75	53	73	57	63	38	88	58	92	55	79	65	100	77
4	109	80	94	78	96	69	91	70	80	49	81	60	73	56	70	41	96	60	98	50	89	55	100	77
5	104	80	99	74	96	70	90	69	78	50	72	52	75	58	70	40	97	59	98	60	90	64	100	78
6	102	78	103	79	92	73	88	70	83	52	66	40	79	65	62	39	92	59	99	62	92	69	99	77
7	109	79	102	78	93	70	89	69	84	50	79	53	81	65	50	36	73	58	82	50	93	68	99	79
8	105	74	105	83	90	69	89	70	82	55	75	66	79	61	48	38	70	47	65	42	97	67	102	80
9	102	77	89	73	*	......	91	70	88	58	82	67	78	58	50	40	70	50	83	40	93	62	100	80
10	108	72	75	66	90	64	89	69	88	54	72	59	83	60	70	43	74	45	87	50	93	62	99	72
11	110	77	*	......	90	70	91	71	90	60	59	40	82	58	76	50	86	52	82	52	*	......	98	78
12	110	79	......	......	80	63	85	70	92	58	59	29	61	55	80	51	78	50	87	53	......	......	95	78
13	108	74	89	64	81	67	88	68	92	56	58	33	63	50	67	46	78	51	90	52	......	......	94	75
14	103	75	93	70	85	70	89	69	90	60	57	37	71	55	70	42	75	50	93	57	......	......	97	79
15	104	80	94	71	87	63	87	69	89	59	65	33	75	55	73	45	65	48	98	59	......	......	97	77
16	106	78	94	75	90	64	91	71	88	57	71	45	76	53	80	50	63	43	98	59	......	......	96	75
17	105	80	94	73	92	71	85	59	69	44	75	45	78	53	77	50	70	42	97	55	......	......	96	74
18	107	77	92	75	89	63	82	64	64	39	68	47	88	59	75	48	80	46	92	60	......	......	95	75
19	108	80	92	74	91	69	81	59	70	37	65	53	80	59	72	49	81	50	92	50	......	......	95	73
20	104	75	90	74	94	70	82	57	70	30	68	46	80	58	75	46	65	47	91	50	......	......	97	74
21	107	79	93	73	90	68	82	60	70	33	80	56	81	52	77	50	63	42	90	50	......	......	94	74
22	103	79	98	76	93	70	85	60	73	38	76	63	71	41	80	51	64	46	97	55	......	......	94	72
23	104	80	98	75	89	69	83	57	77	48	84	63	72	49	85	53	66	43	96	60	94	72	98	74
24	105	80	98	80	82	65	76	56	80	52	74	30	62	48	85	53	71	40	103	60	93	72	102	77
25	103	83	96	76	82	62	74	53	80	59	50	21	81	45	89	54	89	58	92	71	97	76	102	78
26	107	80	97	79	88	64	78	48	80	52	49	20	78	46	88	55	96	60	94	65	98	79	100	78
27	104	81	95	79	85	64	78	51	80	57	64	29	77	50	86	58	90	55	92	74	100	79	102	80
28	102	80	95	76	85	63	76	39	76	53	76	45	80	51	85	60	87	50	91	73	95	79	101	80
29	100	79	92	75	89	70	80	52	63	40	81	55	85	55	58	46	85	55	82	69	96	80	101	80
30	101	81	93	78	89	70	80	55	69	45	83	55	62	50	......	......	84	48	74	62	96	79	99	77
31	106	75	98	75	......	......	60	45	......	......	79	58	62	38	......	......	82	50	......	......	97	78	......	......
Range	38°		......	......	......	......	52°		62°		64°		50°		55°		57°		63°		......	......	30°	

*Observer absent on repair duty.

Elevation of thermometers above ground, 5 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, LEAVENWORTH, KANS.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	75.5	68	91	70	84	63	83.5	66	50.5	33	57	38	43	25	38	24	54	29	60	42	74	47	72	52
2	88.5	69	94	71	82	61.5	78	67	47.5	34	48	31	51	38	42	25	63	36	71	51	77	54	78	53
3	90	71	93.5	72.5	82	60	72	64	41	23	37	27	60.5	51	25	10	70	51	62	47	74	52	80	58
4	86.5	69	96	76	76	57	78	67.5	58.5	31	57	34	60	47	40	22	69	43	71	46	80	56	89	68
5	89	73	89	72	77	57	84	66	61	41	55	32.5	62	46	39	26	50	29	70	46	86	63	86	64
6	92	76	81.5	72.5	76.5	53	83.5	70	63	42	48.5	31	51	45	49	29	55	38	55	39	90	68	77	58
7	95.5	71	76	66.5	69	56	79	67	73.5	54	41	29	55	44	45	23	49	25	47	31	82	63	74	58
8	92.5	67	75	59	69.5	49.5	84.5	68.5	67	43	36	27	56.5	44	49	27	50	22	56	35	69	58	77	63
9	96	78	75.5	55	70.5	57	82.5	72	55.5	40	48	33	56.5	31	47	21	46	32	71	42	78	58	85	65
10	95.5	75	88	59	73	58	78	64.5	66	47	33	17	61	34	56	31	43	34	62	47	78	56	87	74
11	97	73	88.5	69	85.5	58	82	67	69.5	57	22	9	63	28	65	42	45	27	53	36	81	62	86	73
12	88	74	84	71	73.5	49	77	69	63.5	52	31	11	41.5	22	48	31	32	20	71	38	88	65	85	74
13	90	73	86	68	67	52	81	66	59	46	42	17.5	45	26	38	22	35	14	78	46	89	73	86	74
14	92	76	76	60	74	48	80.5	66	58	47	36.5	6	48	30	43	29	28	4	74	62	85	72	85	73
15	93	77	79	62	73	57	80	68	58	41	33	5	50	26	54	32	36	11	62	41	81	61	75	58
16	91.5	74	74	57	82	52	75	58	58	41	47	22	54.5	38	59	39	37	18	61	39	89	59	79	57
17	81	69	80	52	79.5	56	62	47	48	36	22	13	57	35	55	28	48	24	81	49	85	68	80	59
18	81	67	81.5	58	73	55	65	45	40	30	29	17	64	38	33	22	50	32	81	43	86	70	80	68
19	78	68	90.5	68.5	64	47	64	42	52	26	32	24	64	40	39	22	56	29	59	33	76	62	85	68
20	85	73	91.5	72	67	44	66.5	42	34	16	24	9	45.5	36	42	30	53	32	67	41	71	53	86	70
21	90	74	92.5	74	71	50	72	45	42	26	34	16	44	34	54	30	62	33	79	47	78	54	86	70
22	95.5	77	91.5	75	72	60	64	49	54.5	33	24	6	36	26	67	38	66	34	83	57	85	56	89	67
23	87	68.5	90	69	74.5	53	53.5	37	45.5	33	24	6	48.5	29	61	36	62	41	89	67	86	68	90	71
24	82.5	71	88	65.5	64.5	43	57	32	57	33	6	—6	53	31	67	51	57	40	70	50	87	72	83	73
25	83.5	67	86	69	67	43	58.5	40	52.5	34	26	—8	55.5	35	61	44	67	45	66	46	79	68	82	72
26	81	63	93.5	68.5	87	59	63	40.5	70	46	44	5	55.5	36	65	39	76	52	60	39	78	62	81	67
27	82	66	93	76	90.5	70	71.5	39	63	35	44	20	37	28	67	23	57	39	70	40	66	57	77	67
28	89	65	91.5	73	80	71	71.5	44	35	25	63	32	32	22	23	11	53	36	61	51	72	52	76	60
29	82	64	87.5	69	82	67	63	45	38	24	32	14	42	25	35	7	60	37	58	42	72	53	85	63
30	85	61	86	67	76.5	70	48.5	37	51.5	35	22	15	41	20	......	......	69	47	67	38	84	54	78	66
31	88	68	85	64.5	......	......	42	26	......	......	34	20	43	25	......	......	59	46	......	......	75	53	......	......
Range	36°		44°		47°.5		58°.5		57°.5		71°		44°		60°		72°		58°		43°		38°	
Monthly mean	79°.8		77°.6		65°.9		62°.1		44°.6		26°.7		41°.4		37°.9		42°.9		56°.4		71°		74°.7	

Elevation of thermometers above ground, 34 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, LITTLE ROCK, ARK.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	91	67	90	72	84	69	86	69	54	42	60	36	53	45	44	38	51	38	70	57	69	47	77	64
2	92	75	92	73	83	69	86	70	63	40	67	42	63	52	39	34	59	45	68	62	69	55	77	64
3	92	73	94	74	84	65	83	70	50	39	64	57	70	53	42	34	72	57	83	58	73	57	82	60
4	91	74	96	76	86	66	85	70	58	32	65	53	72	64	48	26	78	66	89	61	79	58	87	66
5	94	72	96	76	84	65	87	68	58	48	65	50	73	59	54	38	72	64	94	61	84	61	89	74
6	96	74	96	76	86	64	81	67	63	51	63	40	78	63	55	33	64	51	83	63	87	64	82	68
7	96	75	90	75	88	67	81	67	74	58	68	42	68	59	58	33	57	51	65	48	86	65	84	63
8	96	75	77	64	79	67	84	67	70	64	63	54	73	62	62	36	55	47	60	45	86	70	89	69
9	96	75	78	64	75	61	84	68	78	62	72	54	74	59	56	38	57	47	65	45	87	70	91	74
10	99	76	80	63	82	60	89	71	80	69	70	42	67	49	69	45	65	43	80	46	89	71	91	76
11	99	77	82	62	87	65	85	69	82	69	43	32	73	54	68	59	60	43	65	51	91	71	92	73
12	97	75	84	63	74	67	80	65	81	67	39	25	54	43	67	52	47	42	67	43	90	72	92	72
13	100	79	85	66	78	62	74	68	80	67	42	27	50	36	52	41	48	39	77	51	89	72	92	74
14	99	77	86	69	73	56	82	65	77	64	52	35	56	37	50	36	45	37	75	64	85	69	91	76
15	99	77	79	67	78	54	83	67	71	57	49	32	61	48	58	32	39	34	82	68	83	64	90	76
16	94	76	81	63	82	61	83	68	71	50	63	37	69	45	63	43	40	32	84	59	87	67	81	63
17	90	75	80	63	83	61	71	59	67	48	52	39	66	54	69	57	45	32	84	62	85	64	83	65
18	90	75	81	61	86	63	71	52	53	43	44	34	70	44	65	42	50	42	83	70	85	64	85	65
19	90	75	84	61	79	64	65	50	58	35	68	42	70	50	49	34	61	44	77	53	85	66	87	65
20	92	75	86	65	73	59	64	50	52	34	73	44	68	56	44	39	67	43	69	49	85	67	87	65
21	92	76	88	65	77	56	67	46	52	30	57	41	74	51	56	40	66	48	76	47	78	64	89	63
22	95	75	88	71	81	56	72	45	64	34	63	45	53	41	58	41	69	49	78	63	81	61	90	68
23	96	75	75	69	82	61	62	52	63	41	52	42	54	32	69	49	72	47	82	69	87	63	87	70
24	90	76	82	68	76	62	58	41	63	37	49	23	58	38	75	51	68	54	84	69	89	69	83	69
25	90	75	84	66	71	57	62	40	70	51	27	17	60	37	68	57	75	51	78	67	84	69	87	69
26	90	74	84	64	82	58	62	43	71	60	35	16	61	37	74	52	72	66	75	57	87	71	85	71
27	90	73	84	65	83	62	70	50	68	60	47	26	69	42	75	61	72	54	71	52	83	69	85	72
28	86	73	84	66	81	64	74	49	67	39	62	38	59	46	66	35	69	48	61	53	82	70	81	70
29	88	71	82	66	83	62	78	50	50	34	71	62	64	46	38	34	65	46	70	57	86	70	83	68
30	90	71	85	66	85	62	64	52	53	34	66	52	65	41	......	......	66	48	68	50	91	68	85	71
31	91	71	85	69	......	......	54	48	......	......	53	48	47	37	......	......	69	50	......	......	87	71	......	......
Range	33°		35°		34°		49°		52°		57°		46°		43°		46°		51°		44°		32°	
Monthly mean	83°.4		75°.3		70°.8		65°.4		56°.5		48°.3		55°.1		49°.7		54°.2		65°.4		74°.7		76°.7	

Elevation of thermometers above ground, 26 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, LOS ANGELES, CAL.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	75.5	54.5	81.5	58.5	82.0	60.0	73.5	53.0	66.5	45.5	65.0	53.0	67.0	39.0	60.0	33.5	66.0	41.5	60.0	43.0	67.0	50.0	74.0	56.0
2	75.0	59.0	88.0	58.0	84.0	61.0	74.0	55.0	71.0	46.0	63.5	49.0	63.5	42.0	69.5	35.0	57.0	47.0	56.0	53.0	68.0	52.0	76.0	56.0
3	75.5	56.0	87.5	65.5	87.5	57.5	83.0	54.0	68.0	45.0	57.5	51.5	59.0	39.0	64.5	35.5	57.0	47.0	62.0	53.0	67.0	47.0	74.0	56.0
4	79.0	60.0	86.0	64.0	78.0	57.0	85.5	56.0	65.5	43.5	63.5	42.0	61.0	42.0	64.5	38.0	57.0	40.0	64.0	55.0	69.0	47.0	72.0	55.0
5	79.5	55.0	84.0	61.5	80.0	56.0	69.0	60.5	68.0	43.5	66.0	46.0	60.0	42.0	65.0	38.5	60.0	36.0	64.0	50.0	69.0	47.0	82.0	50.0
6	78.0	60.0	83.0	60.0	78.0	55.0	72.0	59.0	68.0	40.0	65.5	45.0	61.0	42.0	65.0	40.0	62.5	39.0	62.0	52.0	78.0	46.0	78.0	58.0
7	78.5	53.5	83.0	62.0	80.0	56.0	70.5	55.0	72.0	49.0	63.5	51.0	63.0	43.0	63.0	38.5	72.0	39.5	67.0	47.0	78.0	50.0	79.0	54.0
8	80.0	52.0	83.5	60.0	79.5	51.0	70.0	48.0	65.0	46.0	60.5	51.0	61.5	46.0	66.5	38.0	60.5	40.5	79.0	52.0	80.0	49.0	74.0	55.0
9	80.0	53.5	86.0	60.0	82.5	52.0	73.5	46.5	61.0	51.0	63.5	44.5	59.0	41.0	62.5	40.0	61.0	45.5	83.0	53.0	75.0	48.0	77.0	59.0
10	78.0	59.0	92.5	66.0	80.0	52.0	74.0	47.5	63.5	47.0	60.0	41.0	56.5	42.0	56.5	46.5	66.5	38.5	75.0	56.0	68.0	58.0	72.0	57.0
11	77.0	58.0	97.5	66.0	86.0	55.0	73.5	42.5	65.0	44.0	71.0	45.0	58.0	40.0	53.0	43.0	60.0	45.0	70.0	48.0	68.0	55.0	78.0	52.0
12	80.0	56.5	89.0	64.0	100.0	64.0	70.0	53.0	62.0	47.0	76.0	43.0	67.5	42.0	59.0	35.0	60.0	49.5	62.0	51.0	66.0	52.0	66.0	57.0
13	78.5	56.0	86.0	63.5	101.0	70.0	64.0	52.5	66.5	43.0	73.0	45.0	68.0	46.0	61.5	37.0	61.0	41.5	66.0	48.0	67.0	43.0	71.0	56.0
14	80.5	56.5	86.0	61.5	97.0	66.0	64.5	45.0	67.0	44.0	72.5	44.0	68.5	42.0	70.5	42.0	61.0	43.5	60.0	43.0	66.0	47.0	78.0	57.0
15	82.5	57.5	85.0	63.5	93.5	65.0	67.5	48.0	65.0	44.0	73.0	44.0	74.5	43.0	66.5	43.5	63.0	37.0	61.0	47.0	68.0	43.0	75.0	56.0
16	83.5	57.5	81.5	64.0	87.0	58.0	82.0	50.0	71.0	51.5	67.0	43.0	75.0	45.0	57.5	44.5	56.5	36.0	63.0	51.0	68.0	48.0	75.0	57.0
17	80.5	61.0	85.0	61.5	82.0	62.0	87.0	52.5	76.0	43.0	53.0	43.0	76.0	46.0	61.0	37.5	53.0	40.5	59.0	47.0	69.0	42.0	80.0	53.0
18	76.5	62.0	77.0	59.5	74.5	59.0	96.5	59.0	77.0	42.0	55.0	48.0	70.5	44.0	61.0	36.0	58.0	37.5	60.0	42.0	71.0	45.0	81.0	51.0
19	79.5	61.0	77.5	57.0	72.5	58.5	96.0	63.0	84.5	48.0	53.5	49.5	67.0	46.0	57.5	34.0	62.5	39.0	64.0	40.0	81.0	49.0	83.0	52.0
20	78.5	56.0	81.0	54.0	78.0	56.0	93.0	62.0	79.5	48.5	57.5	51.0	70.0	48.5	59.5	48.0	71.0	43.0	63.0	42.0	84.0	52.0	78.0	52.0
21	82.0	56.0	79.5	54.5	77.0	53.5	84.0	56.0	79.0	51.5	55.0	40.0	69.0	44.0	54.0	45.0	72.5	43.5	62.0	50.0	78.0	55.0	77.0	59.0
22	82.5	55.0	78.0	54.0	80.0	51.0	73.5	50.0	76.0	46.0	54.0	43.0	73.0	45.0	55.5	41.5	73.5	42.0	61.0	52.0	73.0	56.0	75.0	57.0
23	81.0	60.0	80.0	57.0	81.0	47.0	69.0	46.0	72.0	44.5	51.0	39.0	72.0	43.0	56.0	41.0	63.0	47.0	69.0	46.0	73.0	57.0	72.0	57.0
24	80.0	60.0	81.0	62.0	77.0	50.0	74.0	45.0	64.0	38.0	51.0	33.0	74.0	46.0	57.0	40.0	64.5	44.0	71.0	45.0	69.0	57.0	75.0	56.0
25	81.0	57.5	78.5	62.0	77.5	48.0	90.5	47.5	55.0	36.5	61.0	30.0	60.0	42.0	60.0	40.0	57.0	47.0	70.0	47.0	75.0	55.0	73.0	57.0
26	82.0	55.0	80.0	55.5	76.5	49.0	95.0	60.0	58.0	46.0	63.0	43.0	56.0	43.0	63.5	41.5	61.0	42.0	66.0	46.0	88.0	54.0	74.0	56.0
27	84.0	57.5	83.5	55.0	76.0	54.0	90.0	55.0	63.0	42.0	57.0	50.0	50.0	36.0	57.5	51.0	63.0	42.0	65.0	49.0	97.0	66 0	78.0	53.0
28	83.0	58.5	77.5	55.0	80.0	52.5	91.0	59.0	69.0	41.5	57.0	48.0	49.0	35.0	61.0	43.0	62.0	42.0	64.0	52.0	84.0	54.0	76.0	58.0
29	83.5	60.0	85.0	53.0	76.5	61.0	82.0	54.0	66.0	45.0	55.5	44.0	54.0	30.0	63.5	45.0	59.0	41.0	64.0	54.0	77.0	52.0	75.0	57.0
30	84.5	62.0	85.0	59.0	77.0	61.0	69.0	57.0	64.0	45.0	59.0	37.0	57.0	35.0	......	......	60.0	42.0	63.0	52.0	78.0	56.0	77.0	58.0
31	83.5	60.0	83.0	57.0	......	......	67.0	55.0	......	......	66.0	37.0	59.0	32.0	......	......	64.0	41.0	......	......	74.0	57.0	......	......
Range	32°.5		44°.5		54°.0		54°.0		48°.0		46°.0		46°.0		37°.0		37°.5		43°.0		55°.0		33°.0	
Monthly mean	66°.6		69°.0		66°.8		63°.4		54°.9		51°.5		50°.5		49°.1		50°.5		55°.2		61°.3		62°.9	

Elevation of thermometers above ground, 37 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimnm and mean temperatures—Continued.

STATION, LOUISVILLE, KY.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	93	67	92	74	78	65	85	66	50	32	55	40	52	37	37	26	42	28	66	50	67	43	72	58
2	95	72	92	73	77	65	88	69	53	27	61	45	59	50	30	22	58	36	72	58	76	51	71	52
3	93	72	96	76	72	67	83	70	35	27	59	49	70	53	37	23	64	49	80	59	75	54	80	57
4	92	75	96	75	79	65	86	63	45	23	55	44	64	59	32	22	77	63	77	59	78	57	80	60
5	86	72	96	70	75	60	87	70	53	34	65	48	63	56	45	23	68	48	76	53	80	61	87	67
6	95	72	91	72	77	59	88	65	65	50	57	44	67	57	45	31	54	41	62	49	85	60	80	67
7	94	75	86	73	78	59	78	69	71	52	56	41	64	51	42	35	50	43	50	34	87	65	81	64
8	94	74	77	65	68	56	83	71	75	55	60	44	61	56	51	30	48	37	52	35	88	71	87	64
9	92	72	75	57	68	52	84	68	76	60	67	42	65	47	45	35	59	37	60	41	86	71	89	69
10	96	74	79	57	71	51	85	71	71	56	63	40	57	38	58	37	53	36	69	39	86	70	93	74
11	97	80	84	59	78	54	88	69	75	63	40	25	68	46	61	38	46	36	46	31	78	65	94	75
12	96	77	85	62	79	62	85	69	78	68	27	21	46	31	65	48	43	30	57	34	80	56	93	74
13	88	74	84	68	73	56	85	69	78	64	35	20	38	28	56	35	45	27	76	45	80	58	93	72
14	95	71	87	68	66	53	84	64	74	61	39	34	49	30	42	33	43	36	77	59	71	49	90	74
15	97	75	74	63	71	50	84	65	66	55	39	31	53	40	51	33	40	29	74	61	73	50	83	62
16	98	75	72	60	73	58	77	65	60	47	53	31	62	41	61	41	39	30	74	52	80	54	77	58
17	88	73	76	60	72	58	75	65	49	40	47	30	56	50	67	50	42	28	67	44	86	56	80	61
18	83	70	77	60	78	55	65	53	45	37	38	27	62	42	60	33	60	36	87	53	86	62	84	62
19	85	63	82	61	66	53	55	50	50	35	47	36	65	49	35	25	53	45	77	52	88	65	87	68
20	92	68	86	64	68	48	64	46	43	23	46	34	60	43	45	24	57	43	66	47	87	67	87	65
21	93	75	90	67	70	50	63	58	35	22	46	32	60	45	52	38	51	39	75	49	71	62	86	67
22	84	77	91	73	77	56	70	59	49	31	47	36	54	38	61	38	60	42	80	57	79	56	89	68
23	94	73	79	72	79	60	59	43	48	32	49	34	45	38	52	43	66	43	80	63	86	60	90	68
24	84	73	73	68	68	53	52	38	50	30	49	27	51	36	66	39	47	30	86	66	89	63	90	73
25	87	75	74	59	61	44	54	36	60	44	27	13	57	39	66	59	43	34	73	61	90	70	88	73
26	90	76	77	60	71	46	62	36	58	38	25	12	58	37	67	55	54	43	71	49	89	70	84	72
27	89	72	77	60	73	55	61	53	65	56	38	23	64	39	69	54	70	54	61	46	87	70	84	71
28	86	71	80	62	77	58	61	50	61	41	52	37	55	37	64	50	56	44	67	49	73	63	86	66
29	90	70	83	63	79	61	75	46	41	29	59	51	48	35	50	30	53	35	67	55	77	60	78	64
30	88	66	85	66	83	60	55	44	42	27	59	39	64	41	......	......	54	38	56	42	77	65	84	63
31	94	70	88	69	......	......	52	37	......	......	56	39	41	31	......	......	66	39	......	......	90	62	......	......
Range	35°		39°		39°		52°		56°		55°		42°		47°		50°		56°		47°		42°	
Monthly mean	81°.7		74°.1		64°.4		64°.9		49°.7		41°.8		50°.1		44°.7		46°.5		59°.6		71°.8		75°.5	

Elevation of thermometers above ground, 89 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, LYNCHBURG, VA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	86	64	82	67	86	68	83	51	53	33	48	26	52	39	44'	32	57	40	70	33	64	41	90	62
2	88	61	86	69	75	70	86	54	50	31	58	27	69	36	33	19	56	33	74	42	76	45	72	55
3	92	63	90	69	87	69	88	59	42	32	63	37	63	48	38	20	49	34	67	61	77	50	75	49
4	96	68	92	72	81	66	80	63	41	26	63	51	69	47	39	27	75	44	81	61	76	51	80	55
5	84	71	95	74	83	61	85	58	46	21	56	47	59	43	39	18	77	63	82	51	78	60	80	60
6	80	67	91	73	84	63	87	62	62	32	59	46	49	40	46	30	64	50	76	52	87	58	82	63
7	84	66	91	73	84	63	76	66	61	39	60	41	53	47	48	28	54	44	59	42	89	58	85	68
8	90	73	87	71	80	63	79	64	56	47	65	34	49	43	43	22	53	45	46	36	91	60	85	62
9	92	70	73	63	71	54	85	67	71	54	57	41	48	41	55	30	47	37	58	33	87	62	80	64
10	91	70	75	57	71	51	78	65	76	55	52	45	58	42	39	29	60	38	70	41	85	65	83	68
11	98	74	78	57	71	52	70	67	77	50	61	44	53	45	55	28	59	42	58	36	89	65	94	72
12	95	76	81	62	77	54	75	62	77	59	45	32	66	42	60	45	43	32	54	32	80	64	96	80
13	87	73	83	59	73	61	80	55	79	60	38	26	41	29	68	55	35	30	73	39	81	56	94	76
14	92	70	84	64	72	57	80	58	76	53	41	33	43	23	59	48	46	32	81	55	67	51	88	75
15	96	72	80	68	71	46	82	59	73	60	54	38	50	25	49	38	42	37	84	59	67	43	78	64
16	99	74	85	70	77	50	81	55	64	44	47	32	51	27	57	30	55	36	80	61	78	43	65	59
17	97	76	85	69	79	56	81	56	58	35	59	37	56	28	61	31	49	38	78	62	87	53	79	55
18	84	70	79	67	78	51	73	67	57	42	47	37	59	41	61	48	45	33	76	45	90	60	84	58
19	85	63	80	61	77	55	68	51	43	34	58	35	66	32	50	36	58	38	80	60	91	62	82	60
20	85	65	83	64	67	59	62	42	39	25	65	41	68	45	39	22	58	40	64	52	88	65	85	60
21	86	62	86	69	61	58	56	46	31	20	58	34	58	45	52	28	57	39	69	43	85	68	88	63
22	91	66	87	69	67	57	65	55	38	15	49	32	47	40	56	33	63	35	74	44	74	65	90	67
23	95	74	82	70	71	59	72	51	56	25	47	37	48	35	58	38	67	36	82	53	79	64	91	68
24	87	73	83	71	80	57	52	38	43	27	55	38	46	32	59	31	58	38	75	57	86	67	94	68
25	87	74	87	72	62	47	50	32	57	28	58	35	46	24	67	34	50	32	58	48	90	66	93	73
26	86	74	75	64	63	40	53	28	57	33	35	23	46	26	65	55	51	39	80	53	92	66	88	72
27	90	74	77	65	68	40	55	32	59	34	38	18	51	41	68	41	62	40	67	52	90	71	91	70
28	90	74	78	62	73	47	66	36	64	48	48	25	67	44	59	48	59	45	67	44	85	66	92	69
29	85	72	82	60	78	47	73	49	60	35	66	34	51	38	70	48	50	35	55	47	72	67	88	72
30	77	68	87	65	80	51	69	49	40	26	71	46	46	36	......	......	55	33	64	48	75	66	85	66
31	78	69	89	69	......	......	56	42	......	......	49	41	58	43	......	......	63	36	......	......	85	65	......	......
Range	38°		38°		47°		60°		64°		53°		45°		52°		47°		52°		51°		47°	
Monthly mean	80°.9		75°.7		65°.3		62°.9		47°.7		45°.9		45°.6		44°.7		47°.7		60°.3		72°.7		75°.7	

Elevation of thermometers above ground, 30 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, MADISON, WIS.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	82	64	87	69	77	64	84	67	34	19	46	32	40	19	15	zero	39	16	56	34	75	45	69	50
2	85	67	88	74	70	61	73	63	31	24	41	31	39	29	33	14	50	22	54	40	83	56	72	53
3	88	73	74	63	76	62	77	56	30	17	31	27	55	29	28	12	51	42	57	45	80	60	75	55
4	81	63	84	66	70	54	78	55	34	16	41	30	53	36	23	6	46	36	57	44	79	58	72	59
5	81	64	81	69	72	51	83	65	48	33	54	40	46	34	24	7	39	29	49	36	78	61	74	63
6	84	66	83	66	68	52	83	66	59	39	53	32	58	39	27	7	47	30	41	32	85	61	72	58
7	78	65	73	63	62	51	77	66	56	49	33	20	41	35	29	5	42	16	43	30	86	66	70	51
8	83	65	70	54	55	46	74	66	67	45	35	22	50	39	40	19	37	15	50	31	67	53	74	56
9	84	65	76	55	67	45	82	66	46	38	48	31	51	25	37	11	34	15	70	38	74	56	79	61
10	91	74	81	60	72	49	74	63	52	38	48	15	44	21	45	26	35	11	60	32	68	57	84	71
11	86	76	81	62	66	54	80	60	61	47	15	7	53	23	51	33	33	17	42	23	73	51	87	71
12	87	71	82	66	69	55	79	61	55	45	15	3	32	10	47	24	23	8	59	34	79	54	87	74
13	90	73	72	63	59	51	75	58	55	46	37	13	36	14	24	10	30	16	78	46	70	54	78	66
14	90	74	73	61	62	47	80	64	52	44	37	25	40	17	39	19	23	7	78	54	71	49	71	50
15	89	75	69	55	67	53	80	64	52	38	28	8	39	11	45	26	29	10	54	33	75	44	70	52
16	79	67	69	47	64	52	81	64	47	32	20	9	49	36	49	31	25	11	46	32	82	51	77	56
17	74	57	75	54	70	47	72	49	41	33	9	— 3	39	33	51	28	44	14	57	35	84	61	81	62
18	79	55	77	54	58	48	50	44	38	31	9	— 8	50	34	28	12	43	33	69	48	86	66	78	64
19	82	57	77	61	57	44	61	38	42	21	20	9	43	31	24	3	47	33	64	36	77	61	83	63
20	86	65	82	65	65	45	62	42	21	11	16	6	36	23	37	17	40	28	61	36	69	59	84	67
21	90	71	89	71	63	44	65	43	27	15	28	5	38	35	35	17	55	33	72	47	65	44	84	68
22	87	70	85	68	68	54	61	45	41	25	28	5	36	28	45	29	55	32	59	41	75	49	86	68
23	79	66	84	67	60	48	46	37	33	21	18	— 1	32	23	48	28	45	32	44	38	69	55	88	69
24	76	56	75	58	58	37	49	34	45	20	17	6	43	20	55	38	42	26	44	37	86	59	82	69
25	79	63	76	52	64	41	54	34	42	27	6	—12	46	19	54	32	37	30	61	41	86	66	84	67
26	76	63	79	60	65	46	54	38	40	29	16	—11	50	38	48	32	54	36	49	40	78	69	84	67
27	81	62	85	64	77	57	60	43	51	35	35	16	38	25	39	32	48	37	64	40	73	53	81	68
28	80	66	88	66	78	64	52	43	35	27	32	18	25	7	35	25	48	35	65	47	76	53	72	62
29	77	61	90	70	73	67	51	42	28	19	30	20	35	6	25	6	52	30	53	40	67	53	74	59
30	85	66	90	66	77	66	42	34	36	22	22	12	41	13	......	......	57	33	55	35	75	51	79	56
31	86	67	87	68	......	......	34	24	......	......	31	20	35	12	......	......	52	38	......	......	66	53	......	......
Range	36°		43°		41°		60°		56°		66°		52°		55°		50°		55°		42°		37°	
Monthly mean	74°.3		70°.6		59°.0		58°.0		37°.0		21°.1		34°.5		28°.2		33°.6		46°.6		65°.5		69°.6	

Elevation of thermometers above ground, 32 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, MARQUETTE, MICH.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	88	61	82	68	73	57	70	57	32	17	37	27	42	22	20	— 2	27	3	54	33	61	39	53	39
2	80	73	80	60	70	53	72	58	30	22	27	25	39	23	24	7	35	— 3	42	32	85	38	63	44
3	78	58	80	57	69	59	70	48	27	17	33	24	45	22	19	9	47	35	41	33	73	51	65	37
4	67	53	81	60	67	54	78	53	33	12	35	25	46	23	22	zero.	36	19	47	32	86	46	73	54
5	76	52	87	62	75	54	82	65	35	20	44	32	42	20	16	— 6	31	25	36	29	71	41	70	53
6	76	63	87	58	64	50	74	63	52	22	42	32	42	29	16	— 8	43	18	33	24	52	37	53	44
7	88	58	67	52	55	46	86	69	59	40	32	19	44	28	28	— 4	38	zero.	41	17	68	41	58	44
8	79	63	64	47	54	45	74	65	48	40	29	14	45	34	25	9	24	— 4	48	22	63	48	73	45
9	83	67	77	45	68	38	77	65	42	37	36	22	45	21	23	— 4	27	8	65	38	66	45	76	54
10	79	62	74	60	72	50	71	52	48	32	40	18	37	18	40	16	19	— 6	41	23	58	46	72	58
11	73	58	69	64	75	53	62	48	49	40	18	8	45	7	44	25	19	4	34	23	67	45	60	48
12	84	62	76	62	63	53	60	44	50	42	16	2	17	— 2	43	21	22	— 4	62	26	65	45	70	45
13	83	65	68	55	53	47	75	40	52	42	28	— 2	27	zero.	26	11	25	2	52	29	51	35	65	45
14	85	62	66	50	61	40	84	60	52	40	30	20	37	12	29	11	26	6	59	34	70	40	60	41
15	82	67	64	44	60	47	87	63	47	36	23	12	30	4	38	19	30	2	47	26	86	52	65	45
16	73	58	70	37	57	47	84	65	42	33	19	2	37	27	40	24	23	— 1	36	31	79	60	71	44
17	68	52	76	48	60	42	73	53	35	30	12	— 5	40	32	51	28	32	zero.	53	26	73	51	73	49
18	71	49	77	58	55	41	53	40	37	29	9	— 9	56	24	28	— 3	41	25	51	39	82	49	72	54
19	83	50	74	58	54	40	66	37	35	12	18	3	39	22	18	— 3	45	20	55	34	78	55	77	57
20	88	65	76	65	58	37	70	47	16	8	15	zero.	31	15	36	8	37	14	52	32	62	37	83	65
21	73	57	76	65	58	48	74	50	28	10	15	zero.	32	15	33	12	49	20	49	31	49	36	82	67
22	70	56	75	61	60	51	56	40	35	18	21	6	32	27	35	19	53	25	45	30	58	40	94	66
23	66	52	70	56	54	38	40	30	25	15	23	— 1	27	21	30	14	45	14	49	37	58	42	85	68
24	69	46	67	53	56	35	45	27	35	12	23	7	44	19	50	27	30	13	49	31	82	52	82	69
25	74	58	74	50	71	40	53	25	33	20	7	— 7	43	17	43	21	39	19	46	34	88	52	76	61
26	72	59	69	50	75	52	48	37	33	14	6	— 9	47	27	40	18	46	34	45	34	83	63	83	55
27	77	60	80	60	65	57	56	42	37	15	20	zero.	33	20	31	24	43	37	53	36	68	48	86	64
28	73	60	78	58	68	57	50	42	30	20	30	14	20	6	24	15	39	28	51	38	57	38	70	57
29	76	55	92	58	76	64	45	37	24	12	28	10	23	7	21	— 1	44	24	49	31	79	46	69	55
30	82	66	96	74	77	64	37	28	30	9	18	5	39	9	......	......	51	17	47	31	63	45	67	54
31	93	72	89	67	......	......	29	22	......	......	30	10	18	zero.	......	......	53	35	......	......	61	46	......	......
Range	47°		59°		42°		65°		51°		53°		58°		58°		59°		48°		53°		57°	
Monthly mean	68°.7		66°.7		56°.2		56°.2		31°.9		18°.5		28°.5		21°.5		25°.4		38°.6		57°.2		62°.0	

Elevation of thermometers above ground, 34 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, MASON, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	100	73	98	71	92	65	86	64	57	39	70	35	56	39	37	34	65	45	78	66	63	55	88	74
2	98	73	99	73	94	62	85	65	67	36	73	53	69	55	44	33	67	57	82	65	63	53	77	68
3	92	75	97	73	97	61	81	66	69	42	66	46	66	54	43	32	75	64	87	56	71	60	90	72
4	94	75	96	71	93	64	82	68	(*)	......	75	50	62	47	48	31	85	65	92	64	85	56	90	70
5	98	73	96	72	94	65	84	69	81	46	61	41	70	53	48	26	83	63	96	63	84	63	86	72
6	98	73	98	75	92	66	84	68	81	44	75	38	74	57	45	32	78	66	94	67	84	63	87	70
7	97	73	86	72	93	63	85	67	77	64	76	51	74	58	48	35	(*)	60	73	43	83	65	91	71
8	97	72	83	70	92	62	86	69	80	55	57	45	74	58	55	43	......	......	59	40	86	67	92	72
9	97	70	70	64	91	70	88	71	81	48	77	57	71	56	62	46	74	52	70	37	85	72	91	73
10	98	72	69	63	88	67	85	71	79	70	64	40	75	51	69	56	61	53	76	45	91	73	92	73
11	101	75	77	64	84	73	85	70	74	52	44	31	73	55	77	61	60	56	78	47	85	66	90	74
12	104	73	86	65	68	62	84	66	78	41	44	18	56	44	71	52	56	40	80	43	86	64	88	73
13	105	75	88	64	79	63	84	60	78	60	44	35	56	31	57	34	40	27	79	57	87	67	90	70
14	103	74	93	65	82	58	83	60	78	62	62	39	66	44	52	33	32	18	86	65	85	63	90	73
15	101	75	86	73	86	55	85	64	76	51	63	26	59	40	65	27	30	23	88	67	84	65	91	71
16	103	76	90	61	86	59	86	65	80	47	69	45	71	38	69	46	47	23	93	54	84	65	92	71
17	100	78	88	63	85	55	76	57	69	45	59	33	70	50	75	46	54	34	92	63	83	66	88	72
18	103	77	88	63	83	56	78	51	51	34	52	28	72	45	65	44	72	47	92	71	85	68	89	68
19	100	75	90	63	84	62	75	50	65	28	70	49	69	57	45	36	70	41	82	52	86	71	89	62
20	101	75	90	67	84	65	74	44	54	35	73	49	73	54	55	40	68	47	75	39	78	60	91	68
21	102	73	91	67	85	57	78	41	63	26	75	52	73	52	78	45	58	53	82	52	84	61	88	66
22	103	72	93	61	89	57	79	41	70	33	75	58	56	38	80	54	68	53	84	69	88	65	89	61
23	105	74	94	65	89	57	69	50	70	34	79	60	59	28	82	55	73	55	93	70	87	64	88	61
24	103	76	99	66	85	56	65	44	68	52	21	12	56	43	79	62	71	51	92	72	87	70	90	64
25	102	77	100	70	86	70	66	33	70	56	28	9	61	31	67	55	76	60	85	60	87	69	96	68
26	101	79	99	72	87	65	66	33	74	62	48	14	70	37	70	48	85	67	85	47	92	74	90	65
27	102	75	98	71	87	66	70	52	78	63	62	31	75	45	75	64	70	50	79	64	91	71	95	74
28	102	76	94	67	79	71	76	39	67	37	76	44	70	50	67	31	81	42	83	63	83	69	87	77
29	100	79	90	63	86	67	83	40	55	27	78	58	72	48	50	32	82	54	73	60	85	66	92	73
30	98	66	91	65	86	71	69	54	63	25	74	64	66	41	......	......	68	59	66	53	89	70	94	71
31	95	67	90	65	......	......	46	42	......	......	69	38	43	31	......	......	76	64	......	......	88	72	......	......
Range	39°		39°		42°		55°		......	......	70°		47°		56°		......	......	59°		39°		35°	

Elevation of thermometers above ground, 16 feet.

* Observer absent on repair duty.

Maximum, minimum and mean temperatures—Continued.

STATION, MEMPHIS, TENN.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	93	67	92	71	81	68	91	70	55	37	56	38	56	41	40	34	50	36	72	51	68	45	72	65
2	94	75	94	73	76	67	92	72	60	40	64	43	68	55	36	27	65	42	69	57	71	49	78	60
3	94	73	93	73	83	66	91	69	51	34	60	53	73	58	42	29	70	56	82	55	73	56	80	59
4	94	76	95	73	85	66	89	66	55	29	63	50	70	60	38	25	75	65	81	63	76	57	86	61
5	94	74	96	76	81	62	90	67	61	45	63	49	70	60	45	30	73	61	87	62	83	59	91	72
6	95	78	95	75	83	62	78	67	61	50	57	44	72	64	49	30	63	49	78	55	88	64	82	67
7	96	77	87	72	87	67	76	67	72	54	64	43	70	60	51	38	58	50	59	41	89	66	85	64
8	95	79	75	67	78	64	84	66	75	59	63	55	71	58	57	32	54	46	56	40	90	69	86	67
9	98	79	76	64	72	59	84	70	78	64	69	58	69	59	62	38	53	46	61	39	88	68	93	74
10	99	80	79	61	84	56	87	71	80	66	68	43	67	47	67	47	64	43	78	43	90	69	94	75
11	99	80	82	63	88	65	91	70	77	69	43	31	72	55	67	53	58	43	61	43	89	71	96	75
12	98	81	87	65	77	68	79	66	78	69	35	24	55	37	70	50	47	39	63	35	91	72	93	75
13	98	77	86	68	76	62	79	66	82	66	35	24	45	35	53	36	45	38	77	43	91	71	92	75
14	97	77	87	70	71	55	85	67	77	62	40	32	55	36	48	34	44	38	76	55	84	68	91	77
15	98	75	79	66	76	51	84	66	72	59	38	29	58	46	54	36	38	34	74	56	85	61	86	69
16	97	74	73	63	79	60	77	65	67	50	59	32	67	49	61	40	35	30	82	60	84	63	79	64
17	97	77	77	60	84	58	72	59	64	44	52	36	63	52	68	50	44	30	83	56	87	67	83	67
18	86	74	82	62	86	61	68	51	49	41	40	32	66	46	63	40	53	40	86	69	86	65	90	65
19	87	74	85	62	79	63	62	45	51	32	68	39	67	52	44	32	53	43	76	52	89	66	89	68
20	91	74	87	64	72	54	64	44	46	28	61	39	64	52	44	33	65	43	68	48	86	71	90	66
21	92	74	91	67	76	53	67	56	42	27	65	36	64	48	54	39	61	45	78	48	71	64	90	67
22	93	75	90	72	82	60	70	56	57	33	66	41	57.5	38	61	41	64	47	79	59	80	59	92	69
23	94	76	81	72	84	63	61	47	58	43	70	40	47	34	62	49	70	49	84	69	85	63	90	71
24	93	75	78	71	76	61	57	39	60	37	70	26	53	35	74	49	62	49	86	70	90	68	89	72
25	89	76	80	63	71	52	62	38	68	51	27	14	57	36	69	55	72	46	80	68	84	70	86	72
26	85	74	81	64	79	56	64	47	67	56	31	15	60	37	71	49	76	58	75	58	90	73	85	73
27	91	72	83	65	81	61	67	49	65	59	42	25	67	44	69	59	71	59	68	51	86	68	89	71
28	81	71	84	64	81	60	70	49	67	39	57	37	59	45	69	37	60	49	69	51	77	70	87	70
29	85	73	84	65	84	63	76	51	45	32	70	56	66	42	37	33	59	45	69	55	85	69	83	68
30	88	71	86	66	87	63	63	49	50	31	61	49	68	43	......	......	67	45	65	50	90	72	79	68
31	92	72	82	69	......	......	53	45	......	......	60	43	44	34	......	......	69	47	......	......	89	70	......	......
Range	32°		36°		37°		54°		55°		56°		39°		49°		46°		48°		46°		37°	
Monthly mean	83°.6		75°.4		69°.7		65°.6		54°.4		46°.4		54°.6		47°.4		52°.5		64°.8		75°.0		77°.0	

Elevation of thermometers above ground, 53 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, MILWAUKEE, WIS.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	75	61	88	68	74	65	74	65	33	17	43	31	37	19	20	1	37	15	49	35	72	39	68	48
2	82	67	91	73	70	64	75	64	30	24	42	33	38	29	31	14	44	23	47	40	72	57	72	52
3	90	70	78	65	71	61	71	55	26	16	34	29	53	34	27	15	50	41	65	39	80	60	75	54
4	73	60	81	65	69	55	71	53	32	9	41	28	53	39	23	9	47	35	61	41	74	58	73	59
5	71	57	81	67	72	48	81	64	40	32	52	39	43	35	26	9	40	30	49	36	77	58	74	57
6	75	63	76	63	69	53	75	62	53	36	52	32	47	38	30	6	42	27	41	31	66	45	70	57
7	80	63	76	63	61	51	72	63	56	44	32	24	43	36	23	5	40	22	41	26	86	53	69	51
8	83	67	70	52	56	46	67	61	64	50	33	23	45	37	42	22	31	18	45	29	76	52	63	47
9	85	66	72	51	59	43	68	50	61	39	55	32	53	27	31	10	36	19	68	37	79	51	64	51
10	91	73	80	59	63	42	77	63	48	34	57	19	40	23	39	25	30	11	61	33	70	54	82	57
11	85	68	77	63	69	54	63	58	67	44	19	10	57	29	52	22	34	22	41	24	66	50	89	62
12	80	65	80	57	70	59	65	57	58	44	17	7	29	16	51	28	26	11	57	31	64	51	87	62
13	85	68	74	59	59	50	67	55	56	45	28	15	32	18	28	15	32	21	77	41	56	44	79	57
14	91	70	65	59	58	43	68	56	52	45	35	25	44	21	35	18	27	10	77	38	57	45	57	47
15	91	72	65	58	70	51	68	63	54	41	32	10	38	15	44	29	32	11	58	36	65	44	64	48
16	79	68	64	55	60	48	68	61	45	31	23	9	44	36	45	33	28	16	42	33	73	48	70	53
17	69	59	69	49	69	46	68	51	42	36	12	— 4	44	34	54	33	41	11	45	30	85	59	78	60
18	65	57	71	51	59	48	52	45	40	32	10	—11	47	33	33	13	40	32	63	43	84	68	75	60
19	76	53	73	61	59	41	52	39	43	22	26	10	45	35	22	3	45	33	65	38	76	65	76	61
20	80	64	80	65	61	40	58	39	22	13	17	10	35	28	34	18	40	31	61	37	68	46	83	61
21	82	68	89	72	61	42	61	42	28	12	31	10	39	32	33	18	53	29	72	45	52	41	82	65
22	78	71	83	71	70	53	68	44	39	22	32	7	38	28	44	28	53	30	61	39	70	45	87	66
23	73	64	73	63	62	48	44	37	36	23	33	3	29	25	39	29	46	32	42	37	66	54	89	70
24	68	61	67	60	52	35	46	30	42	20	34	10	41	23	54	38	32	22	43	35	78	53	87	69
25	81	60	67	58	62	37	52	34	39	28	10	— 9	43	28	54	32	36	30	59	38	79	59	83	67
26	79	64	69	55	64	44	57	37	42	29	9	—12	52	39	43	32	43	35	52	41	81	61	82	65
27	82	61	75	60	69	58	62	42	56	39	35	9	47	30	38	33	43	37	61	38	72	59	76	68
28	82	65	85	65	79	64	52	42	39	28	37	20	30	11	37	25	37	34	62	45	63	50	73	63
29	76	60	89	69	75	66	51	42	28	18	38	20	34	11	26	8	39	30	54	40	60	49	71	57
30	86	59	84	68	81	65	43	31	34	16	30	12	43	18	......	......	45	31	46	35	73	47	80	56
31	83	66	85	66	......	......	36	25	......	......	37	21	35	12	......	......	51	34	......	......	66	56	......	......
Range	38°		42°		46°		56°		58°		69°		46°		53°		43°		53°		47°		42°	
Monthly mean	71°.8		69°.4		58°.6		55°.6		30°.8		23°.5		34°.7		28°.6		33°.0		44°.9		61°.5		67°.8	

Elevation of thermometers above ground, 105 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, MOBILE, ALA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	86.5	78	91.5	72	85	77	90	74	67	49	63	42.5	73.5	53	62	42	62	54	75.5	53	74	53	89	72
2	93	77	88	77	88	76	90	74	68	52	70	43	74	57	60	40	71	56	71	63	67	62	89	74
3	88	76.5	94	75	90	70	89	71	66	45	68	58	70	59	53	34	75	63	80	66	78	62	88	72
4	92	74	90	75	88	74	85	70	61	41	67	50.5	74	60	51	34	77	(*)	85	70	80	61	90	70
5	94	71	90	73.5	87	69.5	80	72	67	47	70	62.5	74.5	60	48	42	82	......	81	71	84	66	89	76
6	93.5	75.5	94	74	89	68.5	77	69	68	55	65.5	49	73.5	60	53	40	78	......	84	68	83	65	89	76
7	94	75	93	77	88	73	83	70	73	58.5	66	44	72	60	59	37	79	......	74	56	84	68	85	73
8	95	73	92	76	91	73.5	88.5	75	76	60	72	54	71	60	62	48	79	......	56	46	83	68	89	72
9	100	76	88	74.5	87.5	73	85.5	73	79	67.5	74	59.5	72	62	64	50	73	60	63	45	86	67	90	74
10	99	77.5	84	70	86	71	87	69	77.5	67	73	64	68	58	71	50	64	54	70	42	86	70	90	77
11	99	80.5	84	67	87	75	87	70	79	70	65	44	73	57	70	51	76	64	73	53	86	69	91	75
12	95.5	81	89	71	86	73	84.5	69	80	70	53	35	71	62	71	62	76	68	69	47	83	68	91	73
13	99	80	88.5	73	78	69	85	70	80	70	46	40	64	46	65	54	77	59	73	45	83	67	94	74
14	160	76	83	69	80.5	65	84	70	80	70	66.5	46	63	39	61	42	73	62	75	58	87	67	95	75
15	90	75	89	71	85	61.5	78	71	82	73	60	44	66	55	60	40	77	62	80	66	87	71	95	76
16	86	77.5	87	70.5	84	64	80	71	81.5	71	58	38	68	52	63	39	73	47	76	65	86	66	88	68
17	90	75	83	70	88	64	84.5	70	81.5	70.5	62	39	69	51	66	48	56	39	82	68	83	61	84	63
18	91	76.5	84.5	65	85	66	75	64	74	48	64.5	43	68	53.5	73	58	72	47	82	68	85	62	87	67
19	91.5	78	88	65	88	68	70	58	55	42	67.5	44.5	68	45	64	46	72	56	77	71	85	65	89	65
20	85	76	93	68	86	71	66	58	50	40	66	52	70	54	56	43	72	53	76	62	81	70	83	73
21	84.5	76	92	75	78	70	76	63.5	50	33	68	60	62.5	59	57	50	63	55	83	66	84	73	85	67
22	89	77	79	76	73	68	75	66.5	57	34.5	68	61	63	50	58	40	60	54	83	69	90	72	77	71
23	88	77	85	77	75	68	78	59	64	39	71	60	50	41	76	54	72	47	81	70	89	70	85	72
24	89	75	92	78.5	82	69	62.5	49	64.5	45.5	72	64	56	43	72	52	75	50	84	73	87	73	88	71
25	88	73	90.5	79	84	68.5	67	48	69	47	69	35	49	43	72	60	73	51	84	73	85	73	81	75
26	87	76	89	73	84.5	63	64	52	71	46	38.5	24	56.5	42	75	62	75	52	85	72	78	72	89	74
27	83	75	82	67	81	64	60.5	54.5	74.5	63	49	30	63	45	77	65	79	64	83	66	86	71	92	78
28	89	74	86.5	67	85	63	73	56	72	68	61	35	70	43	76	63	75	54	83	64	85	74	93	75
29	92	75	84	69	85	64	72	51	64	43	65	47	70	45	75	57	67	50	81	64	82	74	86	74
30	83	76	86	72	87	72	72.5	51	56	36	71	53	73	55	......	......	71	48	75	60	89	75	91	71
31	87	74	84	73	......	......	70.5	57	......	......	71	63	70	59	......	......	73	50	......	......	90	75	......	......
Monthly range	29°		27°		29°.5		42°		49°		50°		35°.5		43°		....		43°		37°		32°	
Monthly mean	81°.7		78°.6		75°.8		69°.7		60°.5		56°.4		59°.4		56°.5		64°.5		69°.2		75°.3		80°.2	

* Minimum thermometer broken.

Elevation of thermometers above ground, 31 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, MONTGOMERY, ALA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	96	75	83	73	85	74	87	73	66	50	56	39	72	51	53	40	68	52	75	52	71	49	90	73
2	90	74	88	73	88	76	87	72	68	50	68	46	74	53	51	40	74	48	70	57	70	59	89	72
3	93	73	89	75	86	68	87	67	62	43	68	54	74	53	53	34	77	61	84	64	72	61	88	67
4	96	72	90	74	87	68	86	70	57	34	66	60	74	58	48	33	82	64	87	69	71	62	86	67
5	95	73	93	73	87	68	79	70	59	41	68	58	75	55	43	58	85	66	90	71	80	64	89	70
6	92	72	92	74	88	67	74	70	71	52	62	48	74	60	54	37	84	68	89	68	86	63	91	72
7	96	74	92	75	90	69	80	70	74	55	63	40	75	62	59	34	84	66	75	50	88	65	85	73
8	97	76	84	72	89	71	82	72	77	61	67	47	74	62	61	44	70	62	51	44	87	67	92	70
9	98	77	84	71	83	68	87	71	79	64	73	57	74	63	64	40	70	57	60	42	83	70	95	74
10	98	77.5	83	64	86	63	88	70	76	69	76	59	69	61	68	49	69	50	70	42	82	69	97	75
11	100	79	84	66	84	68	82	67	80	66	68	40	73	58	73	47	66	61	68	51	86	66	94	73
12	100	79	85	68	87	65	80	69	82	65	50	33	73	57	75	61	83	64	64	40	87	66	95	74
13	101	80.5	86	72	73	64	81	67	82	69	48	35	60	43	73	52	67	55	74	42	86	68	97	75
14	98	79	76	72	81	61	83	67	79	64	56	42	56	41	58	42	66	55	81	58	88	67	98	76
15	95	74	87	72	82	58	80	72	83	69	56	43	59	41	57	38	78	61	82	64	83	68	97	77
16	96	75	86	73	84	62	82	70	80	69	58	37.5	63	43	62	35	66	44	79	63	82	62	81	70
17	95	76	81	69	89	62	79	72	81	63	64	37	72	45	67	49	55	39	86	68	86	60	85	68
18	95	75	86	65	90	64	72	65	73	47	68	43	66	49	72	57	65	49	87	68	89	63	86	64
19	86	73	88	65	90	64	69	57	53	39	70	43	72	41	60	44	68	56	80	62	90	67	87	65
20	86	71	92	67	85	68	63	59	49	37	70	43	70	53	55	38	64	49	73	65	89	69	85	69
21	88	74	90	73	78	67	64	57	48	29	66	55	65	55	53	46	69	51	82	63	79	68	88	69
22	93	73	85	74	74	67	68	62	55	31	69	62	61	46	61	36	66	55	71	64	86	68	90	69
23	97	71	80	75	72	65	74	55	65	35	75	64	49	36	73	51	72	49	81	66	92	67	84	71
24	89	75	90	76	84	67	63	44	60	41	75	66	53	37	71	43	71	50	86	68	87	73	89	70
25	92	74	90	74.5	82	65	61	43.5	65	40	69	31	50	36	75	51	70	44	88	70	86	70	80	72
26	89	75	83	68	77	57.5	62	45	70	41	37	20	45	42	70	60	76	53	81	66	86	70	92	71
27	87	73	83	61.5	77	53	59	53	74	55	47	26	61	43	78	63	77	64	83	59	85	70	95	73
28	88	74	83	64	82	59	73	55	68	60	58	32	70	39	79	58	70	53	79	58	87	71	95	75
29	91	75	85	64.5	84	61	72	46	60	41	64	40	70	44	70	54	65	45	82	63	88	70	89	74
30	83	73	84	69	84	72	75	46	54	33	64	49	67	57	......	......	68	43	73	58	78	70	96	72
31	86	72	82	71	......	......	68	50	......	......	70	57	69	53	......	......	74	41	......	......	67	72	......	......
Range	30°		31°.5		37°		44°.5		54°		56°		39°		46°		46°		50°		43°		35°	
Monthly mean	82°.4		77°.6		73°.8		68°.1		58°.6		54°.4		58°.0		54°.2		62°.0		67°.5		76°.7		80°.1	

Elevation of thermometers above ground, 34 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, MONTREAL, CANADA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	74.0	55.7	85.2	67.7	81.4	64.2	75.1	61.7	29.3	20.4	38.5	10.9	24.8	−7.6	23.8	−15.1	25.8	11.3	46.4	28.0	45.5	22.9	63.9	52.9
2	81.6	60.4	84.9	72.1	76.3	62.5	73.9	55.3	34.6	17.4	38.9	13.8	40.5	12.8	3.8	−17.5	29.2	9.9	48.5	28.6	58.0	35.1	63.9	49.4
3	80.7	65.8	78.8	69.1	77.9	56.7	74.0	55.0	35.2	20.7	21.5	13.8	17.0	−0.8	9.9	−9.1	44.0	17.6	54.1	36.6	74.3	45.2	65.9	49.3
4	79.7	58.1	76.6	64.8	74.0	60.9	62.3	46.2	30.4	18.2	29.5	18.9	39.1	7.7	17.1	6.8	41.0	33.7	62.0	43.3	63.8	38.0	63.9	48.8
5	67.1	51.6	80.0	59.9	65.0	53.8	68.0	45.7	32.6	19.4	25.2	9.6	34.5	5.7	25.7	10.6	39.1	20.0	51.3	31.5	80.0	43.1	68.0	50.3
6	74.1	54.6	73.6	54.8	67.0	48.9	59.8	41.9	34.4	21.3	46.7	18.4	35.0	−3.2	24.4	2.8	27.9	16.1	37.1	23.5	67.1	42.6	71.3	56.9
7	70.0	60.4	70.0	52.5	69.0	53.7	76.3	45.0	39.9	23.5	45.3	35.5	35.8	16.1	19.7	6.9	39.3	9.0	31.2	17.5	59.3	35.2	74.0	56.5
8	73.1	62.2	70.5	56.7	64.8	52.8	75.5	62.2	46.7	35.5	38.8	17.4	35.8	13.7	33.8	6.3	35.2	−5.7	39.6	17.8	67.2	43.7	69.3	53.5
9	76.5	59.2	62.1	50.7	63.0	49.9	75.5	58.9	59.5	43.5	22.5	11.4	43.2	13.5	33.6	−4.4	13.2	−11.2	45.8	26.4	81.3	41.9	72.9	57.1
10	76.3	60.4	69.2	54.5	61.3	48.2	61.8	48.0	57.8	38.0	43.5	19.0	41.3	12.7	29.0	−13.4	26.1	2.7	46.0	31.7	77.5	46.6	76.9	58.4
11	74.1	61.9	73.5	54.8	67.1	48.0	57.0	47.7	41.4	33.2	47.4	30.2	39.6	0.2	26.9	−2.8	9.3	−10.6	35.2	16.7	71.9	50.4	81.1	62.6
12	81.8	59.7	77.4	57.5	69.7	47.0	53.5	46.7	43.8	32.9	33.8	7.9	40.1	11.0	51.2	24.4	26.0	−0.4	34.3	10.2	58.2	39.7	68.2	59.8
13	83.1	63.7	77.3	60.9	64.2	53.5	60.5	40.9	41.0	30.5	30.1	5.8	15.0	4.4	39.6	26.8	20.6	−1.6	41.8	29.9	52.1	38.6	64.9	57.6
14	80.8	65.9	71.3	50.9	60.0	44.1	62.0	42.4	52.9	37.8	29.8	14.0	24.7	−0.6	30.3	17.1	24.0	6.1	34.0	26.2	57.3	36.1	68.8	55.3
15	82.2	64.0	64.9	47.0	60.0	44.1	69.0	49.6	58.5	42.9	30.7	22.0	33.1	14.0	24.8	4.2	32.8	13.4	59.8	26.3	67.2	42.0	71.8	55.5
16	80.0	66.1	58.9	48.0	62.7	47.3	80.0	59.9	49.6	37.6	25.8	3.2	33.4	4.7	41.6	19.1	24.0	12.9	46.2	30.4	64.0	48.0	73.7	61.5
17	69.0	58.0	58.4	51.9	61.0	50.0	73.5	54.3	40.9	27.8	31.8	−3.8	40.3	30.5	40.8	10.0	35.0	15.2	42.1	29.5	68.8	51.4	77.0	59.3
18	67.1	53.9	62.0	56.6	56.0	44.9	66.5	56.1	34.1	23.5	13.6	−7.8	37.7	30.7	44.4	31.6	29.7	11.9	42.0	27.0	67.2	47.0	82.0	62.3
19	69.7	51.9	64.8	55.9	59.9	43.9	58.2	35.0	32.3	19.0	24.8	−5.7	35.6	30.9	34.6	5.8	41.2	17.4	53.0	30.2	72.8	47.9	82.0	63.5
20	73.0	54.7	75.4	51.8	58.0	45.3	49.5	30.9	31.4	11.6	10.9	−10.3	35.6	10.0	20.3	0.6	39.9	22.5	54.1	41.0	76.8	60.9	73.7	60.8
21	74.8	63.2	69.5	60.7	60.0	41.5	66.3	39.8	18.0	5.6	−7.3	−25.2	16.9	3.2	26.0	13.7	32.0	17.5	63.4	36.2	66.9	48.4	68.0	55.4
22	72.4	60.9	80.5	63.9	63.8	38.9	63.8	46.1	27.6	2.2	25.7	−18.3	25.7	−4.4	29.2	12.7	41.1	19.4	56.8	34.4	73.0	45.2	70.5	49.7
23	66.0	58.4	76.9	65.0	63.3	48.4	61.0	33.7	36.8	3.3	27.1	9.2	33.8	22.8	37.1	6.9	34.5	16.7	43.0	25.2	74.0	58.0	67.0	53.9
24	69.1	55.8	68.9	60.9	57.0	37.7	38.3	26.4	25.9	12.2	23.8	6.9	30.0	10.3	14.0	−6.5	27.5	8.2	50.2	27.3	77.8	57.9	82.0	58.6
25	71.8	54.1	67.8	56.4	53.8	33.1	40.6	22.0	38.6	23.6	23.5	−11.2	30.7	12.1	38.0	0.5	23.1	−0.8	54.7	31.2	85.0	61.9	86.1	68.4
26	75.0	63.0	69.0	50.9	58.0	38.2	52.9	24.4	32.4	15.0	−3.4	−17.6	39.3	14.3	48.0	34.1	29.2	9.8	51.4	39.4	85.2	66.0	81.4	68.8
27	71.0	60.9	73.0	52.9	61.8	41.3	53.8	35.1	38.4	14.2	2.3	−10.7	39.9	30.5	40.1	27.6	40.0	12.7	49.2	35.1	83.9	66.9	84.0	65.6
28	77.9	59.9	74.0	56.3	58.0	49.6	50.7	42.0	49.7	34.2	27.0	−0.8	41.0	12.5	35.0	26.4	37.1	15.0	54.5	28.5	74.5	52.0	78.0	65.4
29	78.0	66.3	75.3	60.9	65.3	55.1	54.5	40.6	52.5	14.1	33.7	17.3	16.6	−5.3	48.2	16.7	42.8	21.5	56.5	36.6	65.9	45.9	79.1	67.9
30	77.2	62.9	72.8	54.9	75.5	56.9	54.5	35.2	18.7	9.2	33.2	−15.5	37.1	−9.5	......	......	41.2	20.7	51.0	29.4	60.7	50.4	75.6	62.8
31	81.1	62.5	78.0	59.9	......	......	38.7	26.9	......	......	−1.9	−24.4	43.8	20.6	......	......	49.6	24.1	......	......	68.1	53.8	......	......
Range	31°.5		38°.2		48°.3		54°.3		57°.3		72°.6		53°.3		68°.7		60°.8		53°.2		62°.3		37°.3	

Maximum, minimum and mean temperatures—Continued.

STATION, MORGANTOWN, W. VA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	83	57	85	66	84	67	79	50	48	28	54	27	56	37	38	22	46	34	61	37	56	36	74	55
2	86	63	85	68	75	70	81	56	52	28	60	31	58	51	37	11	51	29	72	37	71	46	63	53
3	87	65	85	69	80	70	79	62	45	26	63	42	63	46	37	23	58	35	66	57	74	54	71	46
4	85	67	81	70	74	63	74	55	45	22	57	48	67	46	34	12	71	53	73	56	79	50	76	51
5	82	63	82	68	73	60	84	54	50	20	62	38	54	43	40	3	65	52	69	53	77	52	79	62
6	84	63	81	73	74	58	85	57	54	37	66	51	65	43	41	16	53	40	62	44	79	55	81	66
7	82	70	82	71	77	61	84	59	67	37	60	42	64	43	44	23	50	40	46	34	82	56	77	63
8	81	76	74	65	69	59	80	67	76	46	55	42	61	45	44	14	46	35	46	29	84	60	78	56
9	81	68	68	55	64	49	80	66	75	64	60	41	67	47	34	24	54	39	53	28	84	67	82	57
10	82	68	70	51	64	45	81	66	66	52	64	49	52	40	55	20	44	35	70	43	83	62	86	65
11	86	71	74	52	68	44	80	61	76	56	50	37	70	43	59	30	46	35	44	32	76	61	89	70
12	80	71	77	56	71	46	78	58	76	63	36	28	42	31	68	47	39	35	52	29	73	50	87	70
13	83	70	78	58	70	60	79	60	73	53	42	24	37	21	57	48	44	30	68	43	64	48	85	69
14	86	72	80	67	62	57	80	58	76	53	53	38	48	12	43	40	46	43	76	60	61	43	78	66
15	89	73	78	67	67	52	79	57	67	52	52	38	44	29	44	34	44	36	70	59	64	42	73	61
16	90	76	78	62	70	63	82	57	60	42	52	32	50	34	55	33	54	35	73	56	72	40	72	57
17	81	69	67	61	71	52	76	58	58	33	38	30	58	44	63	36	43	33	61	45	78	49	76	54
18	76	67	71	58	77	48	70	58	47	34	39	21	52	41	63	38	55	28	78	38	81	55	78	54
19	82	64	74	53	68	52	59	44	55	27	41	30	63	35	39	21	56	43	81	62	83	59	80	57
20	84	62	79	57	67	49	65	38	43	24	50	34	63	45	39	18	54	41	62	47	84	64	78	58
21	87	65	82	64	66	49	62	45	32	21	51	30	52	40	44	32	49	32	67	41	81	64	81	60
22	87	69	81	65	74	49	73	47	46	13	58	37	61	44	52	33	54	31	74	46	74	63	83	63
23	85	70	77	60	74	57	64	47	51	31	51	33	47	39	46	36	61	32	77	51	78	53	85	62
24	83	70	79	69	65	46	53	38	46	21	64	49	47	35	56	31	47	25	70	59	83	60	87	64
25	83	70	73	59	63	42	49	28	64	27	42	31	48	31	71	47	42	20	66	54	84	65	84	71
26	79	68	69	58	70	39	65	30	58	25	32	18	56	28	64	51	51	35	70	57	86	66	77	71
27	83	68	71	57	73	45	60	35	66	37	47	18	53	43	67	39	67	46	57	45	86	66	81	71
28	81	67	74	55	73	52	61	51	69	52	53	28	57	38	62	56	55	32	64	41	73	58	81	71
29	81	62	78	57	73	50	68	43	48	33	62	50	48	34	54	44	40	32	62	51	77	53	78	65
30	79	65	82	65	78	48	57	39	37	27	46	39	63	45	......	......	50	31	59	38	78	65	77	64
31	82	65	82	66	......	......	53	35	......	......	65	40	50	38	......	......	55	30	......	......	75	62	......	......
Range	33°		34°		45°		57°		63°		48°		58°		68°		51°		53°		50°		43°	
Monthly mean	76°.3		70°.3		62°.4		60°.8		47°.0		45°.0		47°.9		41°.8		43°.4		56°.0		68°.2		71°.1	

Elevation of thermometers above ground, 10 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, MOUNT WASHINGTON, N. H.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	51	32	61	49	60	50	50	44	12	4	20	—4	14	—4	19	—27	6	—5	29	11	17	—1	46	31
2	59	43	61	51	55	49	50	39	16	—2	30	10	20	5	3	—22	—1	—10	30	17	29	16	42	30
3	58	43	56	46	59	45	51	33	19	9	40	26	19	4	22	3	24	—3	36	29	44	27	43	31
4	56	36	54	44	50	43	37	25	10	—2	40	15	34	13	18	—7	27	20	40	34	47	37	41	32
5	45	32	57	45	45	32	45	35	7	—2	33	20	18	2	4	—6	36	13	38	15	52	41	50	33
6	48	36	51	33	49	33	45	40	18	6	38	28	30	15	5	—3	20	5	22	7	44	22	54	42
7	49	43	57	31	47	39	52	44	24	13	39	19	26	20	3	—7	32	5	9	—5	37	19	50	46
8	52	45	55	42	47	36	54	49	37	23	22	13	33	24	8	—9	37	—5	8	—7	47	29	54	44
9	48	41	48	33	36	31	56	51	44	36	25	12	35	22	8	—24	12	zero.	33	8	59	47	52	44
10	48	41	39	32	41	30	53	47	44	18	37	18	31	4	3	—12	12	—11	36	14	62	47	53	41
11	55	43	48	35	41	32	51	47	32	16	39	14	34	11	14	—4	9	—12	33	—6	47	35	59	47
12	59	43	54	40	42	31	49	45	37	26	15	zero.	34	10	27	7	10	—12	4	—12	35	21	52	38
13	57	47	57	44	43	34	45	26	37	27	7	—7	17	—4	30	18	7	—13	25	4	28	18	45	34
14	63	49	52	39	44	36	43	25	42	27	32	7	14	—5	33	7	25	6	35	24	22	13	37	34
15	57	48	40	26	39	29	50	36	44	29	32	12	19	8	25	8	9	2	39	32	30	16	46	34
16	58	48	47	34	42	29	53	47	30	22	14	—2	25	12	11	zero.	21	5	37	20	40	24	49	38
17	49	34	51	45	40	30	57	45	24	14	11	—10	31	19	40	11	15	—1	32	16	42	33	52	38
18	40	31	52	47	36	29	48	42	30	15	1	—18	33	20	40	21	9	—1	27	10	43	31	56	43
19	44	33	47	32	36	26	43	10	20	1	15	—3	21	15	21	—19	22	5	40	26	46	33	62	47
20	48	37	45	31	32	26	26	7	25	—3	19	—14	26	14	2	—21	18	9	40	21	57	43	55	42
21	53	42	52	40	36	26	35	24	—2	—20	—5	—26	25	5	14	zero.	16	4	35	19	57	46	47	34
22	52	45	57	48	39	30	41	34	7	—19	17	—7	25	8	14	3	17	3	39	26	56	46	36	28
23	52	47	56	44	43	35	43	25	15	7	20	zero.	31	11	19	3	22	1	26	7	52	44	43	35
24	48	35	47	42	42	23	25	2	11	—6	32	20	18	zero.	15	—2	22	—11	28	13	52	43	56	43
25	53	34	47	36	21	11	9	zero.	17	3	27	—11	17	—1	33	15	—2	—12	34	18	56	45	63	54
26	51	47	48	40	29	16	27	7	12	2	—10	—20	32	16	35	29	2	—12	40	24	61	51	54	48
27	51	47	47	38	36	23	34	20	40	8	5	—17	40	26	29	21	19	zer	32	11	58	50	57	47
28	54	45	50	37	42	32	33	25	41	24	33	4	34	7	33	22	24	8	24	7	52	33	59	51
29	56	49	46	38	51	41	30	20	40	—7	34	23	8	—12	35	5	15	6	32	23	42	26	55	48
30	54	47	43	38	52	43	26	17	—3	—13	26	—12	33	6	......	......	12	6	38	7	42	29	50	45
31	58	45	51	38	......	......	15	9	......	......	27	—8	32	12	......	......	14	6	......	......	46	42	......	......
Range	32°		35°		49°		57°		64°		66°		52°		67°		50°		52°		63°		35°	
Monthly mean	47°.6		45°.4		38°.3		35°.4		17°.1		13°.3		18°.2		10°.1		8°.6		22°.7		39°.0		44°.9	

Elevation of thermometers above ground, 28 feet (below summit of Mount Washington).

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 a. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, NASHVILLE, TENN.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	92	66	86	71	79	67	86	66	53	37	54	31	49	40	40	32	50	34	69	51	65	40	79	65
2	91	67	88	73	76	68	87	66	60	31	59	38	64	43	38	28	59	38	63	56	71	44	73	62
3	92	68	91	71	81	65	88	66	43	30	60	51	72	45	37	27	65	53	80	56	75	55	75	53
4	97	73	95	74	84	63	89	69	46	24	65	52	72	56	32	25	72	62	86	60	75	55	80	54
5	90	73	96	74	80	59	87	66	59	32	65	50	63	57	40	11	72	60	86	60	81	64	84	58
6	93	71	94	75	83	57	83	67	63	44	55	45	65	60	45	15	60	50	71	57	85	58	83	68
7	96	72	88	73	85	63	77	68	70	44	62	36	66	60	45	28	55	50	57	40	88	66	83	61
8	97	77	83	71	74	62	82	68	76	55	65	50	69	59	50	19	54	46	53	40	87	62	85	65
9	77	75	78	62	71	52	86	68	73	66	66	58	69	59	52	34	54	46	58	37	85	65	91	67
10	99.5	79	80	55	77	55	86	69	75	62	69	48	66	47	62	32	60	44	76	45	85	67	93	70
11	101	76	82	57	79	59	89	70	78	63	48	31	70	57	63	38	55	47	55	37	88	65	95	72
12	101	78	85	60	80	62	84	70	74	69	31	23	64	36	68	57	47	40	58	33	88	67	94	69
13	98	78	84	65	75	59	83	67	78	64	39	23	43	32	68	38	45	36	75	42	90	61	96	73
14	96	75	85	67	70	52	86	66	75	67	49	37	53	30	40	32	45	37	78	59	80	60	95	76
15	97	75	86	67	75	48	83	66	74	60	44	36	54	42	53	32	39	34	72	64	82	53	89	68
16	99	75	73	65	77	58	73	66	64	47	57	31	64	43	57	35	39	34	81	58	83	52	77	62
17	97	76	78	62	79	55	80	66	57	46	51	36	58	49	64	43	44	29	69	50	86	57	83	59
18	87	74	80	58	83	53	68	54	47	40	46	34	63	41	58	38	55	36	85	59	88	61	85	60
19	90	72	83	58	75	61	66	51	48	32	61	41	66	39	42	28	58	46	75	58	87	64	85	64
20	90	70	80	61	71	52	62	50	42	28	61	48	65	47	48	27	62	39	67	47	85	63	89	63
21	90	69	91	65	77	52	63	54	37	23	65	45	62	36	51	39	62	38	75	50	78	65	89	64
22	90	68	90	70	81	56	73	60	50	23	64	43	54	41	57	34	63	48	79	54	79	55	92	68
23	94	70	80	69	81	59	60	46	55	38	69	43	43	38	59	44	70	42	84	64	84	57	94	66
24	85	73	85	62	70	58	54	39	54	30	69	36	48	29	69	34	57	39	87	68	87	68	89	74
25	84	72	78	76	68	49	57	37	61	50	36	16	54	31	71	58	64	37	83	67	88	64	82	69
26	85	74	79	58	74	42	65	38	68	46	29	15	59	32	68	53	68	52	78	56	87	68	84	72
27	90	71	79	58	76	51	65	47	64	52	42	24	64	44	61	56	73	58	66	45	87	68	88	70
28	78	71	82	58	79	56	65	49	67	43	52	37	63	40	64	57	58	46	71	50	76	67	87	69
29	81	69	84	59	81	60	74	40	44	33	65	52	63	41	58	36	58	40	63	57	82	67	79	67
30	89	68	87	60	84	60	64	49	47	28	62	52	64	57	......	......	60	39	63	51	86	68	84	61
31	90	68	88	67	......	......	52	42	......	......	63	42	58	36	......	......	69	40	......	......	87	65	......	......
Range	35°		41°		43°		52°		55°		54°		43°		60°		44°		54°		50°		43°	
Monthly mean	83°.5		75°.9		68°.2		66°.7		52°.4		47°.8		53°.1		45°.6		51°.7		63°.5		74°.2		77°.9	

Elevation of thermometers above ground, 34 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, NEW HAVEN, CONN.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	78	57	86	65	82	63	79	56	48	31	44	20	44	25	38	8	46	32	58	33	54	34	86	55
2	83	59	89	69	81	68	76	62	46	24	52	31	49.5	37	20	2	47	26	61	34	61	48	62	47
3	89	65	89	72	77	64	83	62	45	31	52	39	44	31	33	12	55	29	58	45	75	46	69	49
4	92	67	80	69	77	65	70	52	37	25	59	38	50	38	35	23	66	47	55	50	76	54	72	50
5	75	58	82	65	72	57	73	52	41	21	46	32	47	33	35	14	69	48	66	51	71	51	70	52
6	71	51	85	70	71	49	69	54	35	25	55	36	44	31	40	27	48	40	55	38	80	54	71	61
7	73	60	74	64	76	60	68	52	46	29	57	46	47	33	42	19	43	33	46	30	60	48	76	64
8	78	64	70	60	75	59	79	55	56	28	53	43	42	26	37	15	38	25	47	26	64	50	62	54
9	81	65	68	58	67	50	80	63	63	50	45	35	40.5	32	38	12	28	16	50	29	67	54	72	52
10	85	63	71	53	67	52	72	60	62	48	56	33	49	34	37	2	43	25	57	40	83	60	71	55
11	82	63	76	49	68	51	62	56	53	40	59	42	46	28	43	26	24	22	49	30	78	61	74	60
12	80	63	79	59	69	48	72	55	70	47	42	29	52	34	51	36	38	21	42	26	72	56	86	64
13	80	58	80	65	69	50	73	52	63	43	34	25	35	18	53	43	32	19	63	35	58	47	83	66
14	85	63	80	67	68	56	69	42	59	43	37	28	38	10	51	33	43	27	75	49	54	45	75	65
15	90	68	75	60	68	51	77	43	66	53	51	35	43	21	40	29	42	29	67	38	63	39	70	60
16	93	69	67	54	65	54	82	59	59	47	40	34	39	26	47	32	41	31	60	45	73	46	72	55
17	78	63	64	54	73	57	68	62	55	38	46	30	43	33	54	31	39	28	50	42	85	58	78	55
18	74	59	63	57	70	50	72	61	43	32	31	21	46	35	59	43	46	24	59	39	64	55	76	54
19	74	60	74	58	69	49	69	42	45	30	31	28	50	37	36	23	39	33	53	43	65	50	80	54
20	75	54	72	54	67	46	56	35	38	22	44	27	45	34	34	16	50	32	54	48	71	56	80	59
21	75	57	77	59	60	46	64	38	25	15	35	6	40	26	44	25	43	31	61	40	76	59	85	63
22	80	64	81	65	59	50	67	54	42	16	25	4	47	17	46	25	54	27	66	36	74	61	77	63
23	80	68	84	69	67	50	69	52	49	35	37	20	49	37	46	28	52	32	55	44	72	62	81	57
24	79	67	80	67	71	50	54	33	39	29	41	32	44	33	35	17	46	18	49	36	82	62	92	63
25	77	61	71	58	55	42	40	26	49	27	40	19	45	26	46	22	32	12	54	41	89	63	89	70
26	72	59	67	56	57	35	52	24	44	32	27	8	47	28	54	42	46	20	62	44	89	70	89	73
27	84	61	67	54	59	38	56	40	50	30	32	17	52	31	55	39	39	32	63	48	89	68	87	69
28	82	65	71	52	65	42	62	43	58	43	44	27	63	32	55	41	37	33	60	41	89	67	89	73
29	82	70	78	56	68	55	59	45	57	33	47	35	32	19	65	40	39	31	62	46	72	54	88	72
30	84	68	74	61	75	57	58	45	33	25	47	21	53	14	......	......	44	31	64	41	65	57	85	71
31	83	65	76	54	......	......	50	40	......	......	25	10	52	32	......	......	49	31	......	......	79	64	......	......
Range	42°		40°		47°		59°		55°		55°		52°		63°		57°		49°		55°		45°	
Monthly mean	73°.2		69°.6		62°.0		59°.0		42°.3		36°.1		37°.7		35°.8		36°.7		49°.3		64°.3		70°.5	

Elevation of thermometers above ground, 105 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, NEW LONDON, CONN.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	78	57	84.3	67.3	81	62.5	81.5	57	48.5	33	47	20	41.5	23.5	39	10	44	31.5	60	34	51.5	35	81	59.5
2	82	57	89	69	79.5	67	77.3	61	47.5	29	50	31.5	44	34	24.5	2	41	26	52	32	59	46	66	50
3	85	65	88.5	71	76.5	65	80.3	59.3	48.5	31.5	55	39.5	44	31.5	38	18	50	29	55	44	67.5	46	70	50
4	86	65	82	70.5	78	65	71.5	54	42.5	27	60.5	39	50	36	35	21	61	45	54	46	71.5	51	66	53
5	74	56	83.5	69	74.5	59.7	74.3	53.5	41	23	44.5	32.5	49	33	32	13	62	44	65	46	64	51	64	54
6	66	51	86	71	71.5	54	68.5	55.5	35.5	26.5	54	38	50	32	42	25	48	35.5	52	38	81	53	68	58
7	71	58	74	65	72.5	61	68.5	55	49	30	56.5	45.5	49	32	42	19	39	32	46	27	59	47.5	72	60
8	71	62	71	62.5	76	61	76.5	57	55.5	30.5	55.5	41.5	49	28	36	15	45	25	42	24	57	47	65	53
9	82	63	69.5	60	69	53	78	61.5	62	50	48.5	35.5	43	34	34	11	29	19	47	28.5	69	50	69	51.5
10	84	63	74	57.5	71	55.3	69	61.5	63	47.5	54	35	54	35	38	4.5	42	24	54	40	75	58.5	70	52
11	83	65	76	53.4	68	55.5	62.5	55.5	54	41	58	41	46	27	42.5	26	28	21	50	28	78	56.5	71	57
12	79	64	78	64	68	49.5	72	55	71	51	45.5	29	55	36	48	35	37	22	43	25	71	56	85	62
13	79	59	80.8	65.7	68.5	50.5	74.5	53.8	64	43	39	24	37	17	51	40	31	21.5	55.5	35	59.5	48	80	66
14	79	63	81	68	68	57.5	71.8	46.8	59.7	45	43	28	36	12	54	34	40	25.5	74	47	56.5	43	74	63.5
15	85	68	76	63	69	52	76.9	47.5	65.5	55.8	48	36	42	21	40	31	40	30	66	35	65	40	67	60
16	91	67	65	56	66	54.5	82.7	59	62	44.5	41	31	41	29	46	25	37.5	31	57	43.5	68	45	71	55.5
17	80	66	66	56.7	74	58	67	58	56	38	47	27	40	31	51	29	41	27	54	40	83	50.5	77	55.5
18	75	61.3	66	59.5	71.5	50.5	68.7	58	47	34	32.5	19	47.5	34.5	57	40	40	23	57	38	65	51	72	55
19	74.8	60	75.7	60.5	71	52	68	42	42	32.5	38	19	48	36	54	20	37.5	32	48.5	40	60	49	78	59
20	70.5	55.6	73	55.7	67	49	57.5	37.5	43	20	45	29	45	33.5	33	15	46.5	31	57	43	67	54	78	59
21	75.5	59	78	61.5	64	48	66.5	40.5	26.5	12.5	23	10	36	28	42	24.5	44	29	59	38	72	56	80	62
22	79	64	80	66.3	55	53	65.5	56.5	43	15.5	39	11	45	21	42	26	50	27	64	40	65	57	80	61
23	78	67	82.5	68.5	69	60	70	55	48	36	35	22	50	37	44	29	50	33	55	41.5	63	56	79	56
24	81.5	66	77.5	68.3	71	50	58.5	33	41.5	25	44.5	29.5	46	29	38	19	44	16.5	47	35	74	57	86	64
25	76.5	62	73	58	56	43.5	43.3	28	49	28.5	43	21.5	44	26	41	23	34	14	56	38	82	62.5	89	69.5
26	71.7	61.5	68	57.5	59	37	52.5	27.5	46.5	32.7	24.5	7.5	46.5	27	50	40.5	43	18.5	60	41.5	87	65	88	68
27	81.5	66.2	69.3	56.5	61	39	57	40	49	30	30	11	52	29	58	35	39	28.5	62	47	87	66	86	69
28	82.6	66	72	54	64	42.5	60	45.5	57	40	44	28	65	37	50	39	38	31.5	58	39	85	64.5	85	68
29	78.5	68	72	53.2	69.7	59	61.5	44.5	59	32	50.5	35	37	19	62	41	40	31	60	43.5	72	57	87	69.5
30	83	68.5	75.5	61.5	74.4	60	62.3	45.5	39.5	22	54	21	52	11.5	......	......	45	31.5	65	38	62	53	85	69
31	82	68	76.7	56.2	......	......	57.5	37	......	......	39	15	50	32	......	......	50	31	......	......	76	58	......	......
Range	40°		36°		44°		55°.2		58°.5		53°		53°		60°		48°		50°		52°		39°	
Monthly mean	70°.6		68°.9		62°.0		58°.4		41°.5		36°.4		37°.7		34°.4		35°.9		46°.7		61°.3		68°.1	

Elevation of thermometers above ground, 28 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, NEW ORLEANS, LA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	88	76	87	75	81	76	84	73	66	52	60	43	70	58	57	46	68	57	75	57	72	58	88	74
2	87	76	86	76	85	73	86	73	66	56	68	53	72	59	56	43	68	58	72	65	68	63	88	78
3	86	75	88	76	87	73	85	72	67	53	70	55	73	61	56	43	78	64	81	69	77	63	86	74
4	86	73	88	77	87	73	85	72	63	47	66	54	73	63	56	43	78	64	81	72	80	66	88	75
5	87	73	87	75	86	72	83	71	71	51	70	61	75	63	55	45	81	68	81	70	82	67	89	75
6	89	76	87	73	86	73	78	68	71	60	63	53	75	64	54	43	81	69	82	70	81	68	86	75
7	87	74	87	75	86	74	79	71	73	58	69	52	74	62	55	45	80	66	79	61	82	69	86	76
8	88	74	89	75	88	73	82	71	78	61	73	58	73	62	60	48	75	64	61	49	82	69	88	76
9	89	75	88	73	90	74	85	73	80	68	72	65	72	62	64	50	70	61	62	49	83	70	89	74
10	90	75	84	72	83	73	85	71	75	66	76	64	74	63	70	51	70	58	70	53	86	70	88	76
11	91	76	82	73	85	74	85	72	79	69	71	47	75	62	71	57	80	67	75	56	84	74	87	75
12	90	77	80	72	83	73	84	69	81	70	53	40	72	66	73	65	79	67	64	51	83	72	89	76
13	91	76	83	69	76	70	82	69	82	70	50	41	66	52	69	59	71	60	73	51	82	69	87	76
14	91	76	84	72	82	68	82	69	79	69	65	49	65	49	63	48	68	63	80	58	81	69	90	76
15	91	78	86	74	82	65	80	69	82	72	57	46	68	58	62	50	77	64	80	67	77	73	90	76
16	87	78	84	74	84	69	80	70	81	71	63	48	68	57	66	53	64	49	83	70	77	69	87	75
17	87	76	83	72	84	68	85	72	81	70	67	51	72	57	71	56	55	42	83	72	80	67	83	69
18	89	74	82	70	88	71	76	64	75	52	69	54	68	58	74	62	75	51	83	70	80	67	85	71
19	89	76	84	71	86	71	73	60	57	46	68	54	71	56	64	56	71	58	81	71	81	69	88	72
20	89	76	86	72	87	73	69	57	59	48	73	57	70	59	58	48	66	56	72	64	76	71	85	73
21	86	75	84	74	82	72	72	62	58	38	73	64	69	63	69	56	63	56	78	67	85	71	81	69
22	87	77	82	75	77	69	76	66	61	46	74	66	68	59	65	53	63	54	82	70	86	72	79	70
23	85	77	86	76	77	68	77	66	67	49	76	66	59	46	71	60	68	54	83	71	87	73	85	71
24	87	76	88	78	81	71	65	51	68	51	78	70	56	42	72	60	72	57	82	72	85	73	85	73
25	87	76	89	77	84	72	64	50	72	54	73	39	52	46	76	61	73	56	84	71	81	70	85	74
26	87	76	87	75	83	68	64	57	73	57	47	32	62	46	76	67	77	59	82	72	81	70	87	73
27	87	77	84	72	81	71	66	54	74	62	53	34	65	49	77	63	77	67	79	69	81	70	89	75
28	88	77	84	70	81	66	72	57	74	64	62	46	68	51	77	66	76	58	81	70	83	73	88	75
29	89	77	83	73	81	67	74	58	64	48	69	51	71	53	76	61	69	55	83	71	83	74	87	73
30	87	75	82	73	78	71	75	59	55	41	70	55	74	61	......	......	67	53	75	65	87	75	86	73
31	85	75	81	73	......	......	73	61	......	......	69	58	72	61	......	......	73	55	......	......	88	75	......	......
Range	18°		20°		25°		36°		44°		46°		33°		34°		39°		35°		30°		21°	
Monthly mean	83°.0		81°.0		78°.5		72°.4		64°.9		59°.8		63°.2		60°.4		65°.7		71°.2		76°.6		80°.1	

Elevation of the thermometers above ground, 45 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, NEWPORT, R. I.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	78	60	82.5	69.5	76	64	81.5	60	46.5	35.5	46	22	42	24.5	43	12	47	34	55	35	51.5	37	74.5	60.5
2	75	61	86	70.5	74	65.5	75	58.5	45	34	52	39	46	35	24	2.5	43	29	55.5	35	55	45.5	68	49
3	75	64	87	72	75.5	65.5	73	61	48	34	54	44	43.5	31	43	18	49	32	53	44	56	45	71.5	50
4	72	65	82	70.5	76	65.5	71	57	40.5	27.5	58	39	47.5	35	36	23	58	41.5	50.5	45.5	60.5	49	68	54
5	70	55	79	69	75	61	69.5	59	39.5	25	47	31.5	48	31.5	34.5	22	59.5	45	63	46.5	66	48.5	67	54
6	67.5	53.5	86.5	70	70.5	55.5	65	55.5	38	27	52	39	50	31.5	40.5	27.5	51	38	50	39.5	76	51	66.5	58.5
7	67	59	74.5	64	74	61.5	67	55	46	33	57	46	47	32	39	23	42	33	42.5	29	55	47	71	60
8	66	62.5	68.5	61.5	72.5	62.5	75	60	52.5	37	54	43	49	28	39	17	46	22	42	26	60	46.5	64.5	52
9	86	63	70.5	61.5	71	56	79	63	57.5	51	47	34	43	34.5	41	12	35	19	44	32	65	51.5	72	50.5
10	82	66	74	59	70	56.5	69	59	62	47	53.5	34	51.5	35	40	4.5	42.5	24	51	37.5	68	54	66.5	51
11	81	67	75	59	69	56	60	54.5	52	43	55	42	44.5	29.5	41	28.5	32	22	49	29	73.5	53	70	58
12	81	65	76	65	69.5	55.5	68	54.5	64.5	50.5	45	30	52.5	35	47	35	41	23.5	42.5	26	72	55	85.5	60.5
13	78	62	76	67	70	56	72	55	57	43	38	24	37	18	50	41	34.5	23	49.5	32	59.5	47.5	81	65
14	75	65	76	67	70	60	70.5	50	58	43.5	45	29	34	15	52.5	34	40	29	62.5	40	56	44	77	61.5
15	80	67	74	63.5	68	56.5	75	52	60.5	55.5	48	37	47	31	38.5	29	42	31.5	55	39	62.5	43.5	71	59.5
16	82	67	66	57	64	59	81.5	60	60	47	44	33	42	32	45.5	29	42.5	33.5	55.5	43	65	47.5	70.5	58
17	80	66	66.5	57	72	59	66	57	55	41	46.5	29	46	33	49.5	34.5	43	29	46	39	83	52.5	75	58
18	71	61	71.5	60	69.5	53	65.5	57	49	32.5	32	19	45	35	52	43	39	25	54	39	61	52	74.5	58
19	72	60	77	60	70	56	65	43.5	43	29	33	27	48.5	37	50	20.5	38	33	48	38.5	59	51	74.5	61.5
20	72.5	58	71	57.5	67	53	56	39	44	22	47	29	44	35	37.5	17	44	30.5	54	42	66.5	53.5	72	62
21	73	63	73	63	64.5	52	63.5	46.5	29	14	41	7	44	27	43	23	47	30	58	40	67	55	78	60
22	73	65.5	73	65.5	57	53	66	55	40	17.5	43	8	43	22	43	28	46	30.5	56.5	42	67.5	57	75.5	59
23	74	66.5	74.5	67	65	54	66.5	57	48.5	37.5	41	21.5	50	38.5	44	33	47	35	53.5	42	60.5	56.5	82	58
24	79	65.5	71.5	66.5	67.5	51	50.5	35.5	41	29	44	33	44	30	40	21.5	45.5	20	47	35	67.5	56	81	63.5
25	78	63	74	58	57	45	43	31	50	30	45	20	41	28	43	25	41	14	50.5	37	76	61.5	86	67.5
26	72	63.5	66	57	59	41	53.5	34	45.5	35	24	9	47	30.5	51	40	44.5	22	56	42.5	84.5	61	83	67
27	76*	66	67	56	60	45	56.5	45	47	31	33	15.5	52.5	33	56	34.5	40	27	62.5	47	80	65	86	68.5
28	83.5	67	70	55	64	50	59	48	56	45	43.5	27	61.5	38	50.5	40	40.5	30.5	54	41.5	77	62	81	67.5
29	77	67	71	55	67	58	60	46.5	56	33.5	48	35	40	17.5	56	46.5	42	30.5	55	44.5	71	57	83	67.5
30	80	67.5	73.5	61.5	71	61.5	59.5	46.5	36	23.5	50.5	19	50	16.5	......	......	42	31	60.5	39.5	63	53	82	68
31	83.5	69	75	59.5	......	......	51	39	......	......	36	13	51	33.5	......	......	48	32	......	......	77	61	......	......
Range	32°.5		32°.0		35°.0		50°.5		50°.5		51°.0		46°.5		53°.5		45°.5		37°.0		47°.5		37°.0	
Monthly mean	69°.5		68°.0		62°.4		58°.4		42°.3		37°.1		38°.3		35°.8		36°.7		45°.5		58°.4		60°.9	

* Highest observed temperature; maximum thermometer out of order.

Elevation of thermometers above ground, 19 feet.

The daily means are obtained by dividing the sum of the 7 p. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, NEW YORK CITY, N. Y.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	84	62	86	68	86	65	84	60	45	34	43	24	42	31	39	13	48	34	67	39	53	34	85	62
2	84	62	90	72	80	68	80	65	44	35	53	33	45	33	29	10	45	30	60	42	70	47	64	48
3	91	66	89	72	72	67	85	61	40	31	55	40	46	35	36	20	52	34	66	48	76	53	70	54
4	92	71	83	68	81	69	71	59	39	28	62	42	51	38	36	24	69	46	62	48	78	54	73	56
5	75	61	84	68	74	63	77	56	40	26	47	38	53	39	30	17	70	48	65	51	69	54	71	59
6	71	59	88	74	70	59	74	59	44	30	56	42	47	36	40	26	49	40	56	39	81	53	78	61
7	71	59	77	67	78	66	68	58	54	36	56	45	49	39	41	26	41	34	41	31	60	51	85	63
8	82	63	80	67	74	60	75	59	53	40	56	44	50	34	34	20	48	30	43	28	66	51	72	57
9	84	67	70	62	71	55	82	65	68	51	49	39	43	37	31	16	32	24	48	33	82	54	72	54
10	87	67	76	55	70	54	78	64	66	54	56	39	54	38	34	12	43	25	58	38	83	63	73	53
11	84	69	78	58	72	58	65	60	55	47	60	43	48	34	48	27	32	25	48	29	82	63	76	61
12	83	66	82	65	69	58	73	59	73	47	44	30	53	34	53	38	36	25	44	27	72	59	89	68
13	79	66	79	64	68	60	79	61	73	50	42	28	35	22	58	46	33	25	60	35	61	49	85	71
14	85	65	83	67	65	57	72	53	60	47	44	32	35	17	50	38	39	27	75	49	60	47	78	65
15	92	68	76	67	70	53	80	53	70	58	47	36	41	27	39	32	40	34	76	54	67	43	69	60
16	94	70	68	63	70	58	88	64	59	48	36	28	43	29	50	30	40	32	65	44	76	51	73	58
17	79	66	77	64	72	60	74	65	60	43	45	31	38	27	54	37	40	31	55	42	86	59	83	59
18	81	62	70	60	71	55	73	64	49	37	34	23	47	34	62	43	38	26	61	39	75	55	86	62
19	79	61	80	61	72	60	68	46	40	34	35	30	50	38	44	23	41	34	52	43	63	52	82	63
20	73	63	75	64	71	56	62	42	35	22	41	31	46	38	35	19	49	34	58	45	76	55	87	64
21	73	62	77	62	63	54	63	48	26	17	36	13	43	31	37	26	41	29	65	42	79	63	87	65
22	85	65	84	66	62	55	66	57	36	21	34	12	51	28	42	30	50	32	65	46	72	59	74	65
23	83	68	84	69	71	53	73	54	50	34	41	33	51	37	44	29	53	35	52	43	77	61	80	60
24	84	70	76	69	71	51	53	35	42	28	41	34	43	34	42	23	43	21	48	38	82	64	92	68
25	77	65	71	59	59	46	44	32	48	32	41	23	41	30	46	28	37	16	52	41	94	67	90	73
26	74	62	68	60	66	46	54	33	50	34	25	13	51	33	56	42	47	24	61	43	92	72	90	73
27	86	67	72	58	65	50	54	40	48	35	28	11	55	37	65	45	47	34	60	49	92	71	89	70
28	85	70	76	57	66	51	63	47	58	42	39	27	64	40	54	43	38	32	59	42	86	68	90	72
29	85	71	82	60	64	56	61	45	57	32	43	34	46	26	64	47	41	30	60	46	75	60	89	71
30	81	72	82	68	76	57	58	46	33	26	50	26	49	23	......	......	49	34	59	40	70	58	84	72
31	89	72	85	63	......	......	48	39	......	......	32	20	50	37	......	......	54	33	......	......	78	63	......	......
Range	35°		35°		40°		56°		56°		51°		47°		55°		54°		49°		60°		44°	
Monthly mean	73°.5		71°.1		63°.4		60°.4		43°.3		37°.5		39°.9		36°.6		37°.3		49°.0		65°.5		70°.9	

Elevation of thermometers above ground, 148 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, NORFOLK, VA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	81	65	89	71	89	68	81	62	53	44	48	30	52	42	51	35	67	47	64	42	65	45	97	68
2	87	64	93	75	82	69	82	62	55	44	60	35	64	38	37	27	51	42	73	48	76	48	80	58
3	96	65	92	72	87	73	87	66	49	32	67	47	58	45	51	37	61	42	74	60	79	56	71	58
4	98	69	93	71	84	73	74	63	41	30	66	51	66	42	45	31	74	58	81	61	74	55	80	58
5	84	65	96	76	81	69	81	62	45	32	58	51	57	48	43	31	81	63	82	59	70	59	84	63
6	73	63	92	75	88	67	84	67	61	37	69	55	61	46	47	38	71	49	74	56	88	59	88	66
7	87	61	89	78	90	69	82	66	59	45	62	51	59	45	55	34	55	46	57	45	78	60	92	66
8	94	70	89	75	85	69	85	66	70	45	66	42	55	43	49	31	52	43	48	40	95	61	78	65
9	92	75	75	60	72	61	86	69	74	52	56	46	48	42	57	36	48	39	53	39	94	66	74	63
10	90	72	72	62	70	67	81	68	75	57	71	45	54	46	57	37	56	38	68	37	89	67	83	65
11	102	73	79	60	70	59	74	67	78	56	73	58	55	45	56	37	61	40	58	39	89	66	81	67
12	92	73	78	63	72	57	74	64	77	61	45	38	64	47	62	46	43	38	51	24	78	64	99	68
13	81	71	86	64	81	58	76	61	76	65	46	35	47	27	78	55	45	39	70	39	73	58	89	71
14	88	68	89	70	74	63	75	63	80	63	51	43	45	30	68	49	46	39	80	49	62	53	87	72
15	95	70	84	72	74	59	78	63	79	64	58	45	53	40	52	41	46	41	83	56	61	46	78	67
16	102	68	82	73	80	65	82	62	68	55	50	31	50	36	54	37	66	44	82	63	77	48	68	62
17	93	71	85	74	82	63	82	62	60	49	58	37	59	33	64	38	49	40	78	65	90	58	75	60
18	76	68	76	66	81	62	81	62	62	44	47	39	56	46	69	50	53	37	66	51	93	65	81	61
19	82	64	79	60	82	61	71	56	47	34	55	40	60	40	61	35	54	37	82	53	96	68	81	60
20	77	65	81	65	74	66	60	50	43	28	69	48	65	41	35	22	55	41	70	49	91	67	90	62
21	84	64	86	66	68	60	67	50	32	21	60	41	59	43	52	30	55	41	63	47	90	68	91	65
22	91	67	90	69	67	63	71	60	42	21	60	43	64	42	52	35	60	37	73	45	89	67	93	69
23	96	70	90	72	69	60	72	60	57	33	59	44	64	42	58	39	65	43	81	52	88	72	90	72
24	96	71	86	73	80	61	60	42	45	33	58	45	51	38	50	36	59	36	73	49	92	70	101	73
25	96	73	91	76	64	51	49	37	58	32	69	37	48	35	68	32	45	27	58	49	95	69	98	79
26	92	76	80	64	64	51	54	41	50	40	38	29	50	40	71	50	67	35	84	55	98	71	98	78
27	88	77	70	63	67	53	66	40	61	38	42	25	67	49	68	52	62	45	74	59	98	74	95	77
28	88	75	71	62	75	58	70	52	70	50	50	27	61	50	67	50	65	47	61	47	95	72	101	76
29	86	72	79	60	72	57	67	45	65	38	63	35	53	42	77	58	52	33	68	49	81	70	100	72
30	89	71	84	65	77	61	73	50	39	32	70	46	63	43	......	......	51	32	71	51	92	69	91	72
31	86	70	88	67	......	......	57	48	......	......	52	43	63	48	......	......	58	38	......	......	84	70	......	......
Range	41°		36°		39°		50°		59°		44°		40°		56°		54°		60°		53°		43°	
Monthly mean	78°.9		75°.7		69°.0		65°.0		50°.6		50°.2		49°.0		48°.9		48°.5		60°.0		73°.4		76°.6	

Elevation of thermometers above ground, 44 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, NORTH PLATTE, NEBR.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	76	68	96	67	90	51	88	60	45	14	57	25	53	12	44	9	59	19	70	38	86	39	70	43
2	89	66	80	63	91	52	77	54	40	10	40	20	47	13	32	14	65	33	56	36	87	44	88	48
3	83	53	86	62	76	56	77	43	57	14	54	16	52	16	33	9	63	27	68	38	86	48	94	61
4	81	57	80	66	81	46	85	47	69	16	42	29	50	16	35	11	56	17	68	40	88	57	92	59
5	92	61	76	65	73	52	88	40	61	22	50	15	57	33	35	10	49	16	56	43	94	61	73	51
6	94	71	77	62	86	41	88	63	76	32	41	22	54	25	43	19	60	14	53	32	83	48	77	43
7	82	65	79	58	69	43	87	64	60	29	28	1	61	20	54	12	39	5	49	27	67	41	84	54
8	94	64	83	59	70	40	89	61	50	35	22	−13	55	29	38	16	56	16	63	22	63	45	84	62
9	99	69	89	56	76	45	75	44	50	22	30	− 7	50	23	53	14	44	19	79	26	59	34	74	56
10	97	71	92	57	84	49	73	30	56	34	23	− 8	63	29	56	12	50	20	60	37	74	36	82	57
11	91	68	80	58	78	48	79	50	62	27	13	−21	37	19	52	31	35	− 2	66	26	93	47	87	68
12	96	66	85	57	80	34	87	51	67	26	18	−12	38	12	35	16	− 2	− 7	85	37	93	61	82	64
13	99	72	83	58	76	35	87	62	47	33	29	8	54	18	42	10	7	−19	86	34	88	60	85	63
14	95	62	85	56	80	46	87	65	56	16	18	8	45	26	41	12	23	−21	63	32	81	61	76	53
15	83	65	78	56	79	55	76	42	51	20	45	10	59	23	59	20	31	−10	54	34	76	59	85	51
16	77	63	81	53	81	44	51	36	48	33	34	5	54	25	66	21	37	11	72	31	83	58	75	56
17	74	63	83	58	80	46	66	32	45	19	20	1	64	22	30	14	32	18	80	40	94	63	85	54
18	79	61	90	60	59	45	76	34	48	11	32	8	70	26	38	3	48	9	57	23	79	50	88	59
19	88	66	92	60	72	43	80	32	48	21	14	− 2	44	27	43	18	46	19	52	20	63	54	93	64
20	86	70	96	64	73	41	78	31	41	9	10	− 5	61	20	62	12	51	24	69	25	74	41	93	66
21	87	65	92	56	77	45	78	31	57	23	22	− 2	48	28	65	15	55	24	80	36	78	48	91	67
22	87	66	94	60	76	48	54	36	52	23	15	−15	42	15	61	21	63	25	90	45	74	48	93	69
23	81	64	90	60	58	47	55	25	54	16	− 6	−15	44	15	66	26	64	26	64	46	84	57	92	60
24	76	66	92	59	57	41	63	33	55	18	− 3	−27	49	14	54	33	74	35	56	33	90	52	83	59
25	78	57	90	64	76	42	61	35	52	17	26	−25	54	22	54	21	79.5	28	42	28	68	50	86	57
26	68	60	96	55	86	40	61	23	40	24	43	3	43	20	51	24	67	37	62	27	68	51	94	64
27	82	61	93	58	83	40	70	28	24	17	41	15	24	16	45	− 6	53	29	72	33	72	44	76	52
28	80	60	99.5	67	81	58	76	32	35	− 2	31	3	19	5	21	− 8	72	20	60	41	73	49	74	42
29	87	56	87	65	69	46	50	35	41	8	14	1	15	7	39	zero.	70	35	60	24	83	54	85	46
30	92	63	80	57	77	46	42	24	62	19	30	2	23	zero.	......	......	58	40	80	32	65	44	76	59
31	91	69	86	46	......	......	33	20	......	......	45	6	40	− 2	......	......	55	35	......	......	65	43	......	......
Range	46°.0		53°.5		57°.0		69°.0		78°.0		84°.0		72°.0		74°.0		100°.5		70°.0		60°.0		52°.0	
Monthly mean	73°.7		71°.9		60°.15		54°.7		35°.4		14°.9		31°.9		29°.6		32°.6		48°.8		63°.6		69°.6	

Elevation of thermometers above ground, 19 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, OLYMPIA, WASH. TY.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min	Max.	Min.	Max.	Min.	Max.	Min.
1	74.0	41.0	77.0	43.0	74.0	48.0	60.0	49.5	55.0	27.0	55.0	40.0	43.0	33.0	41.0	30.0	45.0	37.0	50.0	29.0	61.0	42.0	64.0	46.0
2	71.0	54.0	79.0	43.5	70.0	42.0	58.0	41.0	54.0	31.0	52.0	45.0	40.5	34.5	43.0	32.0	42.0	31.0	51.0	32.0	56.0	47.0	61.0	45.0
3	62.0	51.0	80.0	45.0	75.0	42.0	56.0	48.0	54.0	36.0	47.5	41.5	39.0	34.0	43.0	29.0	40.0	32.0	46.0	36.0	55.0	42.0	58.0	44.0
4	57.0	51.5	83.0	45.0	76.0	44.0	56.0	49.0	51.0	40.0	50.0	38.0	43.0	34.0	43.0	31.0	39.0	30.0	46.0	34.0	54.0	41.0	57.0	42.0
5	58.5	50.5	83.5	48.5	81.0	46.0	55.0	45.0	59.0	47.0	47.5	38.0	37.0	27.0	44.0	30.0	42.0	35.0	52.0	32.0	53.0	40.0	58.0	44.0
6	63.5	47.5	85.0	52.0	66.5	48.5	50.0	40.0	50.0	41.0	44.0	35.0	40.0	33.0	41.0	29.0	47.0	35.0	63.0	28.0	53.0	40.0	62.0	51.0
7	73.0	42.0	83.0	50.0	66.0	54.5	57.0	40.0	45.0	37.0	42.0	35.0	35.0	32.0	45.5	32.5	47.0	39.0	67.0	30.0	52.0	41.0	62.0	50.0
8	81.0	45.0	80.0	47.0	56.0	54.0	54.0	38.0	47.0	36.0	42.0	32.0	40.0	26.0	43.0	33.0	49.0	28.0	73.0	30.0	54.0	40.0	60.0	47.0
9	70.0	51.0	85.0	47.0	58.5	47.5	55.5	46.5	52.0	41.0	41.0	34.0	38.0	30.0	47.0	34.0	46.0	28.0	71.0	38.0	55.0	34.0	62.0	46.0
10	63.0	55.0	82.0	49.0	63.0	39.0	53.0	44.0	52.0	35.0	41.0	34.0	33.0	26.0	45.0	35.0	49.0	39.0	62.0	47.0	54.0	39.0	60.0	42.0
11	56.0	47.0	81.0	50.0	68.5	41.5	50.0	43.0	46.0	39.0	51.0	34.0	35.0	27.0	43.0	26.0	48.0	32.0	53.0	40.0	52.0	43.0	74.0	48.0
12	61.0	46.0	82.0	53.0	70.0	43.0	56.0	42.0	46.0	41.0	50.0	39.0	40.0	29.0	40.0	35.0	44.0	32.0	51.0	39.0	59.0	39.0	68.0	47.0
13	67.0	43.0	82.0	50.0	77.0	44.0	51.0	39.0	49.0	39.0	55.0	47.0	45.0	30.0	41.0	34.0	47.0	23.0	52.0	34.0	56.0	40.0	59.0	41.0
14	61.5	52.5	83.0	51.5	68.5	46.5	51.0	45.0	49.0	39.0	56.0	49.0	47.0	35.0	45.0	34.0	47.0	24.0	49.0	36.0	58.0	45.0	61.0	41.0
15	63.0	53.0	84.0	50.0	74.0	48.5	55.0	41.0	48.0	38.0	50.0	42.5	49.0	41.5	40.0	32.0	50.0	23.0	48.0	35.0	64.0	37.0	71.0	36.0
16	70.5	42.5	76.0	50.0	74.0	46.5	49.0	39.0	47.0	33.0	44.0	36.0	48.0	37.0	46.0	27.0	45.0	35.0	48.0	35.0	69.0	36.0	64.0	42.0
27	75.0	43.0	77.0	49.0	75.0	45.0	62.0	48.0	49.0	35.0	42.0	38.0	48.0	41.0	36.0	29.0	58.0	30.0	47.0	39.0	57.0	37.0	65.0	43.0
18	78.0	46.0	80.0	47.0	78.0	45.0	60.0	41.0	52.0	28.0	41.0	32.0	43.0	37.0	42.0	34.0	49.0	39.0	52.0	35.0	63.0	44.0	59.0	47.0
19	76.5	46.5	69.5	48.5	72.0	50.0	60.0	45.0	52.0	29.0	38.0	26.0	43.0	34.0	42.0	33.0	52.0	31.0	51.0	39.0	68.0	51.0	54.0	44.0
20	74.0	54.0	64.0	57.0	77.0	51.0	55.5	46.5	48.5	32.5	38.0	24.0	47.0	40.0	43.0	25.0	51.0	32.0	57.0	33.0	60.0	49.0	62.0	48.0
21	71.0	49.0	62.0	55.0	62.0	54.0	58.5	43.0	41.0	30.0	31.0	25.0	47.0	35.0	49.0	32.0	53.0	30.0	59.0	40.0	57.0	45.0	65.0	51.0
22	76.0	56.0	67.0	50.0	63.0	52.0	56.0	35.0	43.0	35.0	32.0	22.0	49.0	40.0	47.0	29.0	55.0	39.0	55.0	36.0	57.0	44.0	75.0	46.0
23	81.0	51.0	64.0	54.0	60.5	50.5	61.0	31.0	44.5	34.5	27.0	8.0	47.0	37.0	47.0	34.0	56.0	31.0	56.0	38.0	52.0	43.0	83.5	46.0
24	84.5	54.5	66.0	52.0	59.0	53.0	54.0	38.0	49.0	40.0	31.0	12.0	50.0	36.0	43.0	36.0	53.0	33.0	58.0	41.0	58.0	40.0	84.0	50.0
25	86.5	55.5	64.0	50.0	61.5	53.5	54.0	45.0	45.0	34.0	37.0	17.0	38.0	32.0	49.0	36.0	45.0	36.0	62.0	38.0	66.5	33.5	84.0	50.0
26	88.5	54.0	65.0	55.0	61.0	53.0	58.0	44.0	42.0	26.0	39.0	34.0	38.0	31.0	42.0	36.0	46.0	37.0	62.0	46.0	75.0	36.0	82.0	51.0
27	84.0	54.0	67.0	54.0	61.0	55.5	54.0	48.0	39.0	26.0	40.0	35.0	37.0	27.0	37.0	25.0	43.0	35.0	64.0	39.0	74.0	45.0	88.0	50.0
28	86.0	51.0	63.0	52.0	60.0	49.0	53.0	46.5	45.0	26.0	38.0	29.0	37.0	11.0	40.0	29.0	44.0	33.0	76.0	37.0	62.0	40.0	90.0	53.0
29	75.0	49.0	67.0	54.0	58.0	46.0	54.0	35.5	50.0	29.0	36.0	23.0	38.0	24.0	47.0	34.0	46.0	33.0	82.0	41.0	63.0	46.0	72.0	58.0
30	76.0	47.5	73.5	50.5	51.0	42.0	55.0	42.0	55.0	40.0	41.5	35.0	41.0	22.0	......	......	48.0	34.0	68.0	44.0	71.0	37.0	64.5	57.0
31	72.0	42.0	74.0	50.0	......	......	53.0	27.0	......	......	46.0	40.0	41.0	21.0	......	......	49.0	34.0	......	......	73.0	41.0	......	......
Range	47°.5		42°.0		42°.0		35°.0		33°.0		48°.0		39°.0		24°.0		35°.0		54°.0		41°.5		52°.0	
Monthly mean	60°.7		62°.7		57°.0		47°.9		42°.0		37°.6		36°.6		36°.7		39°.7		46°.9		50°.7		57°.9	

Elevation of thermometers above ground, 23 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, OMAHA, NEBR.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	77	69	93	73	78	58	84	68	46	33	54	34	53	27	29	8	50	28	66	40	83	49	75	49
2	89	70	89	76	77	55	77	62	33	13	43	20	46	25	35	13	65	35	52	41	82	55	81	54
3	84	69	80	65	75	58	76	51	41	23	38	19	57	46	19	zero.	54	33	64	40	80	55	84	59
4	86	67	78	68	72	53	81	63	55	28	38	32	50	30	31	12	40	28	55	38	83	58	97	70
5	89	68	78	70	70	58	87	64	58	31	38	25	53	40	33	18	43	23	67	39	90	63	87	55
6	95	75	83	69	76	48	85	68	64	40	40	24	44	31	38	(*)	53	30	45	33	91	70	72	55
7	88	78	74	59	67	46	79	67	63	52	32	4	47	32	40	......	41	10	45	26	81	57	77	58
8	95	74	74	56	69	44	84	67	55	41	28	12	47	36	36	......	46	16	56	32	68	51	78	58
9	95	79	79	56	71	54	79	65	53	39	39	16	43	17	41	......	41	22	79	40	69	50	80	64
10	96	76	88	62	76	58	74	52	59	40	19	7	54	28	52	......	43	27	59	38	72	55	90	68
11	94	75	85	68	72	52	83	65	60	47	10	— 1	54	12	58	......	33	16	52	28	84	56	91	67
12	93	78	82	64	77	44	79	65	55	47	22	— 2	38	10	41	23	24	12	76	37	92	64	82	63
13	92	72	77	61	66	45	82	66	54	41	39	20	43	19	37	17	20	zero.	85	60	92	70	86	65
14	95	77	81	63	74	45	83	67	57	40	33	— 4	38	24	39	20	22	— 7	74	46	88	65	78	62
15	84	70	74	62	68	55	79	67	57	37	25	— 3	48	20	52	30	29	11	51	34	87	60	70	56
16	78	66	75	55	78	54	72	51	50	35	29	5	56	34	59	37	35	5	62	35	91	64	79	55
17	76	63	77	56	73	49	60	49	45	28	11	zero.	57	33	48	20	40	23	77	44	91	70	84	64
18	86	68	81	60	62	44	63	42	37	22	22	4	62	36	29	11	38	32	83	30	82	66	80	65
19	79	65	86	66	62	49	65	44	47	18	22	8	47	34	37	15	50	27	52	28	82	58	86	66
20	88	70	93	70	66	39	71	47	28	8	10	— 4	42	24	51	24	54	27	70	40	71	58	90	67.5
21	87	72	92	73	73	51	70	45	45	22	22	5	43	26	51	22	54	35	78	52	77	48	90	67
22	90	74	87	64	76	55	53	48	49	29	15	— 4	37	24	61	30	65	32	83	48	79	61	92	68
23	82	68	92	71	62	46	52	35	45	25	8	— 3	47	23	62	31	53	35	89	53	92	62	94	70
24	81	65	87	66	61	37	57	32	57	32	7	—17	46	29	66	46	58	33	57	43	92	69	85	68
25	77	68	80	64	67	44	61	41	45	28	11	—16	52	31	55	33	71	39	54	40	82	65	86	66
26	79	60	89	68	88	53	62	46	65	40	38	zero.	46	29	56	35	79	43	59	36	72	61	92	67
27	82	63	92	73	81	58	72	41	42	28	43	26	29	15	44	13	46	38	70	39	74	50	81	61
28	82	68	93	74	74	67	76	42	32	17	45	13	20	5	13	1	55	35	60	50	78	54	76	57
29	83	60	92	70	75	66	65	43	35	17	13	zero.	30	8	32	zero.	62	38	55	37	66	56	81	56
30	86	63	87	66	80	68	45	33	53	30	20	3	24	10	......	......	70	43	66	35	76	51	79	66
31	91	70	81	65	......	......	36	21	......	......	40	16	39	15	......	......	62	38	......	......	66	48	......	......
Range	36°		38°		51°		66°		57°		71°		57°		....		86°		63°		44°		48°	
Monthly mean	78°.7		75°.5		62°.0		62°.0		40°.5		17°.8+		34°.9		31°.4		36°.5		52°.3		70°.1		73°.4	

* Minimum thermometer unserviceable.

Elevation of thermometers above ground, 59 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, OSWEGO, N. Y.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	83	54	90	65	89	65	72	62	39	33	48	22	40	31	32	4	32	29	50	34	49	34	67	48
2	90	59	88	70	76	68	83	61	42	32	48	37	44	31	19	2	37	26	57	33	64	44	62	47
3	82	70	80	68	78	68	74	60	42	30	46	32	44	16	20	11	55	27	63	49	78	51	60	46
4	80	64	79	66	73	58	63	52	33	27	37	32	49	38	32	15	50	42	68	44	76	50	71	49
5	73	59	83	61	68	55	72	50	39	28	47	32	40	30	37	21	58	34	46	37	80	59	80	59
6	85	54	80	64	72	48	65	59	41	30	50	39	45	28	32	22	37	31	38	33	62	44	85	63
7	81	68	81	60	67	59	81	58	47	33	50	43	46	33	34	19	43	30	33	24	56	43	71	55
8	76	65	70	62	63	56	76	58	59	45	44	31	48	39	37	13	40	10	37	28	85	51	72	55
9	83	59	67	58	59	55	75	60	68	52	44	26	48	36	37	9	38	12	52	31	82	63	74	57
10	78	65	72	54	61	48	73	63	55	46	58	37	49	32	34	3	34	21	62	37	75	59	86	61
11	80	65	79	57	63	46	72	62	60	40	57	32	53	33	41	20	33	18	43	24	64	49	78	64
12	74	63	82	56	75	48	73	63	58	45	33	26	52	24	58	38	29	19	40	26	54	44	75	60
13	91	60	86	65	70	58	66	51	51	40	37	26	31	20	43	31	35	16	59	38	50	42	74	56
14	86	68	71	64	62	50	60	43	62	48	38	28	40	22	33	25	39	29	52	37	52	40	61	54
15	90	67	65	54	66	47	68	48	65	50	39	31	39	29	37	26	36	25	67	44	60	39	73	56
16	78	68	58	52	70	53	67	57	52	46	34	28	45	27	45	27	38	28	53	38	68	49	72	56
17	68	63	60	55	63	53	80	58	48	38	32	18	49	38	54	31	32	26	50	36	68	51	78	57
18	72	63	65	57	62	50	71	58	39	32	33	15	47	39	55	34	41	22	52	38	61	51	79	57
19	74	57	74	59	62	47	59	44	39	28	32	22	49	37	35	17	44	30	63	49	84	57	83	59
20	86	55	79	61	60	49	59	39	38	17	36	7	38	18	31	15	44	27	55	42	75	62	75	63
21	86	68	81	64	59	44	65	41	26	14	13	— 7	30	19	39	24	39	23	71	42	73	57	71	62
22	83	67	92	69	70	46	67	49	36	20	38	6	39	20	45	30	43	30	69	42	74	59	68	61
23	73	66	79	67	70	56	61	43	42	28	37	30	41	30	45	23	45	32	44	32	83	56	85	60
24	73	61	70	61	62	48	44	32	37	27	45	30	36	29	31	12	34	13	51	40	81	63	84	71
25	71	58	68	57	55	44	41	31	43	32	33	10	44	26	48	29	30	15	58	38	84	71	84	74
26	79	64	70	60	62	36	53	28	39	36	24	6	46	28	56	37	38	19	58	45	86	71	85	67
27	78	66	73	58	69	44	60	39	48	32	32	16	44	38	56	33	45	32	47	40	86	72	83	70
28	80	62	78	56	69	54	54	44	59	44	42	25	43	29	61	37	36	25	59	39	75	54	85	71
29	83	65	75	62	78	57	58	48	53	24	45	34	30	11	55	30	40	29	57	46	64	50	77	65
30	81	65	74	61	77	60	53	42	28	19	41	4	48	17	......	......	41	32	54	33	78	55	76	63
31	84	60	81	58	......	......	43	34	......	......	35	3	48	29	......	......	43	35	......	......	78	53	......	......
Range	37°		40°		53°		55°		54°		65°		42°		59°		48°		47°		52°		40°	
Monthly mean	70°.6		67°.6		59°.2		57°.3		40°.4		32°.4		36°.2		31°.9		32°.8		45°.7		61°.9		67°.0	

Elevation of thermometers above ground, 35 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, PARRY SOUND, CANADA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	79.7	45.7	87.0	59.2	78.7	58.2	69.8	58.2	32.3	15.5	39.5	24.8	35.3	23.8	24.8	—19.2	19.6	9.2	*	......	43.0	27.3	52.8	38.2
2	85.7	52.6	82.7	66.1	76.8	54.1	76.7	59.2	32.1	19.5	37.0	16.5	37.7	11.5	16.6	—22.4	28.6	13.5	......	......	64.8	38.2	66.8	33.0
3	79.2	63.2	72.8	51.1	69.8	62.2	64.8	52.1	25.0	15.5	24.8	14.5	35.0	8.2	13.1	5.2	46.0	23.8	......	......	68.8	44.7	59.8	39.7
4	71.3	54.1	74.0	52.0	67.8	51.1	64.8	37.2	26.8	16.5	23.8	8.2	46.0	20.8	19.6	— 3.0	40.7	31.0	48.3	34.0	70.8	44.7	67.0	38.7
5	72.0	47.0	77.0	54.1	64.8	49.2	68.8	52.1	32.3	14.0	38.2	20.8	34.8	10.0	25.8	9.2	34.0	18.5	36.8	25.8	76.8	42.7	69.8	55.1
6	77.0	55.0	74.8	57.0	67.8	47.2	79.7	49.1	34.0	21.8	47.0	37.1	38.7	24.8	17.1	— 2.0	30.8	14.5	34.0	20.8	54.8	35.1	79.0	60.2
7	77.0	63.2	84.0	52.7	66.8	47.2	79.7	59.2	47.0	21.8	42.7	27.8	35.8	21.8	13.8	4.2	39.7	5.2	28.0	13.0	52.8	41.7	63.8	44.2
8	73.0	60.2	60.3	49.6	53.3	46.2	73.7	60.2	61.8	45.2	30.8	13.5	38.2	29.8	35.0	1.2	15.1	—13.2	35.8	17.5	70.3	47.1	60.8	41.7
9	80.7	52.4	63.8	42.2	53.0	39.0	70.8	63.2	59.8	43.2	31.8	12.5	45.0	34.0	10.1	—12.2	25.8	— 1.0	45.7	23.8	75.6	50.1	78.4	41.2
10	77.8	56.1	66.8	43.5	59.0	34.0	78.7	63.2	45.0	28.8	49.8	29.8	35.3	14.0	22.8	— 8.0	15.6	— 8.0	41.7	26.8	66.8	46.2	81.7	58.2
11	75.8	58.1	72.8	51.1	64.3	38.2	72.8	65.0	49.0	27.8	36.8	16.5	46.0	24.8	58.3	— 5.0	25.3	— 9.0	31.8	12.3	55.8	36.1	74.8	56.1
12	76.8	58.2	81.2	48.1	71.3	44.2	69.8	58.2	49.8	37.1	18.1	— 3.0	33.8	10.5	43.7	23.8	18.8	— 3.0	37.3	17.8	60.8	40.2	70.0	57.1
13	82.3	57.3	72.8	57.2	61.3	51.1	63.8	44.2	44.8	36.1	26.8	14.0	23.8	3.2	26.8	15.5	29.0	— 5.0	53.0	32.8	57.8	35.0	64.8	48.0
14	77.7	52.1	67.3	48.1	55.0	38.2	67.3	42.2	57.0	41.2	30.8	8.2	35.8	7.2	23.3	5.2	28.0	9.2	47.3	31.0	57.8	34.5	65.0	48.1
15	81.7	54.1	64.8	40.2	62.5	31.0	65.3	49.7	48.0	37.1	29.8	5.2	34.8	6.7	31.8	19.8	29.0	— 4.0	53.3	26.8	61.6	30.5	78.2	51.1
16	75.8	51.1	61.8	44.2	60.0	51.7	74.8	51.1	44.7	37.1	24.0	1.2	38.7	21.8	37.0	18.5	26.8	5.2	40.0	26.8	64.8	41.2	80.7	47.1
17	83.2	41.6	69.8	36.1	57.8	49.1	73.8	59.2	42.7	24.8	21.8	— 5.0	40.2	34.0	49.8	29.8	22.8	2.2	41.0	26.8	65.8	43.2	79.0	44.2
18	71.8	51.1	76.0	50.1	56.0	44.2	66.3	41.2	28.6	20.8	22.6	— 2.0	36.0	32.0	46.8	7.2	34.6	1.2	48.0	24.3	67.3	53.1	76.8	45.7
19	74.8	44.7	74.8	47.2	55.3	38.2	47.0	31.0	36.2	19.5	18.4	— 2.0	37.0	24.8	13.6	— 1.0	39.7	15.5	69.0	37.0	70.0	51.1	78.0	47.2
20	79.0	50.6	80.0	52.8	54.8	37.1	58.0	38.2	24.8	0.2	19.6	—12.2	25.5	9.2	24.5	— 8.0	38.2	12.5	47.8	36.0	66.8	47.1	75.3	58.2
21	78.0	62.2	75.8	62.2	54.8	35.0	61.6	44.0	18.1	— 5.0	— 1.7	—23.4	22.0	— 2.0	30.8	18.5	39.0	— 7.0	57.8	29.3	67.0	50.1	74.8	57.7
22	75.8	59.2	76.8	63.0	65.8	37.7	62.8	42.2	30.0	14.5	28.8	— 3.0	36.8	18.5	33.8	12.5	36.7	24.0	55.8	31.0	64.8	46.1	78.2	55.2
23	74.8	61.0	69.8	60.7	58.3	51.1	57.3	26.8	34.8	14.5	23.8	12.5	35.8	13.5	29.0	10.5	39.7	10.5	48.6	23.8	66.6	44.2	83.0	57.2
24	72.8	51.1	67.8	52.6	54.0	31.0	36.7	16.5	34.8	10.5	25.8	1.2	22.8	— 3.0	34.2	10.5	16.1	— 5.0	53.8	28.8	77.7	50.1	83.6	57.2
25	78.7	51.1	66.8	47.1	57.3	27.8	44.7	14.8	38.0	23.8	3.2	—13.2	35.6	19.5	42.7	33.0	23.3	— 9.0	51.8	28.8	80.7	60.2	72.8	63.0
26	76.7	59.7	71.3	53.1	59.3	34.6	51.8	41.2	31.0	21.3	12.6	—10.0	42.7	22.8	39.7	27.8	41.7	4.2	45.3	37.3	82.7	58.2	79.0	57.4
27	72.0	56.1	70.8	47.1	65.8	40.0	56.8	48.1	46.8	27.8	29.3	— 7.0	42.0	25.0	36.5	26.8	49.0	28.8	40.7	31.8	77.7	50.2	83.2	60.7
28	81.7	52.1	75.0	50.1	64.8	55.1	51.3	43.2	49.8	19.5	31.0	20.8	33.8	8.2	36.5	25.8	(*)	......	48.8	27.8	55.8	40.2	75.8	62.7
29	73.8	56.1	77.3	53.1	68.8	58.2	51.3	41.2	35.0	5.2	34.8	3.2	15.1	— 5.5	48.8	10.5	......	......	59.5	39.2	72.8	36.1	72.1	56.9
30	75.3	50.1	78.7	52.1	74.7	56.2	45.7	29.8	26.0	0.2	6.4	—15.2	43.0	10.5	......	......	......	......	43.7	24.8	69.8	53.6	72.6	54.1
31	84.3	49.4	80.0	54.0	......	......	33.8	21.8	......	......	28.0	—13.2	33.8	18.5	......	......	......	......	......	......	68.8	47.1	......	......
Range	44°.1		50°.9		50°.9		64°.9		66°.8		73°.2		51°.5		80°.7		......	......	......	......	55°.4		50°.6	

* No data received.

Maximum, minimum and mean temperatures—Continued.

STATION, PEMBINA, DAK.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	78	58	80	53	81	44	70	31	20	11	7	1	40	10	-2	-35	4	-24	30	11	80	41	60	35
2	80	49	76	45	78	50	62	42	18	-4	8	-1	20	-10	-1	-7	28	-6	33	10	85	41	64	37
3	82	53	80	42	68	37	66	31	20	-8	8	-5	38	6	-2	-13	15	-11	36	14	72	47	74	48
4	74	54	86	50	77	36	76	38	29	7	28	5	6	-8	6	-20	14	-16	16	8	65	38	73	52
5	85	56	86	51	59	47	81	40	40	26	11	-12	35	-2	-8	-32	7	-11	21	4	76	43	65	47
6	88	62	67	49	56	39	90	57	43	27	11	-2	-2	-19	-2	-30	10	-10	22	8	75	53	68	44
7	77	60	74	38	63	43	63	42	48	33	4	-3	-2	-13	8	-10	-10	-30	32	-3	66	44	73	42
8	89	55	77	45	70	33	51	43	33	25	1	-12	32	-8	7	-21	-2	-17	45	11	75	36	70	50
9	86	57	88	46	72	42	63	43	30	17	10	-3	-5	-20	4	-20	-12	-27	44	30	60	46	72	54
10	83	57	85	54	65	50	63	39	40	18	7	-11	24	-20	16	-2	2	-25	31	20	63	44	74	53
11	86	60	62	52	72	46	51	33	45	35	-11	-36	-1	-24	25	2	-2	-18	40	17	73	36	67	55
12	90	60	62	54	56	34	52	28	36	32	-14	-41	-10	-30	2	-15	-2	-27	56	32	73	53	60	51
13	86	59	71	53	55	29	85	51	37	22	1	-18	30	-32	6	-20	5	-17	32	18	76	55	63	41
14	82	62	73	47	60	35	73	50	44	24	-18	-37	30	-13	16	-16	6	-21	27	17	75	55	71	48
15	75	53	80	45	67	41	53	49	30	16	-10	-41	27	-13	24	15	1	-12	36	8	76	60	75	46
16	74	46	82	46	56	40	53	44	20	0	-11	-30	18	-2	30	12	4	-31	54	32	77	50	68	55
17	80	48	82	48	55	35	46	38	20	16	-18	-42	30	15	30	-15	10	-6	45	33	65	50	76	50
18	82	60	76	58	58	30	53	26	36	11	-23	-35	18	5	-12	-21	24	3	33	23	56	48	81	60
19	85	66	78	55	58	30	79	34	36	-2	-17	-35	5	-20	11	-32	26	5	38	25	53	39	83	61
20	78	55	80	43	66	30	63	39	15	-9	-24	-45	15	-10	19	-2	35	1	38	17	53	32	86	65
21	80	55	81	52	61	39	52	25	35	14	-1	-29	20	-7	24	-3	32	18	48	25	67	37	76	66
22	68	56	75	54	54	30	42	30	35	8	-20	-35	-1	-14	24	6	38	14	53	25	58	48	83	58
23	79	45	78	55	50	19	42	24	20	-5	-34	-53	16	-6	36	3	14	-1	56	34	71	41	77	59
24	76	54	73	57	70	24	53	19	28	15	-42	-59	16	-5	30	-3	38	13	55	33	67	50	77	54
25	70	55	78	51	72	37	53	35	22	4	-16	-48	30	-4	10	-14	37	21	42	33	66	53	72	50
26	78	49	80	48	68	35	60	32	22	16	4	-34	28	-7	10	-13	38	34	46	29	56	42	76	60
27	75	55	80	47	75	45	54	30	17	1	-2	-19	-7	-22	-8	-18	34	32	60	34	61	34	70	50
28	70	45	82	55	67	45	50	26	15	-2	-8	-25	-15	-31	-11	-26	40	26	46	35	65	43	70	47
29	86	50	89	65	74	48	40	24	17	5	-25	-45	7	-25	1	-24	45	30	43	28	72	55	73	45
30	87	56	78	55	72	40	24	14	33	7	-2	-33	2	-15	......	......	43	36	70	28	62	40	74	47
31	77	57	66	53	......	......	21	1	......	......	10	-5	-8	-26	......	......	36	26	....	......	55	31	......	......
Range	44°		51°		62°		89°		57°		87°		72°		71°		76°		73°		54°		51°	
Monthly mean	67°.0		62°.8		49°.9		44°.7		20°.8		-14°.5		0°.6		-1°.0		8°.5		31°.2		56°.1		62°.6	

Elevation of thermometer above ground, 4 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, PENSACOLA, FLA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	......	......	......	......	......	......	......	......	(*)	......	59	44	71	56	66	45	70	57	74	55	74	56	86	72
2	......	......	......	......	......	......	......	......	......	......	64	50	71	60	64	44	69	58	73	67	70	64	88	75
3	......	......	......	......	......	......	......	......	......	......	71	62	70	62	54	37	77	66	75	70	75	64	87	73
4	......	......	......	......	......	......	......	......	62	44	71	58	71	64	53	36	75	68	77	70	78	65	84	77
5	......	......	......	......	......	......	......	......	65	48	72	64	71	61	46	43	77	69	77	70	78	65	85	76
6	......	......	......	......	......	......	......	......	67	59	68	52	71	61	54	41	77	68	77	70	81	64	87	76
7	......	......	......	......	......	......	......	......	70	60	65	46	72	59	60	42	78	70	77	60	81	71	86	78
8	......	......	......	......	......	......	......	......	72	64	69	56	73	60	60	50	74	69	60	48	78	71	85	76
9	......	......	......	......	......	......	......	......	75	66	73	63	73	61	67	50	75	62	63	47	80	70	88	75
10	......	......	......	......	......	......	......	......	74	68	74	69	71	58	67	51	69	56	67	44	82	70	88	79
11	......	......	......	......	......	......	......	......	74	69	70	46	73	62	69	53	77	68	76	55	84	69	89	75
12	......	......	......	......	......	......	......	......	78	71	54	38	73	62	73	64	78	71	66	48	83	69	88	78
13	......	......	......	......	......	......	......	......	79	70	54	44	66	49	69	57	79	71	70	46	84	68	89	75
14	......	......	......	......	......	......	......	......	79	72	67	53	60	47	63	47	78	66	74	66	83	68	92	75
15	......	......	......	......	......	......	......	......	78	73	61	48	62	53	62	44	77	66	76	66	84	71	91	76
16	......	......	......	......	......	......	......	......	79	72	58	40	64	54	61	44	74	48	71	61	77	67	91	71
17	......	......	......	......	......	......	......	......	79	69	63	42	70	54	66	50	62	40	77	61	79	62	84	66
18	......	......	......	......	......	......	......	......	74	49	65	44	69	55	72	62	70	51	75	69	81	63	88	70
19	......	......	......	......	......	......	......	......	51	45	65	48	68	47	66	51	72	58	78	70	82	66	86	69
20	......	......	......	......	......	......	......	......	53	40	69	51	70	52	58	46	70	54	74	68	80	72	81	71
21	......	......	......	......	......	......	......	......	49	32	66	58	62	60	63	53	66	58	79	68	79	74	85	69
22	......	......	......	......	......	......	......	......	56	36	71	63	67	51	60	45	69	55	78	68	88	70	80	72
23	......	......	......	......	......	......	......	......	67	38	73	64	51	42	73	55	71	49	80	72	83	75	80	73
24	......	......	......	......	......	......	......	......	62	47	73	67	57	43	67	50	74	52	82	73	82	75	83	73
25	......	......	......	......	......	......	......	......	66	45	75	41	50	40	73	64	70	53	82	74	81	74	86	72
26	......	......	......	......	......	......	......	......	67	49	42	28	54	43	73	65	72	52	82	75	78	71	85	74
27	......	......	......	......	......	......	......	......	71	60	50	29	62	44	76	65	75	65	83	68	79	72	86	77
28	......	......	......	......	......	......	......	......	71	65	60	37	66	45	75	67	73	56	79	69	81	72	86	78
29	......	......	......	......	......	......	......	......	65	46	68	50	67	48	76	66	69	50	80	67	81	75	86	76
30	......	......	......	......	......	......	......	......	58	38	67	62	68	59	......	......	70	50	78	62	83	75	88	74
31	......	......	......	......	......	......	......	......	......	......	72	60	68	61	......	......	71	49	......	......	85	75	......	......
Range	......	......	......	......	......	......	......	......	......	......	47°		33°		40°		39°		39°		32°		26°	
Monthly mean	......	......	......	......	......	......	......	......	......	......	57°.9		60°.4		58°.2		65°.8		69°.6		74°.5		80°.2	

*Observations commenced November 4, 1879.

Elevation of thermometers above ground, 20 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, PHILADELPHIA, PA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	81	61	88	71	86	*	86	58	46	32	45	26	43	32	39	19	48	36	63	39	54	36	85	60
2	86	64	91	72	80	*	86	65	48	35	53	33	46	34	31	12	47	31	69	46	72	48	62	51
3	92	67	93	74	75	......	87	62	42	34	57	41	48	36	38	20	54	35	68	54	78	54	74	53
4	93	72	88	74	79	......	76	59	37	28	61	45	53	37	38	26	70	48	72	55	78	54	75	57
5	80	63	89	72	78	67	79	56	45	26	48	36	53	39	32	18	75	56	72	52	71	53	79	61
6	78	61	88	75	81	60	79	62	46	31	60	43	51	35	42	29	56	42	60	45	84	55	82	63
7	77	61	79	68	85	66	74	61	54	31	60	48	46	39	45	30	41	37	46	34	72	53	85	67
8	85	67	82	70	76	62	76	61	60	39	55	42	42	33	37	24	43	32	44	32	80	54	75	63
9	82	72	72	62	70	56	84	68	72	54	45	39	45	37	38	17	32	27	50	35	89	57	67	58
10	87	67	76	55	68	53	81	66	69	57	60	43	53	39	36	14	44	29	66	39	88	66	77	58
11	87	71	81	60	72	54	69	63	59	48	61	43	54	33	52	29	35	26	53	31	85	66	83	64
12	79	69	83	64	75	56	72	62	75	52	43	30	54	33	57	35	36	25	45	29	75	61	92	71
13	86	67	81	63	75	57	78	62	69	54	38	27	33	24	64	51	32	25	62	35	66	50	88	72
14	87	65	86	66	69	59	74	56	66	51	43	31	40	19	54	37	42	30	81	50	58	46	78	69
15	93	69	76	68	73	53	82	59	73	60	49	37	40	26	39	33	45	34	81	52	64	44	69	60
16	96	75	83	67	74	54	84	66	61	50	37	28	39	29	52	31	43	34	69	52	77	52	74	58
17	85	70	78	†	75	61	83	62	56	43	47	34	47	29	57	36	40	35	59	46	87	61	81	59
18	80	64	70	62	74	55	77	66	49	37	42	27	49	33	65	47	45	27	65	41	89	59	83	61
19	77	63	79	57	68	60	71	47	38	30	36	29	53	36	47	24	41	34	68	42	74	55	86	64
20	78	61	80	64	67	55	62	44	39	24	40	32	57	40	39	21	50	36	65	47	91	57	87	65
21	81	62	82	64	62	54	62	47	29	19	38	16	53	34	42	26	45	32	70	45	86	67	87	67
22	89	66	86	67	61	55	68	57	36	21	43	15	54	31	46	33	52	32	70	47	80	64	83	66
23	87	70	86	70	73	53	72	53	52	28	42	33	51	39	47	31	57	36	57	45	74	63	86	67
24	82	71	79	70	70	54	53	37	44	29	43	33	44	33	43	27	46	22	46	41	83	66	94	71
25	73	69	72	62	57	47	43	32	50	30	49	27	44	32	59	35	40	20	54	41	92	68	94	74
26	78	67	67	59	64	43	53	33	47	30	27	13	51	31	61	44	47	26	65	46	96	73	90	74
27	88	71	70	57	71	46	54	41	53	31	29	11	58	37	67	45	55	37	63	51	94	72	90	72
28	88	74	74	56	70	51	60	46	63	40	42	27	63	46	58	48	47	34	64	43	88	70	92	74
29	84	72	84	59	70	57	62	44	59	34	46	32	46	29	66	48	40	31	59	46	79	62	88	72
30	79	73	84	......	79	56	60	47	35	29	54	29	47	25	......	......	48	33	61	41	78	61	85	70
31	86	72	81	......	......	......	49	39	......	......	38	21	50	39	......	......	54	35	......	......	78	66	......	......
Range	35°		....		....		55°		56°		50°		44°		55°		55°		52°		60°		43°	
Monthly mean	75°.6		72°.7		64°.4		61°.7		44°.7		38°.8		41°.7		39°.1		39°.6		52°.4		68°.8		73°.8	

† Thermometer not set. * Minimum thermometer broken.

Elevation of thermometers above ground, 99 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, PHŒNIX, ARIZ.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	100	65	109	83	105	72	91	65	81	52	69	40	65	37	53	31	72	35	80	44	88	53	98	56
2	99	65	100	77	107	71	96	64	80	50	67	37	64	40	54	30	72	38	72	51	92	53	104	58
3	103	62	103	81	107	75	94	65	82	49	65	37	62	39	55	30	66	41	78	52	92	54	103	62
4	100	64	100	72	105	70	94	62	80	54	67	39	62	35	53	27	66	46	81	48	96	56	101	69
5	105	75	105	79	103	71	79	70	79	45	65	36	65	37	56	25	66	45	87	50	95	57	98	58
6	106	74	98	73	102	66	86	65	78	42	67	37	61	39	58	25	69	44	85	59	87	60	100	54
7	109	78	96	74	100	73	81	56	71	47	67	35	70	44	62	29	71	37	80	49	87	46	104	56
8	103	78	100	77	104	75	77	56	69	42	67	37	61	45	67	26	77	36	83	48	91	49	104	63
9	96	77	98	72	103	72	75	43	59	51	62	43	61	35	69	32	86	40	82	55	95	54	100	66
10	94	69	100	74	102	73	81	43	62	49	61	29	61	37	64	41	64	45	88	48	97	58	95	64
11	100	73	102	73	103	72	86	47	61	40	62	29	62	36	62	37	71	41	90	50	93	55	94	55
12	101	73	104	74	103	69	89	53	64	40	63	33	62	32	55	31	74	42	91	52	90	59	98	56
13	102	73	104	73	101	73	85	66	63	42	62	32	69	32	60	29	66	45	89	48	77	55	92	57
14	104	80	107	75	99	73	76	61	63	38	62	35	66	35	61	29	56	39	75	48	79	46	100	56
15	102	80	105	73	99	72	70	44	67	38	65	35	72	35	63	31	57	30	74	50	88	45	103	62
16	105	78	104	83	100	68	76	41	62	42	68	35	70	35	69	33	62	32	80	46	90	52	109	63
17	105	78	106	76	102	70	86	44	66	37	69	34	72	39	62	36	62	34	77	48	87	52	111	68
18	104	77	98	77	101	65	89	51	66	44	69	38	73	42	65	32	67	39	65	39	90	50	105	69
19	106	77	102	74	102	68	89	55	74	40	70	35	70	39	67	36	66	39	72	36	97	52	102	78
20	106	74	103	75	102	66	87	53	76	44	67	45	71	39	70	35	70	35	72	40	101	59	99	69
21	103	75	103	75	99	66	89	51	76	40	65	52	66	34	74	48	73	38	84	56	100	60	102	72
22	100	80	101	72	100	67	87	51	74	41	60	46	69	36	66	42	76	38	83	53	100	60	102	66
23	106	74	101	72	100.5	66	89	52	71	42	61	36	66	34	65	45	76	37	75	51	101	62	102	69
24	110	81	101	66	99	66	87	54	69	36	47	31	64	32	64	34	77	39	75	41	97	62	102	65
25	110	80	105	68	98.5	68	87	51	67	36	51	18	65	30	65	34	74	51	83	40	90	58	101	64
26	103	82	107	71	93	64	84	50	69	40	57	25	64	43	66	33	67	48	84	46	87	48	102	67
27	98	82	104	82	75	65	83	59	65	35	57	40	64	41	67	36	74	30	86	46	90	53	104	64
28	106	79	100	74	83	59	87	57	61	30	62	45	54	30	70	38	80	38	87	47	95	53	104	65
29	108	83	99	67	86	67	85	51	64	34	62	48	57	31	66	34	79	45	87	50	97	53	104	62
30	107	87	101	68	97	65	82	54	70	36	58	41	50	25	......	......	74	42	90	57	99	59	103	65
31	108	83	103	66	......	......	80	55	......	......	63	34	44	29	......	......	76	39	......	......	97	58	......	......
Range	48°		43°		48°		55°		52°		52°		48°		49°		56°		55°		56°		57°	

Elevation of thermometers above ground, 4 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, PIKE'S PEAK (SUMMIT), COLO.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	51	34	51	36	54	32	43	26	20	10	23	14	21	10	3	-2	15	-2	23	6	21	10	30	15
2	47	31	55	36	49	32	38	18	26	11	14	5	23	12	1	-22	20	8	21	8	32	13	42	22
3	47	30	50	35	40	28	41	25	26	11	19	9	18	11	-18	-24	15	-1	16	7	33	17	44	29
4	51	32	47	32	49	28	46	30	27	17	10	-2	22	10	-12	-26	4	-5	18	11	38	21	45	27
5	56	35	46	32	48	30	47	30	25	14	12	-2	16	7	-3	-25	6	-7	22	9	37	25	34	8
6	55	35	42	30	46	29	36	25	33	22	13	4	16	9	3	-6	14	zero.	20	13	33	19	38	19
7	56	38	35	30	48	29	44	23	26	11	9	2	17	6	9	-2	10	-5	16	-2	26	3	45	23
8	55	36	36	24	49	29	40	26	15	3	11	2	20	8	10	-4	15	zero.	13	-6	18	5	47	30
9	50	38	45	26	53	27	27	5	12	zero.	7	-13	12	zero.	10	zero.	13	zero.	23	6	24	10	47	27
10	46	36	42	32	53	35	31	11	17	9	-12	-23	14	4	14	-1	13	-1	27	12	33	18	46	24
11	50	35	53	35	42	27	38	17	19	10	-4	-25	5	-12	9	-5	15	zero.	30	12	38	23	45	24
12	58	34	50	31	42	27	42	14	19	3	1	-10	14	-11	zero.	-8	9	-2	32	15	37	23	48	26
13	60	38	42	30	45	28	41	27	8	-6	zero.	-4	17	11	-5	-20	2	-8	29	15	35	18	48	28
14	62	39	36	28	40	29	35	27	8	-7	zero.	-4	12	4	zero.	-27	5	-8	17	-3	33	16	51	22
15	58	39	39	27	45	30	34	3	12	-3	13	2	21	8	11	-3	5	-4	10	zero.	39	16	55	31
16	53	34	39	29	54	33	17	4	14	-8	16	7	15	6	8	-2	3	-14	24	6	36	23	53	34
17	53	34	48	33	48	34	28	11	-1	-15	16	8	22	11	2	-20	6	-3	28	10	40	22	54	34
18	58	34	53	33	42	25	35	19	20	-15	15	8	24	12	7	-21	3	-9	17	-5	36	16	58	35
19	64	34	54	33	34	26	35	17	21	15	13	6	13	6	15	zero.	4	-10	15	-9	30	17	56	36
20	47	34	50	31	40	25	37	23	21.5	13	16	7	16	5	17	5	3	-9	20	4	28	14	55	35
21	49	36	52	33	44	30	32	23	21	13	12	-3	6	-11	16	6	6	-8	30	12	38	21	53	32
22	49	35	51	30	40	26	35	20	22	14	2	-9	2	-12	18	7	19	2	31	16	37	21	57	31
23	52	35	45	30	40	26	32	20	25	15	-2	-10	-1	-9	20	9	19	7	20	1	47	27	48	29
24	49	34	51	31	44	27	33	19	22	13	-10	-31	10	-11	12	3	23	9	5	-5	40	24	45	27
25	50	32	56	32	44	27	28	11	23	8	15	-31	14	4	10	-10	25	9	7	-3	24	13	44	29
26	42	31	56	38	45	26	18	3	15	3	20	12	3	-2	6	-4	12	-8	20	1	20	9	46	30
27	50	30	56	37	43	27	29	13	8	-8	20	10	zero.	-15	8	1	12	-12	25	7	23	8	47	32
28	58	33	49	34	39	20	30	20	11	-9	14	8	zero.	-15	4	-27	25	9	23	10	30	10	42	29
29	56	35	50	28	42	27	29	20	18	8	10	3	2	-9	4	-17	25	12	23	11	32	15	45	32
30	56	37	44	23	44	26	28	15	22	12	9	-3	3	-14	......	......	24	8	28	12	35	21	52	30
31	55	37	48	25	......	......	23	10	......	......	9	-7	8	-15	......	......	15	-1	......	......	29	15	......	......
Range	34°		33°		34°		44°		48°		54°		39°		47°		39°		41°		44°		50°	
Monthly mean	43°.1		39°.2		35°.8		26°.3		12°.5		3°.5		6°.4		— 0°.35		5°.3		13°.1		24°.3		37°.3	

Elevation of thermometers above ground, 5 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, PILOT POINT, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	(*)	(*)	105	70	99	58	91	52	69	34	69	34	50	32	46	28	68	30	82	57	......	......	75	59
2	......	......	102	62	101	61	96	50	68	32	77	30	65	38	(*)	(*)	66	33	86	59	......	......	75	59
3	......	......	102	65	100	60	92	53	65	32	79	39	71	53	......	......	68	34	90	58	......	......	87	62
4	......	......	101	62	98	59	98	54	72	31	75	31	64	50	......	......	74	40	97	58	......	......	89	69
5	......	......	100	60	97	58	93	54	77	57	71	30	66	52	......	......	71	32	100	57	88	62	87	68
6	......	......	100	63	98	58	90	56	75	51	71	31	(*)	55	......	......	67	34	84	58	88	62	86	56
7	......	......	100	62	99	59	90	52	82	50	75	38	......	(*)	57	23	71	14	64	39	87	60	92	61
8	......	......	99	60	97	60	98	55	82	51	59	31	77	49	64	27	66	16	61	32	88	61	92	70
9	......	......	89	58	96	60	100	57	81	40	76	40	72	45	67	28	65	34	72	37	87	64	94	70
10	......	......	99	60	97	55	95	51	83	40	68	27	74	40	65	27	69	41	83	45	93	67	93	70
11	105	70	99	58	95	57	95	56	76	52	40	24	72	60	67	30	56	49	73	44	(*)	(*)	93	67
12	107	72	99	60	89	51	91	55	80	47	43	14	55	34	77	28	55	29	78	39	......	......	90	68
13	103	68	98	60	86	53	92	52	82	57	47	29	53	25	75	20	36	21	81	55	......	......	93	69
14	107	70	99	59	88	54	87	50	75	57	55	24	70	40	70	18	28	15	86	59	......	......	94	70
15	105	67	100	63	93	60	(*)	(*)	72	45	55	18	66	44	67	30	32	18	91	58	......	......	86	67
16	104	62	99	58	97	63	......	......	81	44	67	24	71	39	72	35	(*)	(*)	91	46	......	......	82	63
17	95	65	101	60	97	61	92	50	71	41	58	18	69	32	71	39	(*)	(*)	92	52	......	......	85	59
18	105	60	101	62	94	60	89	45	53	30	59	20	78	37	61	20	67	21	90	70	......	......	88	59
19	106	69	99	63	98	65	82	42	70	27	73	30	74	38	53	23	68	32	80	38	......	......	90	62
20	105	68	101	65	92	66	87	44	55	26	62	29	73	44	60	27	71	38	78	39	74	55	89	65
21	106	67	(*)	(*)	99	61	81	42	60	24	62	27	72	45	65	29	68	30	81	47	82	55	89	61
22	105	70	......	......	94	60	85	40	73	24	62	28	54	32	72	25	74	28	89	62	87	58	89	60
23	106	69	101	64	96	56	75	41	70	32	62	29	65	26	73	38	81	40	93	63	91	62	89	63
24	106	71	102	63	92	57	67	34	74	43	39	6	63	25	69	25	80	48	93	65	89	63	93	63
25	103	70	100	66	95	55	77	34	72	50	26	2	65	32	(*)	(*)	81	55	85	52	93	66	97	63
26	103	72	101	66	97	53	76	33	69	59	40	9	71	21	72	29	(*)	46	76	45	94	66	96	68
27	104	70	101	64	95	54	75	34	79	58	55	21	67	37	68	30	......	......	82	45	85	60	90	64
28	102	70	103	68	96	50	83	42	53	28	72	36	50	35	46	10	......	......	79	55	81	63	(*)	(*)
29	101	70	100	68	88	51	88	46	67	24	77	34	70	34	62	18	84	41	(*)	(*)	85	61	86	62
30	101	72	101	53	91	52	71	44	63	30	41	29	67	31	......	......	77	54	......	......	92	63	90	63
31	103	67	100	55	......	......	74	37	......	......	42	28	42	27	......	......	79	41	......	......	89	69	......	......
Range	......	......	......	......	51°		......	......	59°		77°		......	......	......	......	......	......	......	......	......	......	41°	

Elevation of thermometers above ground, 17 feet.

* Observer absent on repair duty.

Maximum, minimum and mean temperatures—Continued.

STATION, PIOCHE, NEV.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	79	52	95	64	87	57	74	52	60	37	44	34	42	17	40	15	52	27	55	40	71	40	72	42
2	80	56	85	70	88	56	74	43	62	36	48	27	44	24	29	19	48	34	46	36	71	48	81	47
3	83	53	83	62	88	62	77	47	62	40	46	28	40	25	27	8	44	30	47	35	73	44	78	52
4	80	56	83	55	88	60	77	48	62	36	41	24	41	(*)	35	14	35	18	55	36	73	52	73	45
5	81	57	89	61	88	61	72	53	63	38	45	26	41	......	35	18	40	16	58	36	70	44	66	34
6	84	56	85	55	88	55	63	48	62	41	47	28	45	......	40	11	47	23	55	35	53	31	79	44
7	83	57	87	55	85	60	56	34	46	28	44	28	45	......	39	18	46	25	54	35	64	34	82	55
8	83	55	94	60	86	58	42	30	37	23	43	21	43	......	40	21	52	27	62	35	66	40	82	55
9	83	60	94	61	85	60	51	27	36	30	26	11	39	......	46	21	41	21	66	38	70	46	67	41
10	86	53	93	63	84	64	59	34	38	31	40	19	40	......	40	29	45	26	67	47	71	51	55	34
11	79	59	96	66	75	46	61	38	40	26	39	17	24	......	35	22	54	33	69	48	69	50	68	35
12	80	56	91	62	82	50	65	45	43	27	41	29	30	......	29	9	46	13	66	46	60	43	72	46
13	83	60	93	62	85	54	61	46	41	23	46	28	43	......	36	9	23	5	45	31	54	33	73	45
14	85	56	90	62	88	54	48	33	50	27	51	35	43	......	32	13	24	5	47	24	56	30	76	49
15	86	57	93	63	86	59	50	29	49	28	53	33	45	......	39	20	35	7	45	29	64	33	80	50
16	88	59	94	64	88	59	52	32	39	23	55	32	47	......	38	18	41	17	53	34	61	43	82	50
17	89	64	92	67	85	61	62	34	37	20	49	30	54	......	25	8	40	26	49	29	65	37	86	52
18	86	64	86	62	86	60	68	41	45	20	47	31	46	......	33	7	40	19	36	21	70	44	83	56
19	84	58	84	62	85	55	69	42	53	31	44	32	47	......	40	23	42	25	49	23	76	49	80	60
20	82	56	82	58	86	60	73	42	57	34	40	34	46	......	46	25	41	22	56	35	79	49	78	48
21	85	57	83	53	80	59	74	47	61	35	37	27	42	......	49	27	46	26	57	44	82	60	81	51
22	90	62	83	61	79	55	71	47	61	35	28	20	45	......	40	25	53	32	54	38	81	51	81	53
23	89	62	84	57	77	50	69	41	60	36	21	— 6	40	......	36	26	56	32	43	28	78	52	83	54
24	91	65	90	57	76	55	67	42	57	33	4	—13	44	......	34	18	56	33	49	25	55	36	84	52
25	95	66	86	62	70	54	61	43	51	32	22	— 4	42	......	41	23	47	29	58	30	55	33	85	53
26	92	65	84	61	71	47	60	37	41	20	34	8	30	......	48	26	42	25	59	33	59	35	88	54
27	92	62	80	62	71	46	64	43	36	14	34	25	29	......	40	11	51	26	57	38	64	41	91	60
28	93	64	70	50	74	44	65	39	44	19	32	26	21	......	37	7	54	35	57	35	73	43	93	60
29	93	64	72	45	74	54	66	37	47	28	35	25	19	......	44	19	54	35	65	40	81	49	91	64
30	94	65	77	47	71	48	64	37	48	39	25	8	17	......	......	......	48	28	65	49	60	45	88	58
31	91	63	84	53	......	......	61	36	......	......	31	12	29	......	......	......	55	26	......	......	62	36	......	......
Range	43°		51°		44°		48°		49°		68°		....		42°		51°		48°		52°		59°	
Monthly mean	75°.4		74°.1		69°.2		51°.4		38°.9		30°.2		30°.2		27°.0		34°.6		45°.5		57°.4		68°.8	

* Thermometer unserviceable.

Elevation of thermometers above ground, 5 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, PITTSBURGH, PA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	88	56	92	65	90	67	86	53	43	27	52	28	43	33	31	16	37	29	59	40	55	35	71	51
2	93	64	90	71	80	70	87	53	43	25	55	33	51	40	31	11	51	29	72	39	76	51	67	49
3	94	69	92	71	85	67	81	60	38	25	57	44	58	37	27	20	56	36	64	57	81	50	76	53
4	91	69	83	68	77	64	77	46	33	24	54	47	62	51	27	15	65	52	73	54	80	50	81	54
5	85	61	88	69	75	59	91	57	39	22	61	43	51	43	33	11	69	42	69	51	83	55	81	66
6	91	60	82	72	78	53	89	60	46	35	57	48	59	43	36	26	50	38	56	40	83	56	82	67
7	88	70	82	70	79	56	87	64	66	35	51	38	54	47	36	21	45	40	41	32	88	58	82	64
8	88	70	75	62	67	52	79	66	70	46	49	40	56	43	42	10	42	32	45	28	91	63	81	62
9	82	65	69	50	64	50	83	68	74	61	54	41	62	47	40	24	47	31	54	33	89	68	86	60
10	90	62	76	50	64	45	81	64	61	50	60	50	59	37	52	17	42	32	69	36	89	66	90	67
11	96	68	83	57	70	45	85	62	76	50	57	29	67	43	53	30	44	28	36	28	83	63	97	73
12	84	70	86	60	78	46	85	60	73	60	29	22	62	29	65	47	37	28	42	26	76	50	94	71
13	87	66	85	60	73	54	80	59	73	50	35	23	33	22	52	42	38	22	72	39	67	48	90	71
14	94	68	82	68	62	53	85	60	76	60	43	33	43	20	43	33	40	33	79	56	65	42	78	63
15	96	72	74	62	71	50	78	58	62	54	41	25	42	37	36	31	42	30	70	60	69	43	66	55
16	99	74	84	61	73	56	85	57	56	40	42	18	51	35	54	31	40	31	76	56	79	45	77	55
17	80	63	66	58	70	57	77	63	50	35	42	23	56	43	63	37	36	28	56	44	87	53	83	55
18	81	58	77	56	74	48	72	55	41	33	33	20	49	40	62	34	51	26	82	34	90	59	85	57
19	81	57	80	53	66	47	55	41	40	28	40	28	61	37	34	17	50	39	84	53	90	62	85	58
20	87	60	88	57	67	48	62	36	38	17	39	31	57	38	35	15	53	35	65	43	87	64	88	62
21	94	70	92	62	73	46	56	42	28	16	35	25	45	36	41	30	47	25	73	43	85	68	90	67
22	85	70	93	70	77	49	71	52	37	17	54	33	51	39	50	27	53	35	78	47	77	63	92	67
23	89	68	81	67	79	58	62	40	43	26	45	29	39	35	45	33	60	33	80	55	84	54	94	67
24	84	69	81	69	61	44	44	34	37	18	57	40	44	34	51	29	38	21	63	51	91	59	95	69
25	84	70	71	58	60	35	49	29	53	33	40	20	51	30	70	48	39	18	66	49	93	67	85	71
26	79	67	75	53	68	37	64	29	48	25	20	5.5	54	20	61	48	50	30	73	49	94	68	87	71
27	89	67	77	53	76	43	57	35	68	39	34	10	51	38	72	39	60	42	53	42	92	70	90	70
28	82	67	81	55	77	60	55	47	67	46	44	26	50	34	62	54	50	33	65	38	75	61	83	69
29	90	65	85	58	81	53	67	40	35	27	57	44	41	29	57	36	39	28	61	50	77	58	80	63
30	81	65	88	69	86	49	52	38	36	22	56	33	60	37	......	......	50	30	54	39	79	63	81	62
31	84	65	90	67	......	......	46	32	......	......	50	33	56	31	......	......	51	30	......	......	80	60	......	......
Range	43°		43°		55°		62°		60°		55°.5		47°		62°		51°		58°		59°		48°	
Monthly mean	75°.6		71°.2		61°.8		60°.7		43°.2		38°.9		44°.1		38°.2		39°.9		54°.0		69°.6		71°.9	

Elevation of thermometers above ground, 88 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, PORT DOVER, CANADA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	85.8	52.7	84.8	62.8	78.8	62.8	70.7	60.8	37.0	23.0	42.9	30.0	35.0	22.0	28.0	5.6	29.0	23.0	48.8	33.0	46.9	29.0	62.8	48.7
2	81.8	56.7	81.8	72.8	73.7	62.8	72.7	58.8	36.0	26.0	44.9	38.0	41.9	30.0	20.1	5.6	39.9	27.0	46.9	30.0	64.1	46.9	68.7	45.0
3	79.8	69.8	82.8	67.8	75.7	66.8	69.7	54.7	30.0	17.0	40.9	33.0	44.9	24.0	17.1	13.8	40.9	32.0	49.8	45.9	71.1	49.7	72.1	52.7
4	78.8	61.8	80.8	62.8	68.1	56.7	67.1	43.0	31.0	12.8	36.0	32.0	49.8	33.0	26.0	12.8	45.9	36.0	60.1	45.0	62.1	49.7	76.1	49.7
5	77.8	54.7	79.8	67.8	65.8	47.0	74.1	55.7	34.0	19.0	52.1	31.0	37.0	29.0	27.0	11.8	45.9	34.0	46.9	36.0	78.0	50.7	64.1	58.8
6	83.8	53.7	80.0	60.8	71.1	46.0	78.0	57.8	38.9	28.0	47.8	44.0	40.9	36.0	24.0	11.8	38.9	30.0	36.0	28.0	71.7	51.7	67.1	61.8
7	70.1	53.7	82.8	61.8	68.7	49.7	79.8	57.8	52.1	24.0	44.9	35.0	39.9	33.0	31.0	8.8	42.9	24.0	33.0	25.0	69.7	47.0	66.1	55.7
8	82.8	65.8	69.7	53.7	61.8	49.7	67.1	64.8	58.1	47.7	35.0	30.0	45.9	35.0	37.0	8.8	24.0	12.8	38.9	23.0	69.7	42.0	73.1	52.7
9	78.0	58.8	63.8	47.7	60.8	47.0	69.8	64.8	61.8	46.9	43.9	30.0	44.9	35.0	37.0	6.6	33.0	9.8	46.9	33.0	80.0	56.7	83.0	50.7
10	74.7	65.8	68.7	44.0	62.8	40.0	75.7	59.8	46.9	38.0	49.1	40.9	44.9	30.0	38.0	6.6	33.0	19.0	51.1	30.0	67.8	55.7	71.7	61.8
11	73.1	64.8	76.7	58.8	66.8	40.0	77.8	58.8	64.1	41.0	40.9	22.0	46.9	32.0	38.9	13.8	36.0	18.0	32.0	22.0	62.8	52.7	75.1	61.8
12	78.8	60.8	79.0	56.7	72.7	42.0	73.1	64.8	64.1	49.7	25.0	18.0	38.0	24.0	48.9	35.0	32.0	17.0	39.9	22.0	68.1	47.0	77.8	67.8
13	80.8	61.8	73.7	61.8	66.8	51.7	66.1	50.7	57.8	44.9	26.0	19.0	32.0	19.0	35.0	28.0	30.0	17.0	60.1	37.0	57.8	40.0	85.0	59.8
14	81.0	65.8	72.7	59.8	58.8	50.7	67.7	47.0	56.8	42.0	35.0	21.0	37.9	23.0	30.0	18.0	33.0	24.0	59.8	44.0	56.8	39.0	67.7	53.7
15	85.8	69.8	62.8	51.7	61.8	41.0	71.7	49.7	54.1	45.0	34.0	21.0	36.0	27.0	34.0	25.0	31.0	24.0	57.8	44.9	59.8	38.0	73.7	55.7
16	85.0	66.8	56.1	50.7	65.8	53.7	77.8	52.7	45.9	38.0	29.0	15.0	40.9	33.0	37.0	29.0	30.0	27.0	44.9	34.0	74.7	51.7	71.7	53.7
17	70.1	55.7	67.7	52.7	62.8	47.7	71.7	64.8	40.9	33.0	29.0	11.8	44.9	38.0	41.9	36.0	30.0	23.0	42.9	34.0	69.7	54.7	74.1	53.7
18	74.1	52.7	73.1	52.7	54.8	45.8	66.1	49.7	33.0	26.0	18.1	5.6	39.9	33.0	42.9	25.0	38.9	25.0	50.0	30.0	69.7	55.7	77.8	52.7
19	82.8	53.7	72.7	54.7	60.8	39.0	56.1	41.0	40.9	26.0	27.0	13.8	45.9	30.0	25.0	11.8	35.0	27.0	55.8	40.9	79.8	52.7	77.1	53.7
20	83.8	54.7	82.0	53.7	60.8	43.9	59.8	35.0	32.0	10.8	26.0	10.8	37.0	24.0	30.0	12.8	33.0	24.0	51.8	39.0	75.7	57.8	83.0	59.8
21	80.8	58.8	82.0	60.8	63.8	36.0	60.1	37.0	22.1	8.8	11.0	— 2.6	32.0	22.0	35.0	26.0	37.0	17.0	58.8	45.0	68.7	58.7	85.0	64.8
22	73.7	67.8	82.8	68.8	66.8	44.0	61.8	55.7	36.0	19.0	39.9	5.6	38.9	28.0	38.0	26.0	48.1	33.0	66.1	42.9	65.8	57.1	84.8	63.8
23	77.8	66.8	77.1	60.8	68.7	56.7	62.1	34.0	40.9	25.0	32.0	13.8	36.0	28.0	38.0	23.0	45.9	25.0	42.9	34.0	69.7	53.7	84.8	59.8
24	75.7	62.8	74.7	53.7	60.1	39.9	34.0	27.0	37.9	19.0	38.0	30.0	33.0	27.0	40.0	22.0	25.0	15.0	46.9	35.0	75.7	57.7	78.0	65.8
25	80.8	56.7	68.7	53.7	52.8	35.0	47.8	25.0	39.9	31.0	30.0	8.8	38.9	31.0	42.0	37.0	31.0	10.8	51.1	39.0	75.7	56.7	74.7	67.8
26	76.7	61.8	72.7	55.7	60.8	35.0	54.1	44.0	38.0	21.0	9.1	5.6	42.9	34.0	42.0	34.0	48.1	24.0	51.1	44.0	77.8	64.8	82.8	64.8
27	79.8	62.8	72.7	52.7	73.1	40.0	56.8	48.7	51.1	33.0	33.0	6.6	42.9	30.0	52.1	33.0	39.9	33.0	48.1	38.0	80.8	59.8	75.7	65.8
28	80.0	64.8	73.7	54.7	65.8	58.8	53.1	45.9	51.1	37.0	36.0	29.0	38.0	36.0	45.9	34.0	38.9	30.0	55.1	39.0	66.8	53.7	76.7	65.8
29	83.0	63.8	76.1	66.8	71.7	59.8	57.1	38.0	37.0	20.0	42.9	35.0	36.0	18.0	44.9	29.0	38.9	27.0	50.1	44.9	68.7	46.0	73.7	59.8
30	85.8	61.8	80.8	64.8	68.1	58.8	44.9	34.0	33.0	10.8	35.0	13.8	22.9	18.0	......	......	45.9	29.0	46.9	31.0	69.7	56.7	75.7	60.8
31	82.8	59.8	81.0	62.8	......	......	37.0	29.0	......	......	31.0	13.8	38.0	24.0	......	......	46.9	31.0	......	......	72.1	55.7	......	......
Range	33°.1		40°.8		43°.8		54°.8		55°.3		54°.7		31°.8		46°.5		38°.3		44°.1		51°.8		40°.0	

Maximum, minimum and mean temperatures—Continued.

STATION, PORT HURON, MICH.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	80	56	90	65	80	64	82	64	35	19	45	29	38	18	28	8	34	21	50	39	60	29	60	47
2	87	59	91	73	69	62	81	64	32	25	44	37	43	32	22	6	40	28	49	36	72	49	67	47
3	86	70	78	65	72	63	67	56	30	20	42	37	48	24	25	15	47	34	57	47	80	53	57	48
4	79	59	81	63	68	53	71	45	30	11	40	33	50	33	26	12	49	34	58	47	80	52	73	55
5	70	53	83	65	69	44	83	58	35	21	55	33	43	30	27	11	57	31	51	34	80	57	72	59
6	82	57	84	61	72	54	86	64	41	24	56	40	47	36	25	6	45	31	38	28	68	39	73	59
7	72	65	86	60	66	50	84	56	55	34	41	31	40	32	25	17	48	18	31	25	83	39	67	52
8	83	64	66	48	57	48	73	65	65	52	34	30	44	36	40	14	19	11	42	22	79	41	57	47
9	83	59	62	47	56	46	80	65	64	42	47	29	57	39	38	9	35	12	57	29	74	45	76	53
10	79	65	73	46	59	40	84	64	46	33	56	32	39	29	44	14	29	11	58	29	70	49	80	62
11	87	63	74	55	70	43	70	61	65	42	33	20	58	32	48	25	33	16	36	23	67	45	87	64
12	79	60	78	62	72	51	79	60	64	48	25	14	34	24	53	36	37	14	46	21	68	45	86	64
13	83	64	77	62	69	49	67	59	63	44	26	14	32	21	36	27	33	15	69	38	50	40	80	54
14	91	67	69	57	56	47	75	53	62	53	35	21	40	24	33	24	35	25	73	52	49	39	55	51
15	92	71	62	54	60	40	79	57	56	43	32	18	36	23	37	28	35	18	66	36	64	35	62	53
16	81	63	62	52	63	49	76	54	52	36	20	6	42	30	47	28	31	24	44	34	79	50	62	53
17	69	55	64	48	63	47	74	65	44	32	23	7	48	37	56	39	34	13	52	32	82	54	71	52
18	70	54	69	47	57	47	66	45	42	27	17	1	43	35	52	18	39	25	55	38	85	60	80	55
19	68	57	77	52	59	38	51	41	36	25	26	13	47	34	21	8	33	31	66	37	79	62	80	58
20	81	56	80	57	57	41	60	39	28	14	26	12	37	24	27	10	42	25	56	36	66	51	83	61
21	86	63	82	64	63	41	59	43	25	10	12	3	34	24	36	26	45	20	69	44	61	47	85	64
22	75	68	87	67	69	48	64	51	36	19	40	11	41	32	45	24	46	33	60	37	66	53	85	63
23	71	65	79	58	68	53	57	33	38	18	32	12	32	24	35	26	54	22	42	35	79	54	87	64
24	71	64	67	56	56	39	37	27	34	12	37	22	35	25	53	26	22	15	47	35	80	65	88	67
25	72	61	63	61	58	31	48	27	39	27	22	14	43	31	50	42	37	11	52	39	84	62	76	67
26	82	66	66	54	62	39	55	36	36	20	15	— 2	46	35	52	35	48	24	56	42	84	64	81	64
27	76	59	74	51	64	50	56	43	53	35	30	4	50	36	46	32	41	37	53	38	80	50	79	67
28	83	61	82	57	70	56	52	42	57	31	35	26	39	23	59	32	38	30	63	39	60	48	79	64
29	71	63	91	64	76	60	60	38	31	20	40	29	30	16	53	23	33	28	57	46	68	51	72	58
30	78	62	88	64	79	59	45	34	32	14	29	13	52	21	......	......	34	26	46	31	70	54	76	55
31	85	60	90	65	......	......	39	24	......	......	34	12	31	19	......	......	49	29	......	......	75	49	......	......
Range	39°		45°		49°		62°		55°		58°		42°		53°		46°		52°		56°		41°	
Monthly mean	71°.3		68°.0		57°.1		56°.9		36°.8		27°.4		34°.9		30°.2		31°.0		44°.5		60°.4		66°.3	

Elevation of thermometers above ground, 80 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, PORTLAND, ME.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	80	56	86	66	76	62	83	63	43	31	37	20	35	8	35	4	41	30	51	37	50	35	80	61
2	86	57	93	68	85	67	73	60	41	27	50	35	47	30	15	−3	34	22	55	36	66	41	69	53
3	93	67	93	75	70	61	82	58	37	30	45	33	40	24	18	10	47	25	48	38	68	47	67	52
4	90	63	84	68	61	57	69	56	37	28	51	31	46	30	26	12	56	39	55	46	65	50	66	54
5	76	57	82	65	69	56	74	52	37	22	39	30	46	23	34	17	50	35	62	46	66	48	70	51
6	73	55	87	66	74	52	60	48	35	28	47	28	35	16	35	20	41	27	59	39	68	50	63	57
7	69	58	82	59	72	56	73	47	40	32	55	42	39	31	28	15	40	26	46	29	59	41	58	49
8	65	59	70	60	73	62	83	63	49	33	47	35	38	23	30	14	39	16	42	25	55	41	53	48
9	82	61	73	60	69	54	80	61	60	43	38	29	35	25	28	7	21	8	47	29	59	47	60	50
10	79	64	74	59	70	55	61	51	60	45	42	26	46	29	20	2	40	17	53	38	65	47	73	52
11	81	63	80	54	69	56	56	49	53	39	54	40	34	23	35	8	27	15	48	31	81	58	75	56
12	85	61	82	58	69	52	58	52	55	47	45	30	43	31	45	28	34	20	37	23	66	52	78	65
13	81	64	81	61	67	53	65	52	48	37	32	24	32	18	48	40	34	15	56	30	56	44	80	59
14	85	65	79	63	65	59	67	49	50	41	35	25	25	12	44	34	36	27	47	38	53	40	69	58
15	86	68	76	56	69	52	66	49	57	49	37	32	36	18	36	25	42	32	61	37	68	42	79	57
16	86	68	63	54	63	57	78	51	58	46	36	28	35	21	39	25	36	31	63	43	67	51	76	55
17	81	65	58	53	70	55	62	55	53	42	36	24	39	30	44	25	36	25	43	35	72	52	80	56
18	74	59	60	55	67	50	60	58	45	28	24	10	40	36	50	38	39	19	54	33	66	52	78	54
19	78	56	70	56	71	55	61	41	38	26	27	16	46	35	48	14	42	28	50	36	60	47	83	59
20	74	57	79	63	64	50	52	37	36	30	30	15	40	24	31	14	47	32	62	43	74	53	78	61
21	76	59	72	53	63	47	68	41	30	15	21	−2	29	19	36	24	47	35	58	42	75	57	80	61
22	76	62	80	61	59	49	58	53	31	13	15	−2	36	13	41	26	48	30	60	43	72	56	67	57
23	68	63	85	67	65	49	67	54	41	31	34	13	43	33	41	32	50	32	56	38	70	56	77	56
24	76	63	81	65	62	54	54	34	36	23	32	23	38	29	34	20	43	23	52	38	85	58	75	60
25	80	58	76	63	56	42	39	31	43	26	35	13	38	20	39	20	31	18	56	34	77	62	68	58
26	66	58	69	57	61	39	54	28	41	31	15	4	41	25	43	38	37	18	52	43	80	61	84	58
27	79	57	69	57	62	42	56	36	36	26	22	9	42	32	50	34	44	22	59	37	94	61	86	66
28	66	60	71	56	62	47	54	45	51	36	33	17	52	38	47	33	38	28	57	39	82	63	81	66
29	76	58	72	54	66	55	55	43	52	31	41	26	38	13	58	41	40	28	63	42	74	57	90	68
30	82	64	76	59	79	56	56	44	30	22	41	10	37	9	......	......	42	29	65	42	63	53	83	68
31	89	67	83	58	......	......	47	38	......	......	10	−1	47	33	......	......	47	32	......	......	69	52	......	......
Range	38°		40°		46°		55°		47°		57°		44°		61°		48°		42°		59°		42°	
Monthly mean	68°.0		63°.9		59°.9		55°.6		38°.5		29°.2		32°.3		30°.1		33°.7		45°.4		59°.5		65°.6	

Elevation of thermometers above ground, 28 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, PORTLAND, OREG.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	73.2	47.5	79	52.5	67.5	51.5	65.2	52.3	55	32.2	56.3	49	46	37.5	37	30.5	49.5	38.5	54	35	69	49	71	51.5
2	70	54.8	80.1	51.5	74.7	46.5	64	47.5	56	34	56	48	45	39.5	39.5	34	44	34	48	39	63	51	64	54
3	64	54	81.7	51	82.3	56.3	64.2	53.3	59.7	38.3	50.3	45	45	38.5	40	34	44	35.5	49	37.5	61	47	60	47.5
4	64	50.8	83.3	54	84.2	55.2	62.4	51.5	56	39	54.5	42	46	38	40	35	43.5	32	47	36	59	44.5	63	47.5
5	64.2	52	84.3	54.3	85.2	57.5	58.2	47.7	61.3	49	51.5	42	41	35	39	35	47.5	38	56	33	57	42	66	48
6	65	54	84.2	56.3	72.3	55.3	55.5	44.7	55	43.7	46	39.3	50	39	38.5	33	51	40	63	38.5	57	41.5	69.5	53
7	76.7	50	85	56.2	76.3	56.7	58.7	43.3	47	39	45	37	56.5	39	48	33.5	52	38	68	40	57	43.5	65	53
8	83.2	57.5	83.2	56	67.7	57.3	58	42.5	48.7	40	45	35	41	35.5	46	32.5	48.5	35	77	42.5	57	43	60	49
9	75.3	58	86	57.1	61	50.7	55	48	49.7	42.7	40.5	37	48	34	41	33.5	52	30.5	69	44.5	55	42	59	49
10	74.2	58.8	84	58.8	62.7	46.5	56.3	47.3	49	38.7	43.5	36.7	37	30	43	33.5	50.5	39	63.5	48	57.5	40	58	48.5
11	65	52.5	82.3	55.3	73.3	43.7	52.3	45	49	41.5	47	35.7	38.5	33	45	34	46	37.5	55	43.5	57	43	70	50.5
12	67.7	50	82.2	58.5	83.7	55.5	56	45.3	47.7	39.5	49	38.5	45	34.5	40.5	36	40	29.5	53	43.5	59	35	73	47
13	72.7	48.5	83.2	54.8	82	54	55.7	41.3	53.7	39	58	48.7	48.5	43	46	35	41.5	25.5	55.5	42	56.5	44	58	47.5
14	67.5	54.5	86.7	58	77	52	54.5	48.5	50	40.3	57.5	51	53.5	42	46.5	37	47	26.5	52	41.5	59.5	45.5	65	47.5
15	71	56.7	86	57	82	55.7	58.5	46	50	42.5	53.5	45.5	52.5	46	40.5	32.5	52.5	30.5	45	37	64	40	75	42
16	73.7	50	78.7	55.7	81	56.7	56	37.2	48	39.7	47	39.5	52.5	47	41	33	51.5	32.5	50	36	71	44	69	50
17	76.3	52.5	82	54.5	85	54	63.5	40.7	52.3	33.7	42.5	38	57	49	39	29	48	35.5	51.5	37	61.5	46	67	52
18	76	55	86	56	85	56	67.5	41	53	40.5	42	36	50	41.5	43	34	52	40.5	55.5	39.5	63	47	65	51
19	75.7	54.3	76	56.5	85.3	57.2	58.7	44.3	52.3	35	38	24.5	47	40.5	43	32	51.5	38.5	53.5	41	72	53	55	47.5
20	71	58.5	75.5	57.8	80.5	56.5	56	52	51.5	34	28.5	23.5	51.5	44	44	29	52	35	54	37	67	52.5	68	49
21	75	58.2	65.3	57.5	65.5	56.3	56	43.5	50	29	30.5	21.5	51	40.5	47.5	32	52	32.5	56	42	61.5	46	67.5	51
22	77	58	69.6	50	70.3	58.5	59.7	43.5	45.7	30	26	13	50.5	47	48	32	57	35	57	37	62	47	77.5	48.5
23	83	59.5	64.5	58	70.7	52.3	64.3	42.7	48	32	24	3	49.5	38.5	43.5	35	58	33.5	57.5	38	57	45	85	55.5
24	88.3	62.2	69	52.5	65.3	55.3	61	51.3	44	32.3	24.5	8.5	51.5	39.5	47.5	38.5	53.5	36.5	59	43.5	56.5	41	87	58
25	91	61.3	77.5	51	63.5	57.7	59.7	47	45.3	39.5	28	15	42	34.5	52	40.5	48	38	62	40	65	38.5	81	59
26	91.7	64.4	69	55.6	71	50	63.3	45	41.7	31	42	21	38.5	33.5	46.5	36	50	38.5	63	42	75.5	42	82	55
27	86.3	61.5	69.3	54.5	68.8	58.7	59	48	40	28	43	38.5	37	29	37	29	47	37	68	43.5	76	48	89.5	55.5
28	86.3	60.3	66.5	55.3	64	55	57.5	49.8	39.5	25.3	42	35.5	37	26.5	44.5	26.5	45	35.5	80	44	65	44	82	60
29	79.9	56	70	57.2	60.7	50.5	60	48.8	53.8	34	43	32	39	32	48	37	46	34.5	85	49.5	60	47	74	55.5
30	76.2	56	79.5	52.8	56.3	46.5	54.7	47.7	53.3	42.5	46	37	36	30	......	......	43	35	76	50.5	70	41	69	54
31	76.6	49.3	78.5	55.7	......	......	56.3	40	......	......	49	45	34	29	......	......	49	36.5	......	......	75	47	......	......
Range	44°.2		36°.7		41°.6		30°.3		36°		55°		30°.5		25°.5		32°.5		52°		41°		47°.5	
Monthly mean	66°.1		68°.0		63°.7		51°.9		43°.6		38°.9		41°.9		38°.1		41°.4		50°.3		53°.9		60°.4	

Elevation of thermometers above ground, 45 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, PORT STANLEY, CANADA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	78.2	51.0	87.2	61.4	83.8	58.0	73.0	60.9	40.6	23.0	43.2	32.4	35.5	20.0	40.6	9.7	37.0	21.6	64.5	31.0	50.0	26.5	66.0	47.2
2	84.5	54.2	84.0	73.5	76.2	63.1	75.0	55.4	32.2	23.8	45.5	36.2	44.6	26.2	23.0	9.5	43.8	29.0	49.0	29.0	58.6	43.2	70.0	43.0
3	84.2	69.0	85.0	68.0	78.0	65.1	70.0	51.0	35.2	7.9	42.8	34.2	44.0	24.4	29.0	15.0	42.0	32.2	50.2	40.2	60.5	44.2	69.5	52.6
4	82.4	59.5	82.0	62.3	72.8	56.7	69.0	41.4	36.0	— 2.0	38.0	32.2	47.6	32.2	30.5	11.2	50.0	35.2	64.0	42.7	67.0	44.7	69.2	52.2
5	74.5	52.2	85.0	64.0	70.2	46.6	74.0	52.8	38.0	5.0	51.0	33.2	40.4	27.0	33.0	13.4	51.5	33.0	51.0	38.0	72.0	47.8	67.5	58.4
6	80.0	51.2	85.0	55.2	72.5	46.2	76.0	57.2	43.8	26.8	48.2	42.9	45.2	36.2	34.8	10.2	44.0	30.5	46.0	28.0	71.0	48.2	72.4	59.7
7	73.0	66.3	84.0	58.2	69.5	44.6	78.0	62.1	53.5	42.2	45.0	37.7	40.4	32.2	40.0	4.9	48.0	20.2	38.2	26.0	66.5	48.2	73.0	56.4
8	86.0	64.1	70.0	51.2	61.5	49.7	70.0	65.1	60.0	48.4	35.0	29.2	45.2	34.8	36.6	0.9	32.0	13.8	42.6	21.0	69.5	52.6	70.6	40.2
9	82.2	55.3	69.0	46.2	60.5	44.1	73.0	62.1	60.0	46.1	46.8	29.2	47.4	37.0	40.5	11.4	34.4	12.0	44.5	32.7	71.0	56.7	77.0	48.4
10	77.0	62.6	75.0	41.2	64.0	36.2	73.0	60.0	49.0	34.2	50.8	37.2	48.4	28.4	42.4	17.6	43.5	16.5	50.0	29.2	66.0	54.2	75.0	58.2
11	78.0	65.6	80.0	55.0	67.0	39.7	75.0	59.0	56.0	42.5	39.4	19.8	48.0	33.2	40.0	14.6	36.0	17.0	40.5	24.0	71.8	47.4	81.4	62.3
12	81.0	59.4	82.0	61.1	73.0	40.0	72.4	63.1	59.2	51.1	27.4	16.8	39.0	19.0	48.0	34.2	43.0	16.8	45.0	22.6	71.5	41.0	89.0	66.1
13	83.0	59.6	77.2	62.1	70.0	49.0	73.8	55.1	57.0	43.0	28.8	17.5	35.0	15.5	45.3	29.0	39.5	16.8	50.5	37.0	63.0	37.2	93.5	59.1
14	83.6	60.1	74.0	58.1	60.0	46.6	70.0	48.2	58.8	47.7	36.0	22.6	38.8	29.2	40.4	20.0	40.5	21.6	60.8	41.2	62.0	36.2	65.8	52.2
15	86.4	67.0	65.0	53.2	64.0	37.2	73.0	50.7	55.0	45.6	35.0	19.4	43.0	27.2	38.0	26.0	39.6	21.2	59.5	44.7	62.5	34.2	72.8	55.0
16	87.0	66.0	60.8	51.2	67.6	51.1	76.5	52.4	48.0	36.2	35.2	13.0	42.0	32.7	39.4	27.4	38.0	24.0	47.0	35.7	67.0	46.0	82.0	52.8
17	74.0	56.1	74.2	50.1	66.2	47.4	74.2	66.1	41.5	32.2	27.0	10.5	42.5	32.4	45.3	34.2	38.0	21.0	50.6	32.7	69.5	49.2	78.5	53.6
18	77.4	52.0	76.0	45.0	64.0	44.1	68.0	49.5	35.6	27.2	22.0	5.7	43.2	31.0	50.5	23.0	37.5	28.6	56.6	29.8	71.8	53.0	76.2	52.4
19	77.0	51.8	79.0	53.3	62.0	38.1	56.0	38.2	41.2	25.6	28.0	13.8	48.8	29.0	35.0	11.8	41.8	27.0	64.6	40.2	78.0	56.0	79.0	51.2
20	81.2	52.2	77.5	52.2	62.8	39.6	62.0	31.0	31.0	14.2	30.8	12.0	48.0	28.4	32.0	16.3	39.6	26.0	50.0	38.0	74.0	55.2	89.0	56.2
21	84.0	55.2	80.0	61.1	65.5	34.0	63.5	38.2	25.4	9.4	13.2	— 0.3	38.4	26.2	41.6	26.8	38.5	18.6	58.0	40.2	70.0	58.2	89.0	65.1
22	77.0	62.6	82.0	67.7	68.4	47.0	62.0	56.2	38.6	18.6	39.8	7.9	40.0	31.8	40.8	24.2	50.0	32.8	65.0	43.4	66.0	52.2	86.8	63.1
23	80.0	66.7	79.5	58.2	72.0	51.7	62.5	33.4	40.4	23.5	33.0	8.5	36.0	26.0	44.5	22.4	63.0	24.2	50.8	33.0	68.0	48.2	82.2	63.1
24	80.2	63.5	76.0	53.2	59.5	36.2	36.6	20.0	38.8	13.2	38.5	26.0	37.5	26.6	40.4	24.6	26.6	13.6	50.0	35.2	74.0	58.2	80.0	60.7
25	80.0	61.6	71.0	53.6	59.5	32.2	47.6	21.0	41.0	22.0	36.2	7.5	40.0	30.2	48.0	36.2	29.5	8.0	53.5	39.2	78.5	53.7	77.2	65.6
26	82.0	62.1	76.0	52.2	61.0	34.2	55.4	44.7	39.4	15.0	16.8	2.4	42.0	31.0	44.8	29.5	45.0	24.0	58.0	44.7	80.0	59.2	79.5	62.9
27	81.2	61.6	77.0	51.7	64.2	51.5	58.6	49.2	50.0	36.2	34.0	7.4	41.7	34.2	50.5	34.8	46.0	35.7	53.5	38.2	74.0	60.1	79.2	62.1
28	82.0	59.2	79.0	50.2	69.0	60.2	57.4	45.2	50.0	55.0	36.0	20.4	38.2	25.0	48.0	36.2	44.0	28.5	55.5	40.2	72.0	49.2	79.5	64.1
29	81.8	63.9	79.0	61.6	70.0	60.5	61.0	40.2	35.6	23.4	44.4	32.2	36.6	19.2	50.5	26.0	41.0	26.8	55.0	45.2	67.8	44.2	74.5	59.2
30	81.4	60.2	80.0	63.1	72.0	59.4	47.0	33.2	34.8	18.5	34.0	13.2	46.2	20.5	....	....	50.1	27.1	53.5	30.2	76.0	57.2	73.8	59.2
31	82.5	58.1	83.0	60.2	....	....	40.0	26.8	....	....	32.0	13.2	36.2	23.4	....	....	50.0	27.8	....	....	69.5	53.2	....	....
Range	36°.2		46°.0		51°.6		58°.0		62°.0		51°.3		33°.3		49°.6		55°.0		44°.0		53°.5		50°.5	

Maximum, minimum and mean temperatures—Continued.

STATION, PRESCOTT, ARIZ.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	84	45	92	64	92	53	80	47	67	33	58	32	43	17	39	—6	61	25	61	32	71	34	81	38
2	83	43	97	63	92	56	77	45	67	33	56	27	52	22	39	—3	55	26	55	39	74	40	89	41
3	91	42	87	59	92	58	78	43	66	37	53	26	50	27	34	—11	51	37	60	40	74	38	82	41
4	88	43	86	54	100	53	78	42	70	32	44	27	53	25	31	—10	47	32	67	43	76	38	81	57
5	89	62	91	58	89	56	74	50	71	29	58	24	56	27	32	—4	51	28	72	35	74	41	80	45
6	95	60	87	61	98	49	70	49	70	30	58	27	49	28	33	—5	56	23	66	42	67	49	81	37
7	100	60	88	61	91	55	67	42	59	38	56	26	58	29	33	—5	55	22	66	29	69	27	83	40
8	90	58	92	61	92	54	62	38	54	30	56	30	53	33	39	5	56	22	68	32	74	40	82	49
9	84	64	89	56	92	53	60	26	50	37	48	22	54	23	42	13	56	21	65	35	74	48	78	61
10	80	61	90	55	90	57	69	30	46	34	52	17	56	29	46	26	61	28	74	30	75	47	71	58
11	88	56	91	64	90	50	72	32	55	30	44	18	45	27	40	20	62	24	81	35	75	40	76	34
12	87	60	91	62	90	50	74	37	53	30	46	23	45	19	37	10	52	35	76	33	67	42	76	40
13	91	56	93	59	88	47	67	54	48	34	48	18	54	21	37	—1	49	20	61	41	62	35	75	32
14	89	66	92	57	85	54	61	38	59	25	53	26	53	23	39	3	40	23	56	23	63	27	86	41
15	87	64	93	55	87	50	59	28	59	28	58	24	55	21	48	3	45	11	55	33	71	27	90	42
16	97	59	91	61	87	51	58	28	57	31	61	21	54	21	47	28	47	16	59	40	70	31	93	44
17	92	58	89	58	87	52	68	25	46	19	59	22	61	24	44	22	43	26	53	34	71	41	90	47
18	86	59	83	61	87	49	72	30	53	25	56	25	58	31	48	10	50	21	43	27	75	35	90	55
19	94	56	87	57	87	47	72	33	59	20	56	34	56	27	51	18	55	23	53	23	80	39	80	59
20	93	56	91	56	87	54	74	33	58	23	52	41	57	26	53	19	54	20	63	31	83	43	83	59
21	94	55	90	55	84	54	77	36	62	22	51	36	54	24	53	30	55	19	64	40	82	51	84	52
22	88	68	83	52	82	55	76	36	60	23	47	31	53	22	53	27	62	19	62	44	80	50	85	47
23	94	62	90	46	85	53	74	36	59	23	42	10	50	25	50	33	64	25	58	35	80	47	94	52
24	91	62	90	51	83	51	72	34	59	24	22	—11	51	18	47	22	64	24	59	30	79	59	85	49
25	96	60	93	52	80	52	72	34	56	24	26	—18	55	22	51	23	60	38	64	28	68	37	88	46
26	94	62	94	55	78	48	64	31	50	33	39	—4	51	33	54	24	55	30	68	29	66	29	91	45
27	92	61	87	64	68	52	68	33	44	14	51	32	41	25	53	28	63	21	68	31	71	33	88	47
28	90	58	78	57	71	44	69	29	47	19	50	37	37	21	54	19	67	28	69	31	77	35	91	51
29	94	62	80	42	72	52	72	34	53	23	47	30	37	—3	56	20	65	30	68	32	85	39	92	51
30	91	61	85	43	75	46	68	35	59	26	37	17	19	—17	......	......	60	36	68	44	78	40	90	50
31	89	64	90	48	......	......	66	35	......	......	39	10	27	—11	......	......	65	23	......	......	78	40	......	......
Range	58°		55°		56°		55°		57°		79°		78°		67°		56°		58°		58°		62°	
Monthly mean	76°.6		75°.3		71°.4		55°.5		42°.4		35°.5		34°.3		28°.5		42°.0		51°.0		62°.0		70°.7	

Elevation of thermometers above ground, 4 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, PUNTA RASSA, FLA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	88	72	90	75	85	74	89	77	77	66	74	65	78	64	73	63	78	63	76	54	88	70	87	71
2	88	73	88	76	84	75	86	74	77	67	76	61	79	63	74	62	81	64	77	57	88	67	85	71
3	87	73	89	76	83	74	83	72	76	65	76	62	79	65	73	57	80	63	78	66	84	70	88	67
4	83	74	90	74	86	75	78	71	75	61	77	63	80	66	64	52	79	65	79	68	81	72	88	69
5	86	74	88	75	88	76	78	73	76	58	76	63	77	66	77	58	80	67	80	67	81	69	87	71
6	88	75	90	77	87	76	82	74	80	66	75	66	80	65	71	56	80	66	80	67	82	70	85	71
7	91	75	90	79	89	73	87	76	81	67	77	70	78	63	69	58	81	65	81	71	82	70	87	71
8	90	76	90	79	88	76	86	76	82	68	78	65	78	63	76	62	80	67	81	65	81	70	88	74
9	87	78	90	74	87	74	86	75	84	72	80	65	77	64	75	65	81	74	80	66	86	70	89	74
10	86	80	89	75	90	74	86	75	82	72	79	67	78	64	75	62	81	73	70	59	86	69	90	73
11	87	80	90	75	88	72	85	73	80	69	78	67	80	65	79	62	81	71	71	53	85	69	90	74
12	86	80	91	75	86	73	84	72	82	70	78	69	79	64	77	64	81	71	77	62	84	69	89	74
13	87	80	92	76	87	75	83	74	83	69	79	71	77	63	76	69	82	67	78	55	85	68	88	76
14	89	79	91	72	80	75	78	73	82	70	78	67	73	62	78	72	82	67	81	60	86	73	87	79
15	92	77	90	76	85	75	81	74	81	70	77	68	78	61	73	59	81	68	81	63	81	71	88	79
16	91	70	90	77	87	71	84	77	79	69	74	60	75	60	73	54	81	71	81	67	80	65	88	80
17	91	75	87	77	86	72	86	76	81	69	75	60	70	60	79	62	82	75	84	65	82	65	85	75
18	92	80	92	79	86	73	84	73	82	70	77	63	71	59	78	66	82	69	84	67	83	67	86	73
19	92	77	92	77	82	73	85	72	74	58	75	68	74	57	77	66	82	74	81	67	85	68	82	72
20	85	73	91	77	84	75	86	72	62	46	76	68	74	59	78	65	84	69	83	68	84	70	88	71
21	89	74	90	76	86	75	86	74	66	46	72	62	73	57	74	65	82	65	84	69	81	72	81	70
22	88	72	89	77	87	80	86	73	64	49	76	63	74	68	71	64	82	64	84	70	84	71	87	72
23	91	76	89	78	89	72	88	76	67	50	77	64	76	55	70	58	73	65	83	69	84	70	87	74
24	91	71	90	80	87	75	84	73	71	51	80	67	63	53	76	59	77	62	83	70	81	70	90	74
25	89	72	90	79	84	75	78	70	76	57	78	68	74	61	77	60	79	63	83	68	83	72	90	74
26	91	74	87	76	84	74	79	71	79	62	73	60	72	66	77	63	80	62	85	69	85	70	93	75
27	89	76	81	73	85	73	82	72	79	66	74	56	69	64	79	63	79	62	84	72	84	71	91	76
28	91	75	80	73	85	72	78	70	76	67	76	62	66	58	78	63	78	68	86	73	84	70	91	76
29	89	74	81	73	85	72	71	65	77	66	77	65	70	59	78	64	70	59	84	71	87	70	91	76
30	87	73	81	75	90	75	76	63	72	66	79	66	78	64	......	......	73	53	85	71	90	71	91	74
31	83	73	81	72	......	......	79	65	......	......	80	66	76	64	......	......	73	49	......	......	89	73	......	......
Range	22°		20°		19°		26°		38°		24°		27°		27°		35°		33°		25°		26°	
Monthly mean	81°.2		81°.3		79°.3		77°.0		69°.5		70°.4		68°.3		68°.6		73°.0		74°.2		76°.1		80°.1	

Elevation of thermometers above ground, 14 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, QUEBEC, QUEBEC.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	76.0	45.0	85.0	61.0	82.0	59.0	78.0	60.0	36.0	23.0	24.0	4.0	11.0	— 2.0	26.0	—16.0	19.0	4.0	34.0	16.0	39.0	18.0	70.5	53.0
2	88.0	55.0	83.0	68.5	72.5	60.0	71.0	46.5	30.5	20.0	29.0	5.0	35.0	9.0	13.0	—21.0	18.0	3.0	45.0	17.0	51.0	30.0	68.0	39.0
3	82.0	64.5	78.0	62.0	75.0	56.0	72.0	54.0	42.0	19.0	21.0	14.0	20.0	— 3.0	13.0	—11.0	30.0	9.0	40.0	31.0	61.0	37.0	70.0	43.5
4	77.5	51.5	79.0	54.0	65.0	56.0	59.0	38.5	36.0	16.0	25.0	13.5	30.0	7.0	16.0	7.0	38.0	25.0	48.0	36.0	55.0	33.0	69.0	47.0
5	72.0	47.0	79.5	56.0	69.0	52.0	52.0	43.0	30.5	15.5	26.0	6.0	28.0	2.0	20.0	7.0	30.0	13.0	46.0	31.0	55.0	36.0	72.0	45.5
6	78.0	45.5	72.0	53.0	64.0	51.0	52.5	39.0	33.0	23.0	36.0	16.0	24.0	— 2.0	20.0	4.0	18.0	13.0	36.0	20.0	40.0	32.0	72.5	57.5
7	79.0	53.0	70.0	49.0	70.0	53.0	72.0	41.5	35.0	23.0	40.0	33.0	25.0	10.0	20.0	— 3.5	30.0	10.0	29.0	16.0	55.0	29.5	69.0	56.0
8	75.0	59.0	71.0	57.0	66.0	51.0	76.0	55.5	39.0	28.0	38.0	12.0	26.0	10.0	23.0	— 2.0	29.5	— 5.0	32.0	9.0	46.0	25.5	69.0	52.0
9	74.0	56.5	65.0	54.0	66.0	51.0	76.0	47.0	55.0	34.0	19.0	7.5	33.0	19.0	27.0	—14.0	10.0	—10.5	41.0	9.0	55.0	36.0	73.0	51.0
10	79.0	51.0	69.0	53.0	69.0	50.0	57.0	43.0	56.0	33.0	35.0	15.0	36.0	6.0	12.0	—22.0	20.0	1.0	40.0	30.5	69.0	38.0	80.0	52.0
11	79.0	51.0	74.0	53.0	67.0	47.0	50.0	44.0	40.0	30.0	42.0	29.0	24.0	— 1.0	12.0	— 3.0	13.0	—11.0	34.0	13.0	70.0	42.0	84.0	56.0
12	85.0	54.0	79.0	58.0	68.0	49.5	52.0	42.0	35.0	30.0	33.5	2.5	34.0	15.0	36.0	7.0	16 0	zero.	27.0	6.0	55.5	41.0	76.0	57.0
13	87.0	61.0	73.0	56.0	68.0	53.0	59.0	37.0	36.0	30.0	21.0	— 3.0	19.0	— 1.0	36.0	24.0	16.0	— 7.5	34.5	15.0	45.0	36.0	69.0	48.0
14	76.0	60.0	74.0	52.0	60.0	46.0	62.0	38.0	54.0	32.0	25.0	11.0	19.0	— 7.0	27.5	17.0	12.0	4.0	36.0	18.0	50.0	33.0	65.0	54.0
15	79.0	56.0	63.0	44.0	60.0	46.5	55.0	47.0	57.0	37.0	26.0	21.0	23.0	7.0	23.5	15.5	22.0	zero.	46.0	24.5	59.0	32.0	76.5	48.0
16	79.0	57.0	64.0	41.0	64.0	45.0	69.0	51.5	43.0	31.0	25.0	3.5	23.0	5.0	29.0	13.0	24.0	6.0	43.0	23.0	62.0	43.0	80.0	50.0
17	62.0	50.0	68.0	48.0	60.0	49.0	63.0	49.0	41.0	24.0	15.0	— 6.0	31.0	21.0	25.0	5.0	28.0	10.0	36.0	25.0	64.0	45.0	78.0	48.5
18	66.0	48.5	61.5	53.5	59.0	45.0	63.0	53.0	32.0	22.0	3.5	—14.0	33.0	26.0	44.0	22.0	25.0	— 3.0	36.0	22.5	60.0	37.5	83.0	50.0
19	72.0	49.5	62.0	51.5	69.0	44.0	60.0	33.0	33.0	17.0	6.0	— 9.0	32.0	24.0	34.0	zero	33.0	19.0	51.5	25.5	66.0	41.5	85.0	58.0
20	75.0	49.5	74.0	54.5	60.0	44.5	44.0	28.0	30.0	16.0	9.0	—12.0	30.0	5.0	17.0	— 2.5	35.0	22.0	49.0	35.0	77.0	55.0	72.0	59.0
21	68.0	60.0	67.0	49.5	56.0	40.0	58.0	31.0	20.0	4.0	— 2.0	—26.0	19.0	5.0	20.0	6.5	35.0	16.0	54.0	31.0	70.0	44.0	79.0	46.5
22	78.0	56.0	70.0	56.0	60.0	40.0	55.0	38.0	19.0	1.0	6.0	—20.0	20.0	2.5	20.0	7.0	34.0	14.0	49.5	31.0	56.0	40.0	70.0	46.5
23	66.0	57.0	72.0	52.5	55.0	46.0	64.0	35.0	32.0	17.0	13.0	zero.	24.0	16.5	29.0	13.0	30.5	14.0	41.0	23.5	73.0	45.0	69.0	50.0
24	72.0	54.0	72.0	52.0	57.0	39.5	42.0	26.0	29.0	6.0	11.5	1.0	30.0	13.0	17.0	— 3.5	30.0	12.0	44.0	23.0	79.0	50.0	67.0	52.0
25	72.0	44.0	68.0	51.5	51.0	31.0	35.5	21.0	28.0	9.0	12.0	—11.5	20.0	3.5	33.0	— 2.0	25.5	4.0	50.0	25.0	83.0	44.0	82.0	55.5
26	70.0	55.0	68.0	53.0	59.0	32.5	47.0	23.0	30.0	10.0	— 5.0	—24.0	29.0	18.0	40.0	30.0	31.3	5.0	43.0	33.0	72.5	47.5	85.0	58.0
27	64.0	53.0	72.0	56.0	62.0	42.0	48.0	29.0	26.0	8.0	3.5	—17.0	37.0	24.0	38.0	21.0	30.0	3.0	44.0	29.0	85.0	60.0	83.0	57.0
28	78.0	56.0	73.0	58.0	59.0	43.0	52.0	38.0	37.0	21.0	22.0	1.0	38.0	8.0	24.0	17.0	28.0	15.0	46.0	21.0	77.0	48.0	77.0	66.0
29	79.0	60.0	68.0	55.0	63.0	50.5	47.0	37.0	44.0	13.0	23.5	11.0	10.5	— 8.0	36.0	11.0	31.0	21.0	54.0	30.0	65.0	41.0	80.0	64.0
30	79.0	52.5	71.0	54.0	75.0	55.0	45.0	34.0	30.0	8.0	22.0	—13.0	25.0	— 9.0	......	......	30.0	14.0	48.0	27.0	63.0	45.0	75.0	59.5
31	80.0	54.5	78.0	53.0	......	......	36.0	27.0	......	......	7.0	—18.5	40.0	14.0	......	......	34.0	12.0	......	......	60.0	46.0	......	......
Range	44°		44°		51°		57°		56°		68°		49°		66°		49°		48°		67°		46°	

Maximum, minimum and mean temperatures—Continued.

STATION, RED BLUFF, CAL.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	93.0	63.0	107.0	78.0	96.0	65.0	82.0	53.0	70.0	46.0	54.0	48.0	46.0	28.0	69.0	39.0	66.0	38.0	55.0	43.5	73.0	57.5	97.5	60.0
2	97.0	66.0	106.0	72.0	102.0	62.0	87.0	56.5	80.0	45.0	59.0	50.0	45.0	36.0	60.0	45.0	60.0	43.0	63.0	49.0	76.0	54.0	94.5	62.5
3	96.0	67.0	101.0	70.0	103.0	64.0	88.5	56.0	78.0	45.0	61.0	43.0	45.0	37.0	63.0	40.0	55.0	39.0	64.0	46.0	71.5	53.0	86.0	58.0
4	80.0	57.0	100.5	65.0	102.0	64.0	88.0	56.0	72.0	47.0	55.0	43.0	46.0	36.0	69.0	40.0	61.0	31.5	63.0	45.0	68.5	53.5	80.0	54.0
5	90.0	57.0	103.0	64.0	93.0	63.0	•79.0	57.0	64.0	50.0	56.0	50.0	47.0	40.0	67.0	38.0	54.5	31.0	67.0	41.0	66.0	45.0	92.5	57.5
6	92.0	63.0	106.0	69.0	89.0	62.0	62.0	53.0	61.0	44.0	58.0	40.0	46.0	39.0	62.0	32.5	64.0	31.0	72.5	46.5	73.0	41.0	92.0	63.0
7	87.0	61.0	106.0	72.0	91.0	63.0	66.0	47.0	59.0	44.0	54.0	39.0	49.0	37.0	61.0	33.0	68.0	36.5	79.0	46.0	74.5	53.0	85.0	64.0
8	86.0	58.0	106.0	75.0	94.0	63.0	69.0	47.0	55.0	46.0	50.0	35.5	50.0	39.0	64.0	35.0	60.0	43.0	79.0	51.0	67.0	49.0	79.0	55.0
9	90.0	66.0	108.0	75.0	83.0	62.0	78.0	50.0	56.0	44.0	47.0	36.0	52.0	41.0	61.0	37.0	67.0	44.0	68.0	53.0	73.5	46.0	74.5	52.0
10	97.0	67.0	108.0	73.0	86.0	61.0	71.0	50.0	64.0	41.0	50.0	36.0	48.0	35.0	57.0	43.0	75.5	48.0	66.0	45.0	66.0	51.5	78.5	56.0
11	88.0	67.0	106.0	74.0	97.0	66.0	63.0	48.0	58.0	48.0	50.0	36.0	47.0	28.0	50.0	35.0	74.0	45.0	69.0	47.5	56.0	48.5	83.0	60.5
12	86.0	66.0	103.0	66.0	99.0	62.0	58.0	49.0	55.0	43.5	64.0	35.0	52.0	30.0	59.5	30.0	55.0	33.0	63.0	45.0	60.0	43.0	90.0	64.0
13	89.0	67.0	103.0	68.0	97.0	64.0	68.0	47.0	52.0	44.0	69.0	45.0	53.0	33.0	58.0	32.5	51.0	32.5	60.0	39.0	67.0	40.0	87.5	60.0
14	92.0	62.0	105.0	67.0	103.0	65.0	69.0	45.0	56.0	47.0	70.0	45.0	65.0	37.0	61.0	31.0	54.0	34.0	56.0	43.0	69.0	44.0	83.0	58.0
15	93.0	62.0	108.0	72.0	105.0	66.0	68.0	53.0	60.0	47.0	61.0	37.0	69.0	42.0	55.0	36.5	61.0	28.5	57.0	43.0	74.0	46.0	92.0	60.0
16	100.0	66.0	108.0	77.0	103.0	68.0	77.0	48.0	59.0	42.0	61.0	37.0	71.0	40.0	51.0	28.5	58.5	28.0	57.0	39.0	72.0	51.0	93.5	58.5
17	101.0	72.0	103.0	72.0	100.0	65.0	80.0	47.0	67.0	44.0	53.0	37.0	71.5	39.0	51.0	27.0	60.0	41.0	59.0	38.5	75.0	51.0	92.0	60.5
18	96.0	69.0	100.0	70.0	100.0	65.0	85.0	48.0	64.0	37.0	50.0	40.0	68.0	36.0	50.0	36.0	67.0	35.0	60.5	36.0	82.0	53.0	78.0	59.5
19	89.0	65.0	91.0	66.0	103.0	66.0	85.0	52.0	70.0	37.0	54.0	46.0	58.0	37.0	49.0	33.5	67.0	37.0	52.0	42.5	88.0	58.0	77.0	47.0
20	91.0	62.0	91.0	64.5	89.0	62.0	85.0	54.0	68.0	37.0	54.0	42.0	59.0	36.5	50.0	32.0	72.0	39.0	56.5	45.0	88.0	60.0	86.5	56.5
21	93.0	65.0	84.0	60.0	87.0	59.5	86.0	55.0	67.0	37.0	48.0	38.0	69.0	36.0	57.0	37.0	77.0	43.0	60.5	46.0	85.0	55.0	95.5	58.5
22	98.5	63.5	84.0	61.0	82.0	58.0	79.0	54.0	67.0	36.0	48.0	36.0	63.0	42.0	53.0	42.0	78.0	41.0	59.0	44.0	77.0	62.0	95.0	60.0
23	102.0	66.0	93.0	63.0	82.0	54.0	77.0	51.0	66.0	37.0	40.0	25.0	63.0	38.0	47.5	41.0	73.0	40.0	64.0	39.0	76.5	51.0	91.0	61.0
24	105.0	67.0	97.0	69.0	83.0	54.0	76.0	51.0	65.0	36.5	42.0	26.0	58.0	37.0	54.0	42.0	60.0	44.0	75.5	43.0	75.0	49.0	92.0	60.0
25	105.0	70.0	98.0	64.0	80.0	56.0	82.0	59.0	65.0	39.0	46.0	27.5	57.0	39.5	62.0	38.0	59.0	39.0	73.0	45.0	76.5	55.0	92.0	60.5
26	109.0	73.0	88.0	64.0	81.0	61.0	88.0	69.0	55.0	43.0	46.0	27.0	51.0	31.0	63.0	38.0	57.0	38.0	77.0	48.0	86.5	63.0	95.5	62.5
27	110.0	74.0	77.0	61.0	82.0	57.0	87.0	57.0	56.0	35.0	50.0	36.0	45.0	33.0	56.0	40.0	54.0	44.0	80.5	48.5	92.5	58.0	98.5	65.0
28	105.0	75.0	81.0	54.0	83.0	59.0	84.0	55.0	52.0	34.0	49.0	33.0	45.0	29.0	65.5	39.0	58.0	38.0	85.0	51.0	91.5	65.0	95.0	66.5
29	105.0	70.0	92.0	60.0	81.0	59.0	86.0	50.0	50.0	41.0	50.0	28.0	57.0	26.5	67.0	39.0	58.0	38.0	88.5	52.0	84.5	65.0	95.5	63.0
30	105.0	73.0	100.0	70.0	74.0	53.0	80.0	48.5	51.0	42.0	48.0	26.0	54.0	31.0	......	......	61.0	33.0	83.5	54.0	81.0	57.0	99.0	63.5
31	103.5	76.0	102.0	64.0	......	......	69.0	47.0	......	......	47.0	30.0	62.5	36.0	......	......	54.0	45.0	......	......	88.0	62.0	......	......
Range	53°.0		54°.0		52°.0		43°.5		46°.0		45°.0		45°.0		42°.0		50°.0		52°.5		52°.5		52°.0	
Monthly mean	82°.6		83°.8		77°.2		63°.1		50°.8		44°.6		44°.8		46°.6		50°.3		56°.4		65°.2		76°.0	

Elevation of thermometers above ground, 21 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, RIO GRANDE CITY, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	105	(*)	100	75	97	72	87	70	64	52	77	53	82	69	50	45	65	53	89	72	86	71	100	79
2	98	84	100	76	98	69	86	69	72	59	83	62	84	68	64	39	84	62	96	70	86	68	100	79
3	99	78	95	76	99	70	88	70	77	61	81	61	83	66	62	38	93	66	99	70	92	73	100	75
4	98	78	95	76	95	71	90	72	79	62	85	66	78	64	57	48	95	68	95	69	90	64	100	76
5	100	78	101	77	93	68	88	72	84	67	75	54	84	69	56	46	95	69	97	73	93	72	100	77
6	100	75	102	78	92	68	88	69	85	60	82	46	84	69	57	43	90	71	99	70	92	70	102	79
7	101	78	103	79	93	66	88	71	86	68	84	62	84	69	50	40	87	71	97	70	93	72	98	79
8	99	78	102	78	93	70	89	71	89	67	85	68	84	62	53	46	78	58	73	48	94	74	102	79
9	100	75	93	73	85	73	90	72	88	70	85	71	84	63	57	50	66	61	72	52	94	74	(*)	......
10	101	75	77	70	86	75	89	75	88	75	73	59	86	67	68	54	80	62	79	51	95	76	......	......
11	103	77	74	69	92	76	91	72	89	74	60	54	86	64	86	63	96	69	84	54	97	72	......	......
12	103	75	79	70	91	77	85	71	88	70	62	39	75	61	91	65	85	65	84	53	95	72	......	......
13	102	75	86	73	79	73	88	69	87	74	51	47	63	52	(*)	(*)	68	53	88	64	94	71	91	71
14	100	75	90	74	87	71	88	69	89	73	55	42	67	54	(*)	(*)	58	41	92	69	94	70	95	76
15	102	78	96	75	88	64	88	70	89	69	68	37	75	65	72	32	48	39	96	73	94	71	96	75
16	102	76	88	70	88	64	89	70	88	74	76	44	80	63	80	51	63	33	102	71	88	72	93	74
17	103	75	90	72	86	61	83	66	85	66	80	54	82	62	81	59	69	40	94	72	87	72	94	73
18	103	77	90	72	89	67	80	53	67	46	71	64	81	61	77	55	82	60	100	76	93	70	96	72
19	101	77	92	71	88	69	79	52	66	32	81	62	84	65	60	51	82	64	88	72	95	75	96	71
20	101	79	89	74	91	68	79	54	71	33	82	59	85	62	69	55	78	63	81	64	96	70	96	73
21	102	77	93	75	91	68	81	46	71	39	86	67	87	63	77	62	66	60	87	69	94	68	95	74
22	102	78	94	73	93	61	83	54	75	40	85	64	68	57	87	64	64	60	99	73	95	69	97	72
23	105	75	99	75	90	63	82	52	80	53	87	66	63	52	87	65	68	61	104	74	95	70	103	71
24	102	79	97	75	81	69	78	53	80	59	82	37	62	49	91	67	82	66	105	75	96	74	105	74
25	101	79	97	74	82	71	74	43	83	60	38	28	68	46	80	65	89	68	95	76	100	77	103	77
26	101	78	95	78	79	73	77	48	84	61	51	27	78	38	85	55	97	71	90	76	99	69	103	77
27	102	78	93	76	82	72	75	63	86	65	70	31	80	49	86	72	82	66	88	75	100	78	101	78
28	102	77	92	70	85	74	77	53	80	62	86	53	83	60	89	69	83	55	93	74	99	80	99	78
29	102	78	92	68	88	71	81	48	65	47	86	61	85	66	76	46	85	58	96	76	98	79	99	78
30	102	76	89	74	87	72	84	59	73	43	84	65	81	59	......	......	83	71	79	73	100	79	95	74
31	100	76	94	71	......	......	70	54	......	......	83	67	59	48	......	......	86	70	......	......	99	78	......	......
Range	......	......	35°		38°		48°		57°		60°		48°		......	......	64°		57°		36°		......	......

Elevation of thermometers above ground, 5 feet.

* Observer absent on repair duty.

Maximum, minimum and mean temperatures—Continued.

STATION, ROCHESTER, N. Y.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	80	51	90	64	90	65	81	60	37	22	47	18	37	30	28	8	31	27	53	31	47	28	67	50
2	86	58	90	67	78	65	84	60	40	29	50	37	43	32	15	7	37	25	56	32	67	45	62	45
3	88	68	82	69	75	64	75	59	33	25	44	34	48	21	23	10	54	30	65	52	77	54	64	45
4	81	66	77	61	73	59	71	47	27	20	38	32	53	34	27	12	54	40	65	47	74	53	66	45
5	73	56	85	63	68	44	76	50	33	16	56	31	38	30	30	13	57	35	51	25	79	55	77	59
6	82	53	82	61	75	47	76	58	39	25	55	44	46	28	25	18	35	30	35	30	66	50	85	62
7	80	67	82	59	71	54	87	60	53	27	52	39	43	34	32	16	41	30	32	22	54	45	66	56
8	82	65	70	58	63	53	78	61	67	46	40	33	46	40	38	7	35	11	36	22	84	47	72	50
9	84	58	66	55	57	49	77	61	71	50	45	29	53	40	40	5	37	10	52	28	87	63	74	54
10	83	64	71	48	59	44	76	64	53	40	58	43	48	31	36	— 1	32	18	60	40	83	63	82	61
11	78	63	77	57	63	37	78	61	69	35	58	28	54	29	41	20	27	12	40	22	69	54	86	66
12	80	60	83	53	74	44	80	61	68	45	28	23	54	28	57	40	27	19	36	20	67	48	85	63
13	86	58	84	64	69	55	68	49	53	41	34	23	31	22	40	32	29	15	62	32	56	39	80	60
14	89	64	73	60	60	51	65	40	63	45	33	26	40	25	32	26	38	27	58	37	53	38	65	52
15	91	65	63	53	65	45	77	48	61	48	38	28	37	27	35	22	42	22	67	44	66	35	69	54
16	81	67	58	49	71	54	76	54	49	41	28	20	47	25	43	25	33	28	47	36	75	50	78	51
17	70	57	59	52	62	49	81	60	46	34	30	19	52	40	55	30	30	25	48	35	80	58	75	53
18	75	56	68	52	62	48	71	56	38	29	22	15	46	36	57	32	38	18	52	33	66	56	82	53
19	72	51	76	52	61	40	56	42	36	22	27	17	54	36	32	10	41	28	68	48	87	56	82	55
20	82	55	82	58	61	46	63	35	35	14	32	16	38	21	27	14	42	25	56	38	83	63	82	57
21	87	65	85	61	60	37	65	41	22	9	16	— 4	30	20	37	25	36	20	69	43	72	62	77	64
22	87	65	90	62	70	44	67	49	30	12	39	4	42	18	41	24	47	34	71	41	71	59	74	60
23	79	65	80	64	73	57	61	40	37	25	31	16	39	31	35	22	47	30	43	31	79	53	86	60
24	70	61	72	57	60	47	40	31	34	22	45	25	33	29	39	16	30	12	45	36	86	61	89	65
25	70	55	67	50	55	35	43	19	42	32	30	9	45	29	53	39	27	12	53	37	87	62	83	68
26	79	63	69	55	62	34	57	24	40	32	16	5	48	33	55	40	41	21	62	46	88	64	84	67
27	80	64	71	50	70	42	61	40	55	31	30	8	47	38	57	38	43	30	49	38	87	67	86	63
28	83	61	78	51	69	52	53	46	60	48	38	28	48	29	60	39	34	27	62	36	68	56	83	67
29	81	63	80	60	78	61	61	41	48	23	48	35	29	15	57	30	39	26	59	47	69	47	75	63
30	80	63	75	62	80	58	50	39	28	18	37	11	50	16	......	......	46	31	52	33	76	55	73	61
31	86	60	87	57	......	......	41	31	......	......	36	7	47	28	......	......	52	33	......	......	76	56	......	......
Range	40°		42°		56°		68°		62°		62°		39°		61°		47°		51°		60°		44°	
Monthly mean	72°.0		68°.7		59°.6		57°.9		38°.6		30°.8		36°.4		30°.5		31°.2		45°.5		64°.7		68°.5	

Elevation of thermometers above ground, 100 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, ROCKLIFFE, CANADA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	85.2	38.2	90.7	54.0	80.3	58.0	77.0	57.0	27.4	10.7	38.3	13.1	29.9	-6.6	20.3	-25.8	19.4	-3.0	47.8	11.1	47.3	24.6	59.8	42.7
2	88.1	47.5	85.3	62.2	74.7	50.9	77.7	52.9	28.9	8.2	25.0	10.5	39.8	3.9	7.9	-30.8	28.9	-9.0	47.2	21.5	68.8	28.0	67.4	33.2
3	81.1	57.2	78.3	51.4	70.2	54.0	69.0	49.0	25.9	16.6	15.9	10.1	10.9	-14.6	12.9	0.4	46.3	12.1	47.8	34.0	81.7	43.4	57.8	41.0
4	78.7	49.3	77.5	50.9	68.3	48.1	71.7	35.0	23.6	16.6	25.3	13.1	41.3	8.2	18.4	9.2	46.2	27.0	47.8	35.2	66.8	36.2	62.8	34.4
5	74.3	43.1	80.7	48.5	64.7	46.1	75.7	41.9	32.8	19.7	21.9	3.5	21.3	-0.6	26.9	7.2	29.9	7.2	47.4	22.4	82.7	36.2	69.0	48.9
6	77.7	47.9	71.7	48.6	69.6	45.6	65.8	48.2	33.8	18.1	37.0	20.1	22.9	9.4	15.5	-8.8	29.4	-7.0	33.9	16.0	55.0	34.0	74.2	55.2
7	82.7	60.0	66.6	48.6	69.7	43.9	80.7	51.8	39.8	22.6	40.8	20.1	27.9	-3.0	14.7	-2.8	43.7	-10.6	30.4	7.8	54.8	28.5	63.3	48.1
8	80.7	58.6	62.6	50.1	58.0	46.1	76.7	55.7	51.8	37.2	27.1	9.0	33.4	3.0	37.4	-4.8	6.9	-19.4	38.3	7.0	71.8	44.1	65.8	38.2
9	85.1	52.8	65.4	47.0	54.8	44.9	70.7	56.2	61.8	45.0	23.9	1.2	38.8	24.1	10.1	-15.6	12.5	-24.4	46.2	24.4	84.7	48.6	74.7	42.2
10	86.1	57.2	73.7	41.0	61.8	38.2	77.5	58.2	42.3	38.5	39.0	3.2	41.8	-0.6	5.5	-19.4	13.9	-19.9	39.2	24.5	73.7	48.2	78.3	46.6
11	73.7	57.2	75.5	46.2	66.7	37.0	66.7	58.0	38.5	29.0	39.4	14.7	30.1	-0.6	25.9	-15.1	9.9	-23.6	30.3	12.6	68.8	44.7	86.2	54.4
12	85.7	54.4	78.5	46.2	72.1	40.8	71.5	54.0	40.8	32.4	17.9	-3.6	34.8	1.2	47.8	20.1	15.4	-9.6	36.3	7.2	53.3	38.8	66.0	52.2
13	88.7	55.5	73.7	59.0	66.2	50.0	61.3	36.2	39.0	34.2	25.9	-0.8	15.9	0.6	29.9	11.1	18.9	-22.4	54.8	26.6	53.6	36.2	61.6	48.8
14	82.3	62.2	65.1	42.0	57.1	40.2	67.5	37.5	52.6	34.4	24.4	10.2	34.3	4.6	24.9	0.7	27.9	8.2	33.1	23.5	59.8	31.6	70.8	41.6
15	90.2	59.7	64.9	38.0	62.8	31.0	78.2	50.1	52.6	36.5	24.5	3.2	31.4	9.8	22.9	2.2	29.9	-9.2	50.1	28.0	72.2	30.0	78.7	46.9
16	79.2	59.2	61.8	36.0	63.8	43.1	78.2	61.0	44.8	31.6	11.9	-2.8	27.1	9.2	30.9	zero.	23.3	-14.1	38.8	22.3	83.7	49.2	79.2	45.3
17	72.7	54.8	75.5	38.2	60.3	40.9	68.7	57.2	34.0	23.0	13.9	-18.6	35.8	25.0	42.1	22.0	30.9	-6.6	39.8	31.0	68.7	54.8	83.2	42.5
18	71.7	48.1	78.7	53.6	57.8	37.2	70.7	42.2	27.9	12.7	9.3	-18.6	36.8	32.0	45.4	15.1	31.9	-9.1	46.8	27.0	60.8	47.1	86.7	44.1
19	73.2	43.2	79.5	51.0	57.3	37.2	45.3	33.6	35.0	11.6	7.5	-10.0	37.8	18.5	17.1	1.6	35.8	13.7	67.7	33.0	82.7	45.7	86.7	49.1
20	75.7	45.1	80.9	49.1	58.8	37.6	55.0	33.4	35.0	4.2	4.4	-19.4	20.9	2.2	21.4	-8.6	37.4	13.1	50.0	38.5	73.2	44.6	82.7	55.0
21	85.7	55.2	81.0	59.6	59.0	37.2	69.2	33.5	10.1	-1.3	12.9	-33.4	13.9	-1.6	31.9	6.2	24.9	-7.1	65.4	28.6	69.6	48.1	74.8	49.1
22	71.2	57.2	78.7	61.2	69.5	36.8	64.2	33.0	27.9	-1.3	2.3	-9.1	20.9	3.2	26.9	-6.2	39.8	15.1	47.8	27.5	63.8	48.1	80.7	49.1
23	74.7	58.6	70.5	57.2	61.8	45.2	53.5	29.4	31.9	17.7	13.9	-18.2	29.9	12.1	24.9	-5.6	32.9	9.2	44.8	18.1	74.1	45.7	72.7	56.2
24	72.1	46.2	61.4	54.1	48.8	30.0	30.5	16.1	29.9	1.2	17.9	1.6	21.4	1.2	17.1	-18.1	15.2	-7.8	51.8	25.4	82.7	42.7	87.5	55.5
25	74.7	41.0	69.1	51.1	55.3	28.6	43.4	11.1	35.9	20.2	1.9	-28.8	31.3	10.5	35.4	14.7	26.3	-18.6	51.8	22.0	83.7	49.3	74.7	55.2
26	75.3	61.2	72.7	49.6	66.7	31.5	56.4	23.0	25.9	8.7	6.4	-28.9	37.8	9.8	42.4	31.5	33.8	-12.1	58.4	35.2	88.7	45.1	79.7	57.2
27	79.1	57.2	74.3	52.1	64.7	34.5	60.2	37.6	33.4	20.2	9.2	-21.4	39.2	12.1	35.8	20.7	41.8	5.0	45.8	26.1	84.3	51.6	89.2	51.7
28	82.7	52.7	68.4	51.4	61.8	54.1	48.8	30.8	40.5	30.0	23.9	7.2	27.5	1.2	32.3	20.2	37.4	18.6	55.3	24.0	63.3	44.2	77.7	61.2
29	77.7	54.6	77.1	54.5	77.5	55.8	47.8	41.5	32.0	9.1	33.9	0.2	3.9	-17.6	38.4	2.2	43.8	19.1	60.8	32.0	67.8	33.0	76.7	59.5
30	82.1	50.1	74.7	48.0	78.7	54.2	41.5	30.9	15.0	1.2	2.9	-32.4	44.8	-4.8	......	......	48.1	18.6	47.8	27.0	57.0	50.1	75.7	49.1
31	88.7	48.0	87.7	56.2	......	......	33.3	22.0	......	......	-4.3	-37.8	37.0	16.6	......	......	51.8	13.1	......	......	73.7	51.1	......	......
Range	52°.0		54°.7		51°.7		69°.6		63°.1		78°.6		62°.4		78°.6		72°.5		60°.7		64°.1		56°.0	

Maximum, minimum and mean temperatures—Continued.

STATION, ROSEBURG, OREG.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	75	44	82	48	71	50	66	53	50	39	56	47	50	43	35	31	53. 5	35	55. 5	41. 5	68	48	76. 5	43
2	76	49	82	48	76	43. 5	72	45	51	41	56	48. 5	51	43	36. 5	30	44	33. 5	51. 5	40. 5	67. 5	50	68	54
3	68	56. 5	83	47	85	47	64. 5	47	59	40. 5	49	39	48	41	37	30	39. 5	32	45	33	61	40. 5	62	46. 5
4	63	48	83	50	88. 5	49	72	43	58	45	53	40	51	41	36	29	43	28	47	35	57. 5	46	64	45. 5
5	70	49	83. 5	51	88	54	57	46	60	52	51	45	47	39. 5	37	30	52	38	56. 5	29. 5	53	37. 5	73. 5	43
6	72	51	86	51	77	55	51	43	53	41	47	36	55	42	44	29	52. 5	39	66	32. 5	61	33	72	47
7	79	49	86	53. 5	80	51. 5	56	41	46	35	39	32	56	35	44	32	51	33	73	35	55	44	65	53
8	79	52. 5	85	55	71	54	58	42	48	38. 5	41. 5	34	43	35	49	32	46	32	78. 5	35	52	43. 5	58. 5	48. 5
9	73	56	92	54. 5	63	48	57	48	48. 5	41	43	36	47	35	41. 5	29	50	26. 5	67. 5	34. 5	52. 5	40	61	46
10	74	58	85	60	66	39	55	46. 5	50. 5	33. 5	47	41	37	29	37. 5	28. 5	55	28. 5	61	43	48. 5	41	58	46
11	67	54	86. 5	52	74	39. 5	56. 5	44. 5	50	41	56	46	39. 5	27. 5	44	25	47. 5	38	55	42	55	39	65. 5	48
12	70	40	86. 5	56	85. 5	45	55. 5	43. 5	47	38	50	42	48	34	44	30	43. 5	22	54	40	59	38	75	45
13	78	42. 5	86	55	87	49	56	43. 5	51	35. 5	54	45	52	39	49	35	46	20	47. 5	33	55	39	65	40
14	77	45	90	56	84	48	59. 5	41. 5	52	45	54	44	56	42	51	42	48. 5	19	54	35	61. 5	39. 5	64. 5	44. 5
15	75. 5	53. 5	91	56	85	49	58	48. 5	49	41	49	43	50. 5	34	48	33	53	22	46	41	68. 5	37	76	37. 5
16	79	49	86	54	85	53	64	35	48. 5	34	48. 5	38. 5	53. 5	34	38	29	40. 5	26	51	33	69	40	71	45
17	76	45	85. 5	57	89	54	69. 5	38	50	29	43	34	53. 5	35	38. 5	20	49	35. 5	47. 5	36	67	47. 5	67. 5	52
18	75	52	87	51. 5	89	56	70	38	51	26. 5	40. 5	37	49	37	41. 5	33	51	38	56	32. 5	63	49	60	46
19	69	55	76. 5	53	90	54. 5	71	41	51	28	38	28. 5	53	35. 5	39. 5	30. 5	54	33	47	41	77	54	61	46
20	73	55	78	57	77	52	67	44	45	29	37	25	54. 5	43	45	32	59. 5	28. 5	54	35	67. 5	52	69	38
21	70	55	67	55	73	52. 5	57	46	39. 5	30	39. 5	32. 5	50	42. 5	42	31	62. 5	30	54	39	65	38. 5	74	42
22	79. 5	58	73. 5	54	63	53	65	41. 5	40	31. 5	34	21	52. 5	46	42. 5	36	62	30	57	38. 5	63	48	78. 5	47
23	85	53	69	55	67. 5	59	67	40. 5	40	32	26	9. 5	52	39	43. 5	38	61	33	57	40	56	42. 5	88. 5	51
24	92	58	72. 5	47	70	57. 5	64	49	40	32	24	7	54	40	48	39	50. 5	33	61. 5	36	59	35	86. 5	55
25	92	59	81. 5	45	69	54	65. 5	41. 5	42. 5	35	32	15	41. 5	31. 5	49. 5	39. 5	47	34. 5	62. 5	45. 5	64	36	83	51
26	96	62	70	48	72. 5	48. 5	60. 5	39	44	31	36	22	40. 5	25	46	37	52	39	67	40	77	39	84	47. 5
27	94	62	63	55	70	57	57. 5	43	42	26	45	30	39	28	42	30	49. 5	33. 5	73	39	81. 5	44. 5	91	51
28	91	59	66	52	64. 5	55	57. 5	43	44	24	43	32	34	25. 5	46. 5	25	43	32	81	43	73	46	86	58
29	86	54	76	54	62. 5	40. 5	52	47	59	39	42	31. 5	40	26. 5	51. 5	39	43	27	84. 5	43. 5	62	41	81	51
30	84	52	82	51	60	39. 5	57. 5	43. 5	56	48	38	26	38. 5	27. 5	......	......	45. 5	31. 5	78	44	69	36	70	53
31	76. 5	50. 5	84	52. 5	......	......	54	35. 5	......	......	53	35	35	26. 5	......	......	53	34	......	......	77	41. 5	......	......
Range	56°. 0		47°. 0		51°. 0		37°. 0		36°. 0		49°. 0		31°. 0		31°. 5		43°. 5		55°. 0		48°. 5		53°. 5	
Monthly mean	66°. 5		67°. 9		62°. 8		51°. 0		42°. 2		39°. 1		41°. 4		37°. 2		40°. 3		49°. 2		53°. 7		60°. 6	

Elevation of thermometers above ground, 20 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, SACRAMENTO, CAL.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	84	54	103	73	90	56	80	54	67	45	63	46	42	28	54	32	65	40	57	48	68	53	88	62
2	87	64	101	70	94	57	84	52	69	46	61	48	46	29	61	33	56	45	61	51	69	53	86	62
3	87	54	92	61	93	60	87	53	68	48	57	45	46	37	60	34	51	40	58	48	65	51	78	53
4	82	54	88	57	89	56	86	57	68	46	57	42	46	40	58	33	53	33	62	44	68	49	76	56
5	86	58	90	54	82	54	75	53	70	46	55	48	46	39	58	35	55	33	62	49	61	48	84	62
6	82	56	97	59	84	54	62	46	65	50	55	40	43	37	58	36	61	35	65	52	65	49	84	58
7	74	52	98	65	82	55	61	47	61	46	55	39	52	35	56	35	64	38	67	46	71	50	83	62
8	78	51	100	64	86	60	68	43	58	45	52	39	53	38	58	36	58	42	72	53	74	48	78	53
9	87	53	97	65	84	60	70	47	55	45	48	33	49	42	53	40	65	42	67	53	71	49	76	60
10	92	62	98	61	84	60	70	47	59	40	49	40	49	38	56	39	67	41	64	46	64	53	75	61
11	82	56	92	65	91	60	65	46	59	45	49	38	45	32	50	35	70	42	67	47	58	43	82	53
12	81	60	92	58	94	61	65	51	51	42	59	38	47	31	52	32	54	38	63	49	55	39	85	63
13	84	58	93	57	94	64	65	40	55	41	57	38	51	35	55	32	54	34	60	44	59	45	74	55
14	85	56	99	59	91	57	65	44	62	46	58	40	52	33	58	32	56	34	55	45	63	42	78	51
15	86	53	99	62	94	59	69	49	61	44	54	35	55	37	56	37	55	29	51	45	67	46	83	55
16	93	60	97	66	96	63	69	46	60	42	50	37	56	36	49	35	60	34	55	42	65	50	82	56
17	95	63	89	60	94	61	75	47	61	36	45	37	56	39	49	30	52	41	57	40	65	45	83	56
18	81	59	84	56	92	58	78	47	63	36	52	40	57	37	49	38	60	35	57	40	73	48	75	53
19	79	54	78	55	83	58	82	49	62	36	54	45	60	38	52	40	64	38	53	43	78	54	74	53
20	84	56	83	55	82	57	77	50	63	36	54	40	56	37	45	36	65	39	53	47	82	56	83	58
21	85	56	84	56	80	55	76	52	63	35	51	34	58	36	51	39	72	42	58	50	80	58	84	54
22	90	56	80	61	77	54	79	51	63	36	48	37	59	39	52	40	72	43	56	44	81	56	79	53
23	96	64	87	59	75	52	71	47	62	34	41	30	59	39	50	41	63	45	60	43	75	58	76	53
24	95	61	92	62	74	52	73	50	62	35	40	25	61	39	53	43	53	42	65	49	71	58	76	52
25	92	58	88	65	75	54	78	49	59	38	41	26	52	43	56	39	56	39	65	47	73	59	76	54
26	90	58	83	56	78	58	84	52	55	38	42	25	44	34	58	40	58	37	67	46	81	60	78	54
27	92	59	78	54	80	55	82	53	55	33	43	27	43	30	56	39	60	42	75	52	85	61	82	54
28	95	61	78	55	84	57	79	51	56	34	42	33	47	29	60	35	57	45	77	53	86	61	79	53
29	94	61	88	56	78	59	79	51	51	43	45	31	43	25	64	39	58	39	78	56	82	65	78	52
30	98	64	95	62	79	53	73	48	54	43	42	29	47	29	......	......	57	36	71	53	78	62	82	54
31	100	66	95	63	......	......	67	43	......	......	44	27	51	31	......	......	53	44	......	......	83	62	......	......
Range	49°		49°		44°		47°		37°		38°		36°		32°		43°		38°		47°		37°	
Monthly mean	72°.8		74°.9		70°.4		61°.0		50°.8		43°.7		43°.3		46°.1		49°.2		55°.4		63°.4		68°.8	

Elevation of thermometers above ground, 38 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, SALT LAKE CITY, UTAH.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	77	58	88	65	87	55	66	54.5	57	33	48	38	23	2	23	4	46.5	33	46	40	70.5	47	72	41
2	78	58	94	64	85.5	58	69	43	59	36	49	37	37	12	25	9	49	37.5	57	34	74	51	85	49
3	86	55	92	70	82	55	78	43	59	34	44.5	34.5	41	24	27	8	48	37.5	56	37	72	47	81	60.5
4	91	60	89	72	82.5	53	81	52	57	36	39	31	34	19	30	14	38	19	47.5	36.5	73	56	73	45
5	85	66	85	66	83	55	82	58	67	39	48	34	43	27	28	12	36	17	50	38	72	30	66	40
6	87	58	87	65	90	55	69	58	59	44	46	34.5	43	32	37.5	22	42	22	55	37	50	34	74	50
7	90	61	89.5	63	90	64.5	66	41	44	31	35	28	45.5	29	33	14	41	22	57	44	59	34	77	54
8	93.5	65	92	68	89	63	51	39	37.5	25.5	40	25	45	28.5	32	14	40	28	60	42	52	37.5	68	55
9	92	65.5	93	68	91	68	49	35	45	29	29	17	43	28	35	14	38	24	67	38	49	34	59	45
10	85	63	95	65	76	55.5	53	43	46	36	29	14.5	41	21	37	18	41	22	72	44	67	43	59	47
11	91	61	92	63	68	47	62	40	52	32	27	9	24	8	37	26	51.5	27	75	48	80.5	54	64	41
12	84	65	88	73	73	47	77	54	49	31.5	38	24	24	2	29	16	30	12	74.5	53	74	49.5	71	48
13	88	64	88	62	81.5	52	75	59	42	25	42	28	37	15	31	15	20	5	63	30	51	43	76	52
14	87	59	90.5	63	82	50	61	49.5	42	33	46.5	37	40	23	32	15	23	6.5	46.5	27	46	32	86	51
15	94	62	92	65	80.5	55	55	39	47	33	47	33	39	26	41	25	28	7	52	34	61	35	75	51
16	95	68	94	66	82	58	50	39	40	27.5	51	38	40	28	38	19	38.5	10	53	31	67	45	87	52
17	95	66	90.5	68	82	55	55	34	35	15	45	33	41	26	27	6	48	26	41	30	63	50	91	60
18	90.5	74	89	66	80	56	60	37	36	18	49	39	45	28	31	7	40	28	41	29	68	43	93	61
19	93	68	90	66	83	56	61	37	38.5	20	52.5	44	45	26	45	24	42	29	50	29	68	45	78	63.5
20	93	65	89	65	85	57	68	37	39	20	51	44	45	29	45.5	30	42.5	27	60	42	76	49.5	72	49
21	95	64	91	62	86	66	64	39	40	22	44	24	42	32	43.5	26	45	24	63	51	67	56	78	53
22	95	64	79	66	81	59	61	41	34	23	35	23	40	27	45.5	33	49	26	57	31	78	46	84	54
23	91	70	79	57	85	59	64	40	30.5	23	24	3.5	37	27	40	32	59	31	45	29	68	48	86	54.5
24	89	65	81.5	59	86	59	66	41.5	32	22	6	— 8	37	19	40	29	62	36	44	33	54	36	89.5	56
25	88	60.5	90.5	57	82	60	54.5	40	32.5	23	13.5	—10	44	26	41	30	62	29.5	51	31	51	37	90	60.5
26	87	67	92	69	79	52	54	33	34	25	20	9	30	15	41	28	39	26	59	34	60	40.5	88	60
27	89	62	91	68	78	53	56	36	33	26	24	6	25	8	29	8	51	28	55	40.5	66	42	85	64
28	92	60	78	60.5	77	49.5	62.5	36	40	23	37	20	25	15	25	3	62	40	60	40	72	45	86	60
29	97	65	64	47	64	48	66	41	44	27	30	14	23	12	35	10	45	32	64	43	75	48	87	59
30	93	73	72	46	73	45	55	36	47	32	20	2	22	6	......	......	39	29	70	43	60	45	84	62
31	91	68	81	52	......	......	55	35	......	......	17	2	21	3	......	......	51	23	......	......	62	43	......	......
Range	42°.0		49°.0		46°.0		49°.0		52°.0		62°.5		43°.5		42°.5		57°.0		48°.0		48°.5		53°.0	
Monthly mean	78°.4		76°.2		68°.8		51°.8		36°.6		29°.8		28°.8		26°.9		33°.7		47°.1		55°.1		67°.5	

Elevation of thermometers above ground, 53 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, SAN ANTONIO, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	95	73	97	74	97	70	87	67	65	45	70	40	64	50	42	37	65	48	72	67	62	55	95	80
2	98	77	97	75	97	68	88	68	74	40	78	56	77	60	53	36	70	56	83	67	73	55	88	77
3	93	76	95	73	99	65	88	70	73	43	77	66	70	50	54	37	78	65	91	55	72	63	95	77
4	90	77	93	73	98	68	89	72	76	46	80	60	68	58	51	37	89	67	96	55	86	65	94	73
5	96	73	90	72	93	72	88	73	82	63	78	51	73	60	50	37	83	65	90	65	85	64	92	74
6	96	70	96	75	92	69	90	70	84	56	77	40	78	66	48	42	85	66	90	67	85	66	93	71
7	95	75	97	77	93	67	87	70	83	63	78	52	76	65	50	39	80	65	75	48	85	68	95	76
8	94	74	97	77	92	69	90	72	83	69	80	63	75	63	55	45	67	48	62	43	86	70	95	77
9	95	74	85	74	92	71	85	74	88	67	82	70	73	62	57	47	68	47	70	40	87	72	95	78
10	96	73	73	66	85	70	88	72	84	73	73	45	80	61	65	53	65	57	76	39	88	70	92	77
11	97	75	76	68	82	73	87	70	84	68	56	38	76	62	75	62	67	57	82	50	88	68	92	76
12	98	75	83	66	79	70	86	70	85	63	50	28	70	48	77	55	63	46	81	50	90	71	90	76
13	101	75	86	70	82	68	85	66	86	69	50	43	57	41	58	38	50	40	81	55	88	69	94	74
14	100	75	90	75	86	62	85	65	86	71	69	37	67	47	57	38	43	29	85	67	90	68	92	74
15	94	80	92	73	88	60	87	67	88	58	62	38	68	52	62	33	42	27	88	68	87	67	94	76
16	100	78	91	68	90	59	91	66	84	64	72	37	76	48	72	41	56	28	92	70	86	67	95	75
17	101	80	92	69	88	59	82	61	76	52	71	45	73	60	73	56	53	35	88	69	87	67	94	74
18	100	75	90	68	87	62	80	53	60	41	53	37	72	55	64	48	70	49	88	73	89	70	89	74
19	98	77	89	69	89	64	80	53	70	32	74	48	76	61	49	43	73	50	78	68	90	69	93	66
20	99	75	91	68	90	66	78	48	65	39	76	52	77	62	61	45	65	53	80	48	87	68	93	69
21	99	76	90	69	90	63	80	45	67	33	78	64	79	53	72	48	58	52	80	60	91	64	89	70
22	100	75	93	66	92	62	81	45	73	34	78	68	61	50	76	53	65	54	88	71	92	64	89	66
23	101	75	98	69	92	60	77	53	77	43	80	68	63	40	70	62	75	58	92	72	89	63	91	68
24	100	78	100	74	86	64	70	47	76	56	65	29	55	46	83	63	72	56	90	71	90	68	93	70
25	99	77	98	74	85	72	70	41	73	43	36	20	64	38	75	56	81	61	85	64	91	67	97	74
26	99	78	98	74	88	66	74	43	75	62	43	23	69	38	79	60	86	62	90	58	92	74	97	76
27	99	77	97	77	87	67	76	55	81	65	60	20	70	43	80	68	75	58	80	63	94	75	90	78
28	100	75	97	70	82	72	79	46	66	50	76	45	75	60	78	40	80	47	80	65	88	76	91	79
29	100	76	93	67	88	67	81	41	66	36	80	64	75	64	53	37	78	50	80	72	93	76	97	75
30	98	79	93	70	86	69	74	50	68	39	79	66	70	46	......	......	71	60	74	57	98	77	95	75
31	98	71	95	71	......	......	71	45	......	......	70	51	44	38	......	......	75	65	......	......	98	76	......	......
Range	30°		34°		40°		50°		56°		62°		42°		50°		62°		56°		43°		31°	
Monthly mean	87°.2		83°.1		78°.6		71°.8		66°.1		59°.2		62°.4		56°.7		61°.6		71°.9		77°.8		83°.5	

Elevation of thermometers above ground, 19 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, SAN DIEGO, CAL.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	73	59	76	64	74	62	70	59	64	49	63	51	62	40	58	36	57	43	64	45	62	50	68	54
2	73	60	75	63	75	62	67	60	63	53	62	51	62	42	61	35	61	47	58	54	63	54	68	59
3	74	57	80	64	79	61	72	60	63	55	59	51	58	48	63	37	57	49	64	52	67	55	67	59
4	73	62	78	65	73	61	70	58	62	50	61	49	58	45	59	38	57	48	63	52	65	57	68	56
5	74	60	78	63	70	61	68	61	64	47	66	46	57	45	62	40	57	43	62	54	66	57	70	52
6	71	61	76	65	74	61	67	59	63	49	63	45	60	46	62	38	60	38	60	53	65	48	71	53
7	72	61	75	63	71	59	68	54	69	55	62	52	62	42	59	38	63	42	62	47	62	49	72	58
8	72	59	78	65	71	60	66	53	64	48	60	54	61	49	62	40	61	40	72	52	74	49	71	59
9	72	59	78	66	71	59	70	50	59	53	61	49	57	44	61	44	59	43	80	54	68	56	70	61
10	72	61	81	67	73	59	67	47	61	51	60	43	60	44	58	48	64	42	71	54	67	56	71	59
11	71	60	84	64	74	58	68	46	61	46	65	43	58	41	53	46	59	47	65	53	65	56	69	58
12	72	58	79	67	90	60	67	56	61	46	66	45	64	41	56	35	61	53	63	52	62	54	69	58
13	71	58	76	65	89	64	62	54	60	49	71	48	64	44	57	37	61	49	59	53	62	54	69	53
14	73	62	76	66	92	62	62	49	64	45	69	47	65	41	63	41	57	45	63	44	65	46	69	60
15	73	60	77	66	89	64	64	48	62	47	70	47	70	46	62	42	59	39	63	53	63	46	69	57
16	75	60	74	66	78	64	71	48	63	53	59	43	73	46	56	50	59	42	66	53	64	55	69	59
17	72	59	76	66	71	63	80	48	72	49	58	50	70	46	58	47	57	43	59	49	63	49	71	55
18	74	61	76	62	71	62	85	50	79	54	58	52	64	48	56	39	59	45	58	49	65	48	71	52
19	71	59	73	64	70	62	87	56	74	48	62	50	66	48	58	40	59	39	60	42	73	50	73	58
20	72	62	73	63	70	60	90	63	73	48	62	54	65	48	59	43	66	42	61	44	72	56	71	59
21	74	59	74	62	69	62	75	57	69	47	57	49	63	48	57	45	69	46	66	47	69	57	70	60
22	75	63	74	59	70	54	64	55	68	45	57	46	69	46	59	43	66	46	62	55	69	58	69	57
23	74	63	75	63	70	57	63	52	68	45	52	47	63	45	58	45	61	49	61	51	69	57	68	57
24	75	64	74	61	71	56	65	53	60	48	52	36	71	49	59	47	58	47	66	44	67	59	67	58
25	72	64	71	61	71	57	71	48	59	47	57	32	61	42	57	44	58	41	66	44	70	59	66	60
26	72	63	71	63	71	57	92	55	59	53	62	43	57	47	58	42	60	44	62	49	70	51	68	59
27	75	64	76	61	71	54	91	64	61	47	59	53	56	46	61	52	60	41	62	49	84	54	70	60
28	75	61	75	62	72	57	92	60	65	43	58	53	57	39	58	43	59	43	63	48	84	58	68	58
29	75	64	75	54	70	59	75	56	64	43	54	48	53	33	59	45	58	45	66	56	70	60	69	58
30	75	63	74	56	72	63	65	59	61	45	55	41	56	35	......	......	61	44	63	55	70	59	71	59
31	74	63	74	60	......	......	65	56	......	......	61	37	54	32	......	......	61	42	......	......	70	59	......	......
Range	17°		30°		38°		46°		36°		39°		41°		28°		31°		38°		38°		21°	
Monthly mean	65°. 6		68°. 9		66°. 3		62°. 3		55°. 7		53°. 3		51°. 7		50°. 4		52°. 2		57°. 0		61°. 3		63°. 1	

Elevation of thermometers above ground, 19 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, SANDUSKY, OHIO.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	81	62	91	68	85	65	84	63	40	28	49	34	42	29	38	16	38	22	53	40	60	34	64	55
2	92	68	93	73	78	68	85	67	40	28	55	40	44	36	30	17	45	32	59	42	74	52	70	52
3	93	73	85	72	75	65	71	62	34	27	54	39	59	36	33	21	54	41	60	56	78	57	68	56
4	83	68	83	69	75	62	72	51	37	22	44	36	59	40	30	16	62	47	63	52	72	58	77	58
5	76	64	85	69	66	57	84	62	43	28	63	42	52	35	35	15	62	36	53	48	72	56	77	66
6	83	62	81	72	75	55	80	67	46	35	58	40	57	37	35	18	42	34	52	37	69	59	79	67
7	82	72	85	71	70	54	87	68	68	41	50	38	46	36	40	22	49	30	37	31	85	58	72	58
8	86	70	71	61	62	50	78	68	73	55	38	34	46	38	42	20	32	20	43	32	85	67	69	59
9	83	65	69	59	62	52	77	69	68	48	55	36	60	41	43	18	40	26	56	34	82	68	76	60
10	87	67	76	53	63	47	80	67	51	44	60	38	44	34	45	21	32	22	60	32	79	60	87	66
11	96	68	83	63	68	49	78	67	75	49	45	18	64	34	50	33	42	26	33	28	69	58	92	74
12	76	67	83	63	76	53	81	66	72	55	30	18	39	30	56	47	39	23	47	29	74	57	89	73
13	83	68	81	65	75	52	72	65	70	50	32	19	36	27	50	29	36	25	72	40	60	49	85	67
14	91	69	78	64	57	50	68	63	65	57	40	28	41	26	40	27	38	32	78	58	58	48	70	58
15	95	75	70	64	67	49	70	63	62	48	40	18	36	33	37	28	36	27	68	50	58	48	65	57
16	90	73	66	59	67	54	75	63	49	40	39	16	54	35	51	32	36	27	60	42	77	48	75	62
17	77	66	70	60	68	50	78	68	47	37	32	18	56	40	57	45	36	22	46	35	80	58	75	61
18	75	65	70	54	60	52	70	51	39	34	27	13	55	37	57	25	46	29	65	41	85	63	77	60
19	77	63	76	57	59	48	55	47	43	29	37	20	60	39	30	14	42	35	70	42	86	67	79	64
20	80	65	83	61	61	52	60	41	29	19	37	23	41	33	36	20	46	34	63	41	84	63	83	63
21	86	67	88	64	63	49	62	46	30	17	34	21	43	34	40	31	48	29	70	48	69	63	86	68
22	80	70	89	70	74	55	65	55	40	22	49	26	47	35	48	32	50	40	70	45	72	58	87	68
23	85	70	84	70	73	56	60	41	42	27	40	22	42	32	39	32	53	28	45	39	83	60	90	71
24	77	69	74	67	58	46	42	35	40	21	43	27	44	30	52	34	28	20	43	39	84	64	89	71
25	78	70	70	63	57	42	48	31	41	36	30	7	47	35	58	50	35	23	60	43	84	69	85	69
26	85	70	71	62	66	43	60	31	47	28	17	4	53	37	54	43	50	32	63	45	88	69	81	69
27	83	67	72	58	67	51	62	45	63	41	36	10	56	38	54	45	55	45	50	42	85	67	83	71
28	85	65	78	59	76	62	55	45	60	34	43	25	52	32	62	54	45	34	63	42	72	60	82	68
29	83	68	87	66	80	62	63	43	40	26	52	40	36	28	59	26	36	32	59	49	68	58	75	65
30	82	66	90	66	84	59	50	39	36	25	44	25	55	35	......	......	45	32	49	38	72	58	80	60
31	83	68	87	68	......	......	45	33	......	......	36	29	43	22	......	......	44	34	......	......	79	55	......	......
Range	34°		40°		43°		56°		58°		59°		42°		48°		42°		50°		54°		40°	
Monthly mean	75°.1		71°.7		61°.0		60°.4		42°.7		34°.5		40°.9		36°.3		37°.3		49°.2		67°.6		71°.6	

Elevation of thermometers above ground, 54 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, SANDY HOOK, N. J.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	78	63	84	71	87	65	84	61	46	35	45	27	40	27	38	14	41	35	58	37	53	35	85	63
2	84	62	91	74	83	69	77	64	46	35	51	35	44	32	24	10	45	30	48	40	69	48	63	50
3	92	68	92	74	72	68	83	62	43	33	56	42	42	35	38	22	53	35	65	47	78	55	68	57
4	92	69	80	66	80	68	69	60	37	30	60	43	51	39	35	24	63	50	61	47	78	55	72	56
5	72	60	82	69	75	65	77	57	38	28	46	37	46	40	30	15	67	47	64	50	60	50	72	60
6	68	59	87	75	70	62	68	61	42	32	56	42	45	38	38	25	47	40	56	41	77	53	80	63
7	73	60	77	69	74	67	66	59	47	36	56	47	44	39	42	27	42	37	43	32	60	51	86	62
8	82	63	78	70	76	63	75	60	55	39	50	43	43	35	35	20	42	32	44	30	58	50	71	58
9	81	68	74	63	70	57	81	66	70	53	45	40	41	38	32	15	32	25	53	35	78	52	67	56
10	86	67	73	59	67	57	69	64	63	53	58	44	49	40	34	13	44	27	63	41	85	65	71	58
11	85	69	79	62	67	59	64	61	54	47	61	44	50	35	41	26	32	24	50	30	77	61	76	62
12	73	66	83	66	68	60	72	61	70	49	44	32	52	35	55	38	35	25	43	27	70	59	83	71
13	79	65	81	65	69	58	73	63	66	51	36	29	35	23	62	43	32	25	60	35	63	50	88	69
14	88	65	86	67	66	60	70	56	62	51	47	35	36	21	50	36	40	29	77	50	54	47	73	65
15	92	70	74	68	66	55	76	57	71	58	47	38	43	30	36	31	42	33	67	54	63	46	68	58
16	96	70	73	64	67	59	83	63	59	49	38	29	41	31	46	32	37	33	63	47	75	51	70	60
17	81	68	78	69	73	62	71	64	56	43	46	31	41	29	53	37	41	32	56	44	80	60	78	60
18	75	64	71	64	73	56	73	64	53	38	36	24	44	35	64	46	38	26	55	41	70	53	81	62
19	73	60	75	61	66	61	69	48	41	35	35	30	56	37	46	25	40	32	55	43	55	53	83	63
20	72	64	72	65	67	57	60	44	36	23	38	34	42	37	33	19	46	32	60	45	75	54	89	65
21	76	63	78	63	62	57	68	50	26	18	37	15	41	32	37	25	42	31	58	43	81	63	87	68
22	84	65	86	67	60	56	67	57	35	21	42	16	52	34	43	30	52	32	66	44	72	58	75	68
23	84	67	86	71	73	54	70	55	50	33	39	34	52	38	43	30	55	35	51	44	75	62	80	63
24	77	68	76	71	74	55	55	37	42	29	42	34	43	38	38	24	43	20	45	40	82	64	93	70
25	69	65	71	61	55	48	42	34	49	31	43	24	43	33	46	33	34	17	48	42	92	67	91	73
26	73	65	66	61	59	49	53	38	47	36	26	14	44	35	47	42	40	24	60	45	93	68	91	73
27	85	69	67	59	61	52	55	42	49	36	28	10	55	38	58	40	45	37	57	50	93	69	84	71
28	80	72	71	60	66	55	65	48	61	43	43	23	58	40	51	43	38	32	57	44	89	67	93	74
29	85	72	81	61	67	56	61	46	60	34	45	35	40	28	60	45	36	30	60	46	71	61	90	74
30	81	72	74	67	75	57	58	47	34	27	48	28	52	25	......	......	41	34	59	43	73	61	85	72
31	81	71	78	65	......	......	50	41	......	......	38	20	53	37	......	......	48	33	......	......	77	63	......	......
Range	37°		33°		39°		50°		53°		51°		37°		54°		50°		50°		58°		43°	
Monthly mean	72°.7		71°.9		64°.4		60°.6		44°.3		38°.3		39°.9		36°.8		38°.0		49°.5		65°.0		71°.3	

Elevation of thermometers above ground, 28 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, SAN FRANCISCO, CAL.

Day of month.	1879.											
	July.		August.		September.		October.		November.		December.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	61	52. 5	79	60	62	54	72	57	62	54	62	55
2	59	52	69	60	64	53	76	57	63	54	58	53
3	65	53	65	54	63	52	65	55	62	53	58	51
4	65	51	63	54	61	53	65	56	60	53	59	51
5	68	52	63	54	61	54	63	56	64	53	61	53. 5
6	60	52	64	53	65	55	65	52	65	54	58	51
7	62	52	62	52	67	56	60	52	59	51	59	48
8	62. 5	53	64	51	70	58	63	50	57	52	60	48
9	64	53	61	50	67	57	62	52	56	51	55	45
10	62	52	65	52	77	57	62	50	57	47	56	52
11	64	52	62	53	86	60	63	50	52	52	53	49
12	67	56	64	54	76	62	59	52	54	49	58	46
13	63	54	61	53	70	57	58	49	57	49	64	50
14	63	53	63	51	62	53	59	50	60	53	62	52
15	64	52	63	50	65	53	60	54	58	50	57	47
16	68	53. 5	61	53	64	52	66	54	61	50	56	47
17	67	54	62	53	62	54	73	55	62	51	53	45
18	62. 5	54	64	52. 5	64	54	77	58	63	49	57	50
19	61. 5	53	61	54	64	54	78	58	62	49	59	51
20	64	52	64	54	66	58	76	57	63	50	52	46
21	63	53	67	54	68	57	77	57	63	49	53	43
22	67. 5	54	70	60	66	57	67	54	63	49	51	42
23	65	53	64	55	66	57	58	52	61	47	44	37
24	63	53	79	57	65	57	65	55	60	47	44	34
25	63	53	65	55	64	56	72	55	54	48	45	37
26	63	53	65	55. 5	65	57	81	62	57	47	47	37
27	64. 5	56	64	55	65	56	80	62	55	45	47	36
28	64	55	68	56	67	57	78	60	56	47	48	42
29	64	54	73	57	68	55	70	55	58	52	47	39
30	64	55	89	60	63	54	59	52	61	53	49	39
31	76	54	77	57	......	......	64	56	......	......	49	39
Range	25°		39°		34°		32°		20°		30°	
Monthly mean	58°. 0		59°. 6		60°. 5		60°. 1		54°. 6		49°. 6	

Day of month.	1880.											
	January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	48	41	55	42	52	45	57	51	60	48	82	60
2	54	42	62	41	52	45	60	52	61	53	64	53
3	52	45	59	46	52	44	61	52	61	50	63	50
4	47	41	58	43	50	39	60	48	64	53	69	50
5	48	44	58	40	53	40	62	51	58	48	74	56
6	49	41	54	43	56	43	57	50	59	46	66	50
7	59	46	54	41	55	44	60	47	59	49	62	52
8	56	46	57	44	57	45	69	50	62	49	64. 5	50
9	57	48	55	48	65	47	63	50	59	47	63	51
10	52	44	55	45	66	46	57	48	63	48	64	52
11	54	40	52	41	57	47	60	48	57	48	66	52
12	48	41	52	42	54	43	60	49	57	45	62	50
13	54	43	55	42	52	40	54	45	57	46	59	50
14	57	43	55	43	55	41	56	47	56	46	64	49
15	60	48	55	44	54	42	56	48	57	46	66. 5	52
16	60	48	50	38	53	42	57	44	59	49	61	49
17	58	47	50	38	53	43	53	42	59	48	62	49
18	56	47	52	43	53	43	52	42	62	48	60	49
19	52	43	53	42	57	43	58	45	62	52	68	50
20	54	44	51	41	57	45	58	50	63	52	64	52
21	53	44	50	42	62	45	58	52	67	51	60	50
22	58	43	49	45	57	43	58	47	64	51	60	50
23	57	45	53	44	56	43	58	46	65	50	61	52
24	53	43	55	46	54	45	62	48	69	51	60	51
25	53	44	54	46	52	43	57	46	74	57	58. 5	52
26	46	38	56	43	56	42	60	47	80	62	59	50
27	47	40	58	45	59	47	58	48	83. 5	60	59	49
28	50	37	58	43	55	46	65	47	71	55	59	49
29	48	39	58	44	51	42	58	48	69	55	60	50
30	50	39	......	......	52	42	58	48	76	56	61	50
31	52	40	......	......	59	45	......	......	83	63	......	......
Range	23°		24°		27°		27°		38°. 5		33°	
Monthly mean	47°. 8		48°. 5		48°. 8		52°. 8		57°. 5		56°. 1	

Elevation of thermometers above ground, 48 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, SANTA FÉ, N. MEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	87	47	90	58	90	58	71	49.5	57	34	52	18	43	15	30	16	50	9	59	25	55	30	73	33
2	89	50	88	59	89	52	70	47	58	29	53	22	43	16	32	11	51	11	58	26	61	29	80	40
3	90	51	90	59	85	55	71	49	58	30	49	23	50	14	21	6	50	18	59	26	70	31	85	54
4	85	54	90	59	85	58	72	43	60	35	35	24	48	14	19	—3	48	13	62	20	73	39	77	48
5	89	55	90	58	88	57	72	43	60	30	43	18	47	16	25	2	45	18	68	28	69	39	69	40
6	91	57	88	60	84	58	66	48	61	33	48	25	52	16	32	5	48	21	63	30	73	45	75	44
7	91	57	82	55	90	54	68	42	59	33	49	21	50	19	36	4	50	17	53	32	65	24	78	43
8	91	58	78	55	88	58	71	44	42	29	45	20	55	20	45	3	49	19	50	31	68	31	83	46
9	84	57	79	48	88	51	57	36	51	25	30	9	49	14	42	9	54	22	55	28	74	42	83	52
10	83	54	84	50	86	55	68	32	49	33	26	7	54	29	45	11	57	21	65	29	76	43	82	49
11	89	54	89	49	87	52	71	43	40	24	25	10	35	15	37	12	48	23	65	35	77	43	78	45
12	91	54	82	55	81	49	72	50	47	24	29	9	36	13	27	8	50	18	66	27	74	51	85	52
13	95	56	87	55	79	43	69	46	41	27	34	9	45	17	30	1	45	16	63	29	71	39	81	49
14	90	57	90	46	85	46	66	46	45	20	40	10	45	14	25	—2	35	15	65	33	70	36	79	42
15	89	64	86	49	83	49	45	32	49	23	44	13	50	17	38	3	24	zero.	44	25	75	36	86	57
16	92	62	84	55	82	48	47	31	48	30	47	12	45	10	45	2	40	3	57	27	73	50	87	60
17	92	61	88	55	88	48	59	29	32	23	46	15	55	11	43	5	39	8	66	34	76	50	83	53
18	91	60	91	55	78	45	63	33	35	15	46	17	50	21	40	8	34	6	36	26	75	41	88	57
19	92	62	91	58	78	42	65	35	51	18	48	19	50	21	50	10	40	11	51	17	75	42	79	52
20	88	55	88	58	82	42	67	37	50	21	49	20	50	15	50	15	40	17	60	25	71	39	75	51
21	92	55	88	61	78	47	66	36	50	20	42	19	45	13	51	15	48	16	64	39	79	41	79	49
22	91	57	88	55	80	42	70	38	56	20	35	20	38	22	46	11	54	20	66	35	80	46	84	48
23	91	56	90	54	80	50	62	33	54	28	32	17	40	12	44	27	58	13	56	32	80	44	82	52
24	87	60	92	54	74	47	60	34	55	20	25	zero	41	11	36	16	63	24	42	22	78	45	82	59
25	90	60	94	56	75	45	64	35	53	21	14	—13	42	14	40	12	55	23	54	21	65	41	83	54
26	82	60	92	60	76	45	54	34	50	23	35	3	45	9	50	11	37	24	59	27	69	37	87	51
27	84	55	93	60	66	46	62	26	38	22	44	7	35	10	45	17	47	17	64	38	61	40	81	50
28	90	55	86	60	65	47	62	37	30	18	45	10	35	9	32	15	60	13	63	35	60	36	85	54
29	85	57	84	60	63	49	62	33	50	19	43	20	30	3	35	9	58	19	56	33	73	35	87	51
30	91	58	86	58	70	43	57	33	50	18	38	19	25	—2	......	......	55	25	66	32	77	41	......	......
31	95	57	86	53	......	......	54	27	......	......	41	14	35	4	......	......	55	24	......	......	69	43	......	......
Range	48°		48°		48°		46°		46°		66°		57°		54°		63°		51°		56°		54°	
Monthly mean	69°.7		68°.3		62°.7		49°.9		37°.2		28°.7		30°.7		26°.4		34°.6		45°.8		58°.6		67°.7	

Elevation of thermometers above ground, 21 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, SAUGEEN, CANADA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1.	77.0	51.6	88.0	64.6	75.0	60.3	73.0	62.7	36.0	26 1	40.0	27.1	36.0	26.6	27.0	1.6	26.0	14.1	45.0	31.6	51.1	25.6	57.0	43.6
2.	87.0	57.3	86.0	63.3	73.0	60.5	78.0	62.3	35.0	22.6	40.0	27.6	39.0	23.0	20.0	4.1	36.0	19.1	47.0	33.1	62.0	43.6	65.0	45.2
3.	84.0	66.2	69.0	52.8	72.0	62.3	65.0	53.8	30.0	20.1	32.0	26.1	46.3	14.8	21.0	8.1	47.0	30.5	58.0	43.7	77.0	51.7	56.0	41.3
4.	80.0	52.3	76.1	49.7	69.0	55.2	67.0	40.1	30.0	18.9	32.0	23.8	47.0	25.1	23.0	12.8	43.0	34.1	47.0	35.6	72.0	43.4	72.0	47.1
5.	71.0	47.0	76.0	59.5	67.0	53.1	73.0	59.1	34.0	16.1	43.1	26.1	39.0	19.8	26.0	15.1	41.2	26.1	39.0	27.6	76.0	46.1	68.0	59.8
6.	81.0	57.8	77.0	59.8	70.0	51.6	84.0	58.7	38.0	23.8	52.0	39.2	41.0	30.5	22.0	13.6	36.0	26.1	32.0	25.9	48.5	37.6	73.6	58.3
7.	76.0	64.6	80.0	51.8	65.0	52.3	81.0	62.7	54.1	30.1	42.0	30.7	37.0	24.4	23.0	10.1	44.0	14.9	32.0	20.6	62.0	43.6	62.0	39.6
8.	77.5	56.3	62.0	55.3	55.0	48.7	72.0	66.3	67.0	52.7	33.0	23.8	43.0	33.1	35.0	10.6	16.0	0.4	37.0	26.6	72.0	46.4	63.0	35.1
9.	80.2	52.8	63.0	47.1	55.0	38.0	70.0	62.3	62.0	42.6	39.0	24.1	58.0	35.1	20.1	3.1	31.0	0.7	52.0	28.2	77.0	54.8	79.0	48.2
10.	80.0	60.3	64.0	43.2	59.0	33.1	79.0	61.3	47.5	32.6	58.0	33.3	38.5	25.1	32.0	5.1	22.0	4.1	57.0	26.6	69.2	49.1	78.0	56.1
11.	77.3	61.1	69.0	54.8	65.0	40.1	73.0	59.8	61.0	32.1	34.0	20.1	58.0	30.2	40.0	12.1	32.0	6.1	30.0	19.1	58.0	39.9	79.0	56.1
12.	79.5	58.3	82.0	56.9	75.0	49.2	72.0	62.3	56.0	42.1	24.0	14.1	31.0	20.1	48.0	31.6	21.0	6.6	41.0	25.4	52.0	40.8	77.0	53.3
13.	83.0	58.8	76.0	62.4	62.0	48.2	74.0	54.1	51.0	40.1	24.0	13.1	27.9	15.6	32.0	23.1	30.5	6.3	60.0	40.1	49.5	36.1	66.0	49.2
14.	81.0	68.3	65.0	52.3	53.0	35.1	70.0	50.2	61.5	46.6	32.5	18.3	36.0	18.1	28.5	22.2	32.0	23.1	70.0	35.6	58.0	30.3	58.0	48.2
15.	82.2	66.4	64.0	44.7	64.0	33.1	66.0	54.8	50.0	37.2	32.5	24.0	32.0	18.8	33.0	26.1	28.6	19.5	67.0	33.1	56.0	31.6	73.0	51.0
16.	81.0	57.1	65.0	43.2	62.0	47.7	76.0	57.3	51.0	40.1	26.0	17.1	41.0	28.1	39.5	27.1	30.0	21.1	36.0	29.9	69.0	43.9	71.0	47.1
17.	64.0	52.1	66.0	38.3	60.0	48.1	74.0	63.0	43.5	29.0	27.0	8.6	44.5	34.0	54.0	32.1	26.0	16.5	40.0	30.1	64.0	45.2	66.0	43.3
18.	69.0	49.2	67.1	45.1	60.0	48.1	67.0	45.5	32.0	26.9	22.0	9.5	38.0	36.6	56.0	12.6	36.0	18.1	54.0	30.4	78.0	55.5	76.0	44.6
19.	71.0	43.3	74.0	46.7	47.0	47.2	48.0	35.6	39.5	25.1	21.5	13.6	40.0	31.3	20.0	11.1	41.0	25.6	(*)	(*)	74.0	54.3	75.0	50.3
20.	78.0	51.3	78.0	52.8	54.0	36.1	59.0	35.1	28.0	12.6	28.1	3.9	33.0	15.0	27.0	7.6	37.0	18.6	......	......	65.0	49.7	74.0	54.3
21.	83.0	62.8	78.0	62.7	62.0	36.1	62.0	38.6	25.0	10.1	5.0	— 4.9	28.9	8.6	31.0	24.1	43.0	11.7	67.0	34.6	64.0	45.2	70.0	57.4
22.	75.0	65.3	84.0	62.3	67.0	40.1	63.0	47.2	32.5	19.5	31.0	4.9	38.0	25.1	37.0	19.3	37.0	29.6	62.0	33.6	63.2	48.7	78.0	55.8
23.	73.0	62.3	69.0	60.4	58.0	52.8	58.0	33.6	38.0	25.1	27.0	16.1	34.0	22.2	31.0	15.1	42.0	18.6	45.0	27.6	68.0	50.3	88.0	57.8
24.	73.0	55.3	66.2	44.7	57.0	43.7	37.0	27.1	35.1	24.1	35.0	12.6	33.0	24.1	42.0	17.1	20.0	7.6	52.0	32.1	80.0	54.7	85.0	67.3
25.	82.0	54.4	64.0	48.6	57.0	38.6	48.5	23.1	38.0	31.6	14.0	4.1	34.8	25.1	48.1	37.1	30.2	6.9	48.0	31.6	82.0	59.8	73.0	65.3
26.	80.0	62.8	67.0	47.7	61.0	38.9	55.0	33.1	38.0	28.6	18.0	0.9	43.1	25.6	41.9	32.5	44.0	23.1	52.0	32.6	84.0	59.7	78.0	58.3
27.	75.5	55.3	70.0	46.5	68.0	42.6	57.0	46.5	50.0	30.1	30.0	9.1	45.0	30.6	41.0	33.1	46.0	31.9	52.0	33.1	75.0	47.1	79.0	63.5
28.	83.0	55.8	80.0	54.3	67.2	58.3	50.0	42.1	56.0	27.9	30.0	26.7	36.0	17.0	51.1	32.3	34.0	28.1	58.0	32.6	58.0	41.5	77.0	57.1
29.	72.0	53.1	78.0	53.6	81.0	58.3	56.0	38.1	29.0	17.1	35.0	18.0	20.2	9.2	56.0	21.1	35.0	21.8	58.0	33.1	74.5	43.2	72.0	55.8
30.	74.0	49.2	80.5	59.8	78.0	65.4	47.0	35.1	28.5	11.8	18.0	— 6.2	50.0	19.1	......	......	37.0	25.9	38.0	26.1	75.0	42.9	70.0	55.3
31.	84.0	56.8	81.0	57.1	......	......	40.0	29.6	......	......	32.0	— 7.1	35.0	20.1	......	......	44.0	21.5	......	......	75.0	45.1	......	......
Range	43°.7		44°.8		47°.9		60°.9		56°.9		65°.1		49°.4		54°.4		46°.6		......	......	58°.4		52°.9	

*Observation missed.

Maximum, minimum and mean temperatures—Continued.

STATION, SAVANNAH, GA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	83	72	90	79	84	76	82	72	69	55	61	37	74	57	68	56	71	61	77	52	67	56	90	76
2	84	71	89	78	88	76	83	69	67	52	68	43	71	56	63	48	68	55	76	59	72	57	91	76
3	84	69	84	74	90	78	83	72	66	50	72	52	71	52	63	46	73	55	76	65	67	64	76	65
4	87	70	89	74	88	73	82	72	53	38	70	56	72	56	54	38	79	62	80	66	74	64	79	64
5	93	75	94	77	87	72	80	72	59	37	67	49	73	54	53	41	85	66	84	65	78	65	82	69
6	91	77	97	79	86	74	82	73	71	49	73	58	73	57	51	40	80	68	87	66	82	66	85	72
7	90	78	97	80	86	72	84	76	72	56	65	50	75	61	60	43	82	68	77	63	83	65	86	75
8	96	77	97	77	89	75	86	74	76	60	66	48	66	58	57	46	75	65	63	43	82	67	91	72
9	100	80	85	70	82	72	84	71	76	63	69	50	68	56	60	46	78	58	57	41	80	69	92	76
10	102	84	80	63	79	68	86	70	77	62	76	60	71	57	66	45	65	54	67	44	78	69	89	74
11	103	84	81	67	78	64	78	69	78	62	76	64	66	60	69	48	76	59	73	53	74	69	90	75
12	105	86	79	68	77	61	78	71	80	62	66	49	67	59	73	57	76	62	60	42	79	69	98	77
13	100	76	85	69	82	64	76	70	81	67	51	46	64	42	76	64	83	62	69	46	79	68	100	80
14	84	75	89	74	80	69	80	70	79	64	70	46	55	34	66	62	74	56	76	55	78	67	99	82
15	88	75	88	74	79	69	81	71	81	67	66	51	63	44	62	51	81	64	80	62	70	59	99	83
16	93	78	90	76	82	65	83	76	81	70	60	41	64	46	59	41	79	66	84	67	73	56	95	78
17	96	79	88	75	86	60	83	76	74	63	66	44	67	47	68	49	68	55	87	67	79	59	81	67
18	98	73	89	74	83	66	83	73	81	56	66	48	66	52	71	54	68	54	86	68	82	64	82	63
19	79	73	91	75	82	72	81	64	56	37	68	46	69	47	68	55	77	61	84	69	82	66	81	65
20	82	72	86	74	75	69	66	59	54	39	67	50	70	52	56	43	68	52	85	66	83	68	82	65
21	84	71	86	73	73	67	72	61	51	33	71	57	67	55	59	44	66	53	72	64	81	72	82	69
22	86	73	85	75	70	66	74	66	56	37	72	54	71	59	63	43	64	56	70	61	80	73	86	70
23	91	75	90	77	72	64	74	68	65	44	75	59	62	49	72	52	72	50	81	62	85	71	87	72
24	90	78	90	76	79	67	70	52	60	43	76	62	55	45	64	48	70	54	85	66	84	72	89	73
25	92	78	92	78	73	63	59	43	68	43	76	64	54	45	75	53	59	46	88	71	80	70	88	71
26	90	77	88	74	69	55	64	44	67	48	65	35	55	45	78	58	70	50	88	72	84	69	94	71
27	93	76	79	69	75	59	63	57	74	56	52	33	62	54	78	63	77	62	85	70	84	70	94	78
28	95	79	80	66	80	59	70	59	76	63	67	42	68	54	78	61	72	60	77	63	85	71	96	80
29	90	77	77	63	81	70	71	52	68	49	70	49	67	52	80	63	62	49	81	70	85	72	96	78
30	91	76	80	70	81	72	75	53	49	41	73	52	66	56	......	......	59	43	78	65	87	73	95	79
31	89	73	82	73	......	......	73	57	......	......	75	53	74	61	......	......	67	44	......	......	89	75	......	......
Range	36°		34°		35°		43°		48°		43°		41°		42°		42°		47°		33°		37°	
Monthly mean	83°.6		79°.8		74°.2		70°.5		59°.8		58°.6		59°.0		57°.7		64°.2		68°.9		73°.7		81°.9	

Elevation of thermometers above ground, 41 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION SHREVEPORT, LA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	95	67	90	73	83	69	82	73	60	45	63	36	67	59	40	38	51	36	72	60	65	54	83	74
2	93	76	92	73	89	67	79	72	64	38	71	43	72	58	40	34	63	49	72	66	69	57	82	70
3	89	74	94	75	89	65	85	71	64	38	68	53	72	58	43	32	74	63	84	64	74	59	86	70
4	89	73	95	76	89	66	86	68	66	41	73	48	74	64	46	29	83	67	92	69	83	61	91	72
5	89	72	95	78	89	66	89	70	58	50	66	49	74	66	51	32	84	68	93	68	87	66	91	74
6	95	72	95	75	89	66	83	69	69	54	66	41	78	66	52	36	83	70	87	69	88	67	84	67
7	93	75	96	75	89	64	85	64	79	62	69	46	76	65	61	35	74	57	72	44	85	66	87	68
8	93	74	94	74	89	67	86	69	77	66	70	61	73	64	62	40	57	52	58	40	87	69	92	76
9	95	74	74	65	89	67	88	73	82	68	74	65	75	62	64	49	55	51	65	45	87	69	93	74
10	97	75	79	65	87	71	88	72	79	68	70	46	72	57	69	50	63	49	76	46	88	68	92	76
11	97	76	79	64	88	68	88	66	80	63	48	37	78	65	73	63	61	55	69	52	90	72	90	73
12	98	74	82	64	73	66	86	66	84	68	45	26	68	47	70	63	57	48	73	46	91	72	90	73
13	97	78	83	68	80	66	83	66	82	69	45	30	53	41	63	47	51	45	78	50	90	70	92	73
14	100	77	86	71	78	59	84	67	76	70	51	36	63	39	53	34	47	40	80	65	88	68	93	75
15	94	77	88	73	78	55	87	67	82	66	54	36	68	54	62	35	41	38	82	72	87	71	89	76
16	94	75	87	68	82	56	87	67	79	58	67	37	70	53	64	41	40	34	87	71	86	68	83	70
17	92	74	84	68	87	61	76	62	77	53	69	48	74	58	70	59	48	35	86	70	84	62	83	64
18	96	74	87	66	88	63	74	51	55	45	54	41	72	44	66	52	50	45	85	73	86	67	85	64
19	96	76	89	61	87	66	69	51	60	35	70	52	72	50	54	40	60	49	76	59	85	68	89	67
20	97	77	89	63	79	63	65	46	53	42	77	57	73	61	48	42	69	46	71	49	82	64	87	67
21	95	75	92	63	80	58	72	46	58	31	71	50	78	60	52	46	69	54	78	52	79	68	86	63
22	96	75	87	71	85	58	76	46	67	34	72	67	60	45	70	49	73	56	82	68	85	67	85	68
23	99	76	75	72	86	62	68	50	67	43	76	63	59	36	76	57	75	55	84	71	89	66	86	68
24	98	79	83	70	87	66	62	42	68	46	71	28	59	38	76	58	75	51	84	71	87	69	86	68
25	94	82	89	71	84	67	67	39	73	56	30	22	60	36	68	58	77	52	84	65	87	68	88	70
26	92	74	83	69	84	64	76	47	73	57	37	18	63	33	72	54	76	66	78	59	85	71	91	74
27	96	75	86	65	85	64	70	47	76	63	54	25	71	42	78	64	73	63	77	56	86	70	88	71
28	85	76	85	64	85	66	78	47	70	44	66	45	69	51	77	41	76	49	70	63	86	72	85	72
29	88	73	83	64	86	66	81	46	54	34	76	62	74	59	41	35	71	52	73	62	88	76	89	71
30	92	74	87	66	88	63	77	51	58	35	72	64	68	50	......	......	72	54	70	55	90	73	91	72
31	92	72	87	69	......	......	62	47	......	......	75	60	50	40	......	......	75	57	......	......	91	74	......	......
Range	33°		35°		34°		50°		53°		59°		45°		49°		50°		53°		37°		30°	
Monthly mean	85°.2		78°.8		75°.2		68°.9		61°.0		54°.8		60°.4		53°.2		59°.1		69°.8		77°.1		79°.3	

Elevation of thermometers above ground, 24 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, SILVER CITY. N. MEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	91	53	83	64	89	53	78	49	63	38	65	27	56	*	42	24	62	*	67	32	74	39	87	42
2	89	58	86	65	90	55	77	51	69	34	62	24	57	......	43	19	62	......	66	39	78	39	92	48
3	90	56	83	62	90	62	73	43	67	36	54	34	60	......	38	15	62	......	66	41	83	41	92	48
4	83	63	75	56	87	59	75	47	68	37	58	32	57	......	38	13	58	......	68	32	84	49	84	50
5	78	64	80	61	80	53	78	52	73	36	59	37	63	......	42	13	50	......	78	35	82	43	87	62
6	70	60	75	56	79	50	75	54	72	36	60	38	62	......	44	16	48	......	79	40	78	55	88	43
7	86	58	81	59	87	52	72	49	67	35	59	29	62	......	46	19	58	......	70	36	76	39	90	50
8	71	63	75	65	82	50	73	43	58	37	51	36	56	......	50	19	58	......	60	30	77	37	90	53
9	79	60	72	53	82	49	66	38	58	35	50	23	64	......	60	22	61	......	61	30	80	40	89	60
10	82	59	77	49	85	50	76	39	52	32	47	21	63	......	49	30	59	......	69	25	81	41	89	52
11	85	60	80	48	82	65	79	43	44	30	52	21	60	......	52	*	57	......	73	30	81	41	87	45
12	80	63	83	50	81	55	75	52	59	31	48	18	53	......	34	*	62	......	74	36	76	42	90	48
13	83	58	83	53	78	52	70	53	58	34	56	24	58	......	42	17	61	33	70	37	74	39	85	48
14	84	58	82	53	78	45	56	53	57	29	63	26	56	......	51	22	50	22	66	39	76	34	89	49
15	88	58	85	55	84	47	59	40	65	31	66	37	62	......	51	*	42	22	66	39	81	30	95	52
16	87	58	80	53	83	44	63	38	62	30	65	29	60	......	57	......	46	23	71	34	86	44	95	56
17	89	58	82	53	85	48	68	39	58	32	64	26	63	......	55	......	48	29	70	33	84	40	92	64
18	86	64	80	52	77	49	67	38	48	25	61	28	61	30	55	......	47	28	53	30	82	46	97	57
19	84	63	82	52	78	44	70	40	58	18	55	27	59	33	55	......	57	22	62	25	87	46	86	60
20	82	58	81	65	80	46	71	40	60	27	47	40	61	30	49	......	62	22	73	27	84	49	78	57
21	82	58	83	59	82	48	75	37	62	24	50	31	63	35	58	......	65	24	70	42	89	45	86	50
22	85	62	82	56	82	45	76	49	67	24	44	28	59	27	58	......	63	23	73	41	91	51	87	53
23	85	61	86	56	82	47	68	43	68	29	39	28	58	31	57	......	66	30	68	45	88	53	91	53
24	92	66	87	59	80	43	67	38	67	28	41	*	52	24	43	......	71	26	60	37	86	51	91	59
25	85	65	90	58	80	54	72	37	65	28	54	......	52	27	50	......	61	44	68	28	80	54	91	60
26	82	61	84	56	83	48	62	48	61	33	56	......	58	22	56	......	50	37	73	30	78	40	91	58
27	80	63	87	54	66	56	62	35	47	40	52	......	55	23	57	......	68	27	75	32	80	43	95	60
28	78	59	78	54	56	55	68	35	57	27	55	......	46	27	60	......	72	30	74	38	76	37	97	62
29	87	62	83	64	68	53	71	35	60	23	49	......	53	24	59	......	71	30	71	31	85	39	95	60
30	85	62	86	53	73	49	55	48	65	26	55	......	32	7	......	......	72	30	69	42	86	42	95	52
31	84	53	85	59	......	......	49	39	......	......	55	......	43	25	......	......	68	33	......	......	87	46	......	......
Range	39°		42°		47°		44°		53°		51°		54°		....		....		54°		61°		55°	
Monthly mean*	71°.8		68°.6		67°.2		....		....		....		....		....		....		....		....		....	

* Minimum thermometer unserviceable.

Elevation of thermometers above ground, 4 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, SMITHVILLE, N. C.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	85	72	91	79	86	70	84	68	56	49	57	30	59	53	61	50	68	57	70	47	66	47	84	76
2	86	63	90	79	85	70	83	65	64	48	64	39	69	52	50	42	63	49	71	56	71	48	82	60
3	87	63	88	73	87	79	84	69	63	40	69	54	65	45	60	42	68	55	70	62	74	64	78	57
4	88	66	92	72	89	72	82	63	48	31	63	55	70	50	53	34	68	61	70	63	69	64	82	65
5	87	75	91	76	88	68	83	67	52	32	64	55	67	55	52	37	68	62	74	62	71	63	82	70
6	80	73	94	80	87	69	83	65	67	39	67	59	65	56	48	35	73	60	77	63	81	63	83	71
7	86	65	94	82	86	69	82	75	68	47	63	50	67	57	54	35	71	58	65	54	85	64	85	68
8	87	75	92	75	86	66	85	73	71	56	66	50	60	51	50	43	66	53	55	38	82	64	85	68
9	94	78	85	64	78	64	84	70	73	62	65	51	56	49	60	39	60	48	53	37	82	64	83	67
10	96	80	80	60	73	60	80	68	74	58	68	54	64	52	64	40	63	44	63	39	83	69	84	72
11	92	80	83	62	75	57	77	68	75	60	68	62	66	51	61	43	62	54	68	45	83	70	85	72
12	100	81	82	64	80	57	77	67	76	62	64	42	64	52	69	56	59	51	56	34	84	67	90	76
13	89	78	80	69	81	61	80	65	76	65	51	40	62	32	69	60	57	44	65	45	81	66	93	76
14	83	71	89	67	76	68	78	65	75	65	66	44	51	27	64	57	66	46	71	57	73	57	97	77
15	91	68	89	77	72	66	79	71	74	67	63	48	61	44	64	46	63	54	74	59	69	46	90	75
16	91	74	85	77	82	62	83	72	75	62	53	58	56	40	56	37	71	63	72	63	72	48	79	63
17	90	75	88	79	89	68	82	71	68	55	60	42	62	43	63	48	65	49	80	62	78	57	80	60
18	85	72	88	68	82	65	85	73	72	48	57	46	65	49	69	57	61	50	73	60	79	64	80	60
19	85	66	86	72	83	69	80	55	48	33	61	41	62	42	65	43	71	51	76	67	81	65	83	61
20	84	67	85	73	77	68	69	57	44	28	62	50	64	54	47	32	62	46	71	60	82	71	85	57
21	81	69	89	76	75	67	75	64	41	23	63	52	64	53	59	38	63	46	60	52	82	72	86	61
22	88	66	83	75	71	64	76	65	49	28	64	48	65	54	57	38	63	52	70	47	78	72	84	65
23	89	73	88	78	70	63	74	67	59	35	69	59	61	49	65	51	68	50	78	57	87	71	90	65
24	90	78	86	76	80	64	67	45	54	38	67	61	54	43	57	39	61	45	78	65	84	68	91	76
25	83	71	88	79	71	56	54	39	60	33	67	61	48	40	68	49	57	36	74	65	82	71	87	75
26	86	79	82	68	69	49	63	41	60	39	63	30	55	40	67	57	62	42	79	68	86	66	88	77
27	85	77	75	65	73	52	66	49	66	45	46	26	67	54	72	58	68	60	79	64	85	70	91	78
28	91	79	77	61	77	57	72	55	67	52	59	36	71	54	71	57	70	57	68	62	84	68	92	78
29	86	75	81	60	78	64	69	48	69	45	67	55	62	50	69	60	57	43	74	64	89	73	90	76
30	90	75	84	64	79	67	72	55	46	34	64	53	68	46	......	......	55	35	77	63	88	74	87	72
31	89	80	89	68	......	......	64	51	......	......	58	51	68	58	......	......	65	36	......	......	85	74	......	......
Range	37°		34°		40°		46°		53°		43°		44°		40°		38°		46°		42°		40°	
Monthly mean	80°.2		77°.8		71°.6		68°.8		54°.9		55°.4		55°.4		53°.4		57°.7		63°.7		72°.8		78°.4	

Elevation of thermometers above ground, 27 feet.
The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, SOCORRO, N. MEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	95	67	92	74	90	63	77	53	64	46	58	25	46	33	42	26	62	28	72	42	74	46	85	51
2	95	66	92	68	92	53	72	51	66	37	64	36	50	28	41	16	65	29	70	48	77	46	90	57
3	93	65	90	73	90	57	70	49	68	37	60	27	53	26	35	18	67	41	75	45	85	50	95	66
4	92	72	90	66	86	62	73	48	68	45	54	41	48	30	34	12	67	50	79	44	89	55	90	64
5	88	71	90	70	85	56	77	50	68	40	50	29	53	24	33	9	60	37	82	44	87	50	79	54
6	86	69	85	67	84	60	75	53	73	36	58	28	46	28	37	12	53	44	81	50	84	55	92	45
7	89	73	83	60	88	53	76	47	70	35	62	31	57	40	48	12	58	34	69	44	83	45	97	53
8	90	71	80	65	86	54	76	49	60	44	63	30	67	35	42	12	63	30	60	33	84	47	96	58
9	85	64	80	56	85	59	67	46	55	39	55	29	59	33	47	16	65	30	67	31	88	55	95	63
10	82	65	82	57	86	54	73	39	66	39	45	18	63	33	55	24	66	34	73	33	90	54	92	60
11	86	64	84	63	89	54	79	48	57	36	36	21	56	36	57	38	62	34	75	34	90	48	90	58
12	(*)	(*)	88	66	79	56	77	54	61	29	41	18	45	23	49	27	67	35	78	41	84	49	93	52
13	......	......	88	64	82	54	74	59	61	35	44	19	52	20	47	20	65	43	78	49	79	48	90	52
14	......	......	91	58	81	47	72	60	62	30	54	26	56	23	43	20	55	15	75	47	83	42	90	50
15	......	......	87	62	83	46	64	50	65	35	54	25	51	26	53	17	38	13	70	45	87	41	94	55
16	92	72	86	59	82	47	61	39	66	39	55	22	54	24	66	34	50	25	78	40	87	57	95	60
17	92	67	88	56	84	45	61	39	55	31	56	22	55	29	60	43	54	33	77	46	89	59	90	69
18	90	70	80	57	81	49	71	40	44	25	58	23	58	30	49	20	53	35	64	40	86	58	94	65
19	92	73	90	59	78	52	71	42	52	24	53	27	63	31	51	30	54	33	63	35	84	52	93	64
20	89	64	90	59	81	49	72	41	57	29	51	23	58	33	58	41	53	30	76	34	86	54	83	65
21	90	65	87	66	83	60	73	40	56	27	62	45	58	34	58	36	61	30	80	55	91	59	79	64
22	90	69	89	62	84	55	77	44	58	24	59	37	52	28	59	46	65	33	81	48	91	65	89	63
23	90	64	89	62	86	59	71	47	57	29	53	38	49	24	65	48	71	36	79	51	92	61	91	65
24	90	70	91	60	81	55	73	43	60	27	53	22	45	23	52	38	73	45	58	42	92	60	90	70
25	91	72	93	54	82	57	70	46	63	28	26	6	52	18	55	29	65	54	70	34	89	60	92	62
26	88	70	92	59	84	50	60	46	62	36	39	8	60	33	63	25	55	42	77	37	83	48	93	68
27	84	66	91	66	72	55	62	35	58	36	47	27	51	27	63	29	64	35	79	41	72	52	95	66
28	89	68	91	58	66	57	66	33	51	32	63	38	57	27	52	24	70	29	79	48	74	48	96	70
29	91	67	86	71	72	57	69	36	53	25	55	29	52	31	56	22	70	38	73	50	87	41	96	65
30	90	65	88	57	76	53	68	41	56	26	53	37	37	17	......	......	73	38	73	47	87	48	96	73
31	91	64	87	53	......	......	66	46	......	......	52	29	42	21	......	......	69	44	......	......	82	53	......	......
Range	......	......	40°		47°		46°		49°		58°		50°		57°		60°		51°		51°		52°	

*Observer absent on repair duty.

Elevation of thermometers above ground, 5 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, SPRINGFIELD, ILL.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	87.5	69.0	91.0	67.0	81.0	68.0	84.0	63.0	40.0	24.0	53.0	35.0	46.0	28.0	36.0	19.0	43.0	26.0	59.0	38.0	71.0	44.0	70.0	56.0
2	95.5	70.0	93.0	72.0	75.0	61.0	88.0	71.0	40.0	28.5	58.0	40.5	48.0	43.0	37.5	19.5	55.0	35.0	64.0	53.0	77.0	52.0	75.0	54.5
3	96.0	77.0	94.0	75.5	79.0	62.0	75.0	64.0	38.6	20.0	52.0	36.0	63.0	47.0	32.0	18.0	69.0	45.0	73.0	57.0	76.0	54.0	78.0	56.0
4	90.0	69.0	94.0	72.0	73.5	54.0	84.0	63.5	43.0	24.0	49.0	36.5	58.0	46.0	34.0	13.0	68.0	48.0	71.0	53.0	77.0	56.5	74.0	60.0
5	93.5	63.0	86.0	69.0	74.0	50.0	85.0	66.5	63.0	41.0	61.0	48.5	58.0	44.0	35.0	29.0	59.0	36.0	66.0	48.0	81.0	57.0	82.5	67.0
6	94.0	72.0	87.0	73.0	73.0	59.0	84.5	67.5	64.0	41.0	52.0	39.0	57.5	51.0	47.0	23.0	51.0	34.5	60.0	35.0	85.0	61.5	73.0	61.0
7	97.0	80.5	81.0	68.0	73.0	55.0	73.0	66.0	63.0	50.0	45.0	30.0	58.0	45.0	38.0	21.0	48.0	32.0	50.0	31.0	86.0	65.0	78.0	57.5
8	95.5	82.0	74.0	57.5	67.0	47.5	81.0	66.0	71.0	55.0	39.0	27.5	59.0	52.0	54.0	27.0	46.0	26.0	50.0	34.0	79.0	62.0	82.0	63.5
9	95.0	72.0	77.0	54.0	69.0	46.0	83.0	69.0	58.0	45.0	62.0	36.5	60.0	39.0	45.0	22.5	52.0	32.0	67.0	38.0	75.0	62.0	86.0	63.0
10	100.0	81.5	80.0	62.0	69.0	48.0	84.0	71.0	64.0	45.0	62.0	29.5	51.0	32.0	54.0	36.0	39.0	31.0	57.0	41.0	74.0	62.0	91.0	71.0
11	101.5	82.0	85.0	67.0	79.0	56.0	85.0	69.0	76.0	61.0	29.5	16.5	64.0	35.0	58.0	38.0	45.0	33.0	45.0	32.0	73.0	58.0	92.0	73.0
12	96.0	71.5	84.0	69.0	72.0	58.0	84.0	69.0	69.0	53.0	25.0	13.0	41.5	31.5	55.0	34.0	37.0	26.0	61.0	35.0	79.0	55.0	91.0	76.0
13	95.0	71.0	83.0	67.0	67.5	54.0	81.0	65.0	74.0	49.0	32.0	18.0	44.0	30.0	34.0	26.5	39.0	26.0	77.0	47.0	79.0	59.5	89.0	76.0
14	97.5	76.0	77.0	64.0	65.0	43.5	81.5	65.0	65.0	50.0	41.0	28.0	47.0	33.0	43.0	24.0	34.0	21.0	81.0	55.0	72.0	53.0	86.0	72.5
15	97.5	76.0	74.0	63.0	73.0	50.0	82.5	64.0	56.5	44.0	34.0	11.0	43.0	26.0	51.0	30.0	35.5	22.0	69.0	49.0	74.0	52.0	75.0	56.0
16	95.0	79.0	70.0	56.0	82.0	50.0	79.0	65.0	50.0	38.0	50.0	26.0	57.0	36.5	54.0	36.0	36.0	22.0	59.0	46.0	80.5	52.5	78.0	56.0
17	80.0	70.0	72.0	54.0	74.0	50.5	66.0	56.0	47.5	40.0	29.5	17.0	53.0	38.0	62.0	36.0	43.0	26.0	67.0	39.0	85.0	59.0	80.0	60.0
18	85.0	58.0	76.0	56.5	68.0	54.0	56.0	45.0	43.0	36.0	27.0	12.0	62.0	35.0	36.0	25.0	52.0	33.0	82.0	59.0	84.0	64.0	80.0	63.0
19	87.0	60.0	72.0	59.0	61.0	46.0	58.0	41.0	49.0	30.0	38.0	26.0	57.0	47.0	29.0	19.0	52.0	37.5	72.0	37.0	79.0	61.0	83.5	66.5
20	94.0	65.0	87.0	64.5	67.0	44.0	57.0	40.0	30.0	20.0	30.0	16.0	52.0	38.0	40.0	22.0	49.0	34.0	68.0	40.0	70.0	59.0	86.0	64.0
21	85.0	75.0	88.0	69.0	71.0	43.0	64.0	39.0	37.0	23.0	38.5	21.0	51.0	38.0	43.0	31.0	56.5	32.0	72.0	48.0	67.5	58.5	89.0	66.5
22	92.0	72.0	88.0	71.0	73.5	51.0	72.0	47.0	51.0	28.0	39.0	21.0	40.0	32.0	60.0	34.0	59.0	40.0	78.5	53.5	79.0	57.0	91.0	67.5
23	87.0	75.0	84.0	76.0	75.0	53.0	52.0	36.0	40.0	29.0	37.0	20.0	44.0	31.0	53.0	35.0	59.0	42.0	81.0	58.0	82.0	63.0	93.0	70.0
24	84.0	62.0	80.0	64.0	57.0	44.0	51.0	34.0	48.5	26.0	31.0	5.0	49.0	33.0	64.0	40.0	49.0	32.0	80.0	60.0	86.0	64.0	87.0	72.0
25	88.0	67.0	81.0	57.0	62.5	38.0	55.0	33.0	49.0	37.0	12.0	— 3.0	54.0	38.0	61.0	52.0	48.0	36.0	76.0	53.0	82.0	70.0	84.0	70.0
26	85.0	65.0	80.0	58.0	71.5	47.0	62.0	34.0	57.5	35.0	22.0	3.0	54.5	40.0	67.0	45.0	59.0	40.0	62.0	46.0	82.5	69.0	88.0	67.0
27	82.0	60.0	79.0	62.0	76.5	61.5	67.0	41.5	60.0	52.0	39.0	20.0	59.0	39.5	63.0	44.0	62.0	43.0	65.0	41.5	75.0	61.5	82.0	69.5
28	88.0	66.0	81.0	66.0	78.5	63.0	62.0	45.0	60.0	33.0	45.0	25.0	40.0	28.0	58.0	21.0	52.0	39.0	63.0	49.0	75.5	57.5	77.0	68.0
29	82.5	63.0	84.0	65.0	79.0	66.0	64.0	50.0	33.0	24.0	46.0	31.0	43.0	27.0	31.0	15.0	54.0	35.0	60.0	50.0	76.0	58.0	77.5	63.0
30	84.5	61.0	83.5	63.0	83.5	60.0	50.0	35.0	39.0	25.0	36.0	24.5	54.0	27.0	......	......	59.0	35.0	59.0	39.0	75.0	57.0	83.0	61.0
31	87.0	63.0	83.0	66.5	......	......	42.0	29.0	......	......	37.0	32.0	42.0	23.5	......	......	58.0	43.0	......	......	77.5	62.0	......	......
Range	43°.5		40°.0		45°.5		59°		56°		65°		40°.5		54°		48°		51°		42°		38°.5	
Monthly mean	81°.6		74°.7		60°.9		61°.9		44°.7		31°.7		43°.8		38°.2		42°.3		56°.8		68°.6		74°.4	

Elevation of thermometers above ground, 39 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, SPRINGFIELD, MASS.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	79	53	89	63	85	62	84	55	42	33	41	18	38	15	34	9	42	32	58	33	51	35	81	54
2	85	56	93	69	86	69	80	59	45	26	50	31	48	21	17	— 1	42	28	64	31	59	45	66	49
3	91	65	91	71	79	67	81	61	41	32	54	35	41	28	26	11	53	26	62	42	80	43	72	48
4	92	71	82	67	76	67	73	53	36	26	54	38	49	30	35	20	64	43	60	52	83	55	72	51
5	71	59	86	64	70	58	77	43	37	15	43	30	46	29	33	4	69	42	65	47	75	52	72	54
6	74	56	86	71	73	49	65	50	30	23	48	34	37	27	37	22	45	37	59	36	77	50	73	60
7	71	58	75	58	78	61	70	49	43	28	55	42	45	32	34	13	43	32	38	29	64	46	75	64
8	80	62	70	63	76	62	80	55	53	26	48	38	41	21	32	16	38	20	43	25	71	48	65	53
9	82	65	70	59	66	55	75	59	64	50	43	32	37	28	34	9	27	12	53	29	84	54	69	52
10	85	64	73	56	69	55	71	62	60	46	41	30	47	35	28	— 6	39	22	60	37	89	63	76	51
11	84	65	77	47	70	49	60	54	52	38	55	41	44	23	41	18	26	19	45	30	78	63	78	59
12	81	66	80	57	70	47	74	56	67	46	42	29	47	31	46	27	38	17	40	27	71	56	85	66
13	85	60	82	59	66	49	72	50	56	45	35	22	31	15	47	40	33	19	65	32	58	46	82	66
14	89	64	82	66	67	56	71	39	57	44	35	26	28	8	44	32	40	25	77	43	55	42	74	63
15	91	70	75	59	67	52	77	43	68	56	46	34	38	12	38	28	40	29	74	37	65	38	74	57
16	94	71	65	56	64	48	83	56	59	45	38	31	35	15	45	31	38	29	60	43	69	42	77	53
17	78	67	61	54	71	54	72	60	53	43	40	25	41	28	51	26	40	29	46	40	83	53	79	52
18	74	62	61	56	70	48	72	59	42	33	30	16	42	34	57	40	41	22	54	39	64	55	82	58
19	73	57	73	58	68	49	67	42	40	32	32	23	48	35	40	20	38	31	53	40	72	53	86	56
20	76	54	76	53	66	44	57	36	37	22	41	25	39	32	33	16	47	33	56	44	84	59	87	58
21	77	57	81	59	62	38	67	34	22	11	33	zero.	36	23	38	22	42	29	68	34	84	62	82	60
22	81	64	84	66	60	48	64	53	34	14	20	zero.	35	14	45	30	51	26	69	38	77	63	73	58
23	77	68	84	67	69	48	72	52	46	31	37	13	48	34	41	29	54	34	56	42	80	63	79	54
24	79	66	79	60	65	51	52	32	40	27	39	29	41	33	34	17	41	20	50	35	87	62	91	61
25	80	58	71	57	55	39	38	28	48	26	40	15	41	26	44	20	31	13	62	35	92	67	94	69
26	68	62	68	59	58	31	52	20	43	30	18	2	49	24	47	35	41	19	58	44	94	69	88	72
27	83	60	67	57	62	34	58	37	38	27	25	3	42	28	61	31	36	28	61	45	91	68	90	67
28	85	64	73	52	67	39	60	46	57	37	40	21	56	35	50	33	37	28	63	38	85	64	93	69
29	87	68	79	57	69	54	60	48	57	30	45	34	35	14	62	38	40	28	63	41	76	56	88	72
30	85	67	74	60	82	55	57	44	30	22	46	16	41	10	......	......	42	31	65	40	61	54	84	67
31	86	64	79	52	......	......	50	40	......	......	19	5	48	32	......	......	49	32	......	......	76	60	......	......
Range	41°		46°		55°		64°		57°		55°		48°		68°		57°		52°		59°		46°	
Monthly mean	72°.6		68°.4		60°.9		57°.7		40°.5		32°.5		34°.1		31°.9		34°.7		48°.9		65°.4		70°.2	

Elevation of thermometers above ground, 54 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, STAYNOR, CANADA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	79.7	45.2	90.7	63.2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
2	86.7	54.2	92.7	60.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
3	81.7	67.2	(*)	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
4	78.7	53.2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
5	79.7	47.2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
6	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
7	79.7	63.2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
8	77.7	60.2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
9	84.7	57.2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
10	81.7	62.2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
11	72.8	59.2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
12	84.7	58.2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
13	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
14	79.7	59.2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
15	88.7	65.2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
16	77.7	60.2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
17	64.7	54.2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
18	68.8	50.2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
19	79.7	44.3	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
20	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
21	84.7	65.2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
22	76.7	65.2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
23	69.8	53.2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
24	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
25	78.7	48.2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
26	82.7	61.2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
27	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
28	82.7	54.2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
29	71.8	55.2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
30	81.7	50.2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
31	88.7	50.2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......

*No later reports received.

Maximum, minimum and mean temperatures—Continued.

STATION, STOCKTON, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	106	(*)	95	......	90	59	85	67	61	47	78	39	45	39	32	30	70	54	80	57	76	53	69	53
2	99	......	98	......	97	64	80	63	75	45	76	39	48	39	47	28	72	50	77	48	83	49	81	59
3	98	......	93	......	100	71	76	61	69	48	71	36	62	48	37	25	78	39	80	54	89	60	95	68
4	90	......	93	......	94	60	86	58	79	55	77	54	62	39	40	25	84	54	89	59	95	60	104	68
5	95	......	94	......	94	62	87	63	74	48	66	32	72	43	42	25	72	54	90	58	99	61	101	76
6	95	......	94	......	95	64	87	65	67	46	77	48	65	39	46	27	69	54	90	52	95	64	99	66
7	96	......	83	......	93	63	88	64	84	49	78	44	67	44	49	26	69	45	70	42	90	58	104	65
8	98	......	81	......	90	64	86	65	77	58	54	43	82	44	51	29	62	39	55	39	95	62	106	71
9	85	......	65	......	88	65	75	66	81	47	78	39	66	38	63	31	74	44	68	35	99	59	102	70
10	90	......	78	......	97	65	77	67	85	59	57	28	78	44	71	33	74	53	71	38	91	55	100	72
11	95	......	80	......	87	69	81	67	66	50	45	25	67	43	74	44	67	52	79	43	93	64	97	72
12	105	......	87	64	78	60	84	67	77	50	51	28	50	34	74	39	56	43	81	49	93	67	95	71
13	102	......	90	62	75	53	84	68	79	51	48	34	64	46	57	24	45	23	88	52	90	66	97	71
14	101	......	95	64	84	50	83	63	76	52	60	35	68	45	50	31	27	15	88	55	88	63	97	69
15	97	......	85	64	89	50	84	64	74	49	68	27	57	32	71	29	35	18	82	47	86	66	96	71
16	99	......	90	61	87	54	77	63	84	48	76	47	70	39	72	38	60	19	84	49	84	68	91	70
17	100	......	102	60	90	58	71	44	52	45	66	42	65	44	76	36	75	42	91	53	91	65	93	68
18	100	......	91	60	84	62	75	43	48	25	60	24	71	49	55	35	66	44	89	57	92	63	92	67
19	98	......	91	64	80	61	73	44	65	29	71	32	80	55	46	32	67	31	66	42	91	58	93	68
20	96	......	90	63	81	54	75	44	55	29	75	43	72	46	66	34	69	38	81	49	84	62	94	69
21	100	......	91	64	88	58	79	43	60	30	75	43	67	44	76	49	57	48	85	56	92	59	90	64
22	101	......	91	65	90	61	83	47	74	33	75	44	54	32	76	53	56	46	91	58	100	64	93	68
23	101	......	97	64	89	53	65	43	56	34	71	53	62	29	82	47	71	48	91	59	98	65	95	71
24	101	......	99	67	86	54	67	37	75	36	56	19	52	36	72	50	76	55	89	48	100	71	100	66
25	98	......	96	64	86	60	76	47	66	39	29	10	66	29	64	46	86	54	84	44	98	65	99	66
26	96	......	96	63	89	62	65	49	77	46	58	20	73	45	72	44	87	57	83	39	96	71	101	67
27	99	......	96	62	87	63	63	36	71	41	67	29	74	47	72	54	69	37	83	62	88	68	103	67
28	100	......	94	69	85	67	73	38	59	33	81	57	61	53	61	46	81	43	87	58	68	59	91	69
29	97	......	90	64	87	55	83	48	63	34	76	49	73	50	66	42	85	55	70	54	88	58	96	68
30	96	......	89	65	85	66	52	44	71	33	72	54	52	34	......	......	86	51	66	52	97	62	106	71
31	96	......	89	68	......	......	50	39	......	......	58	37	40	24	......	......	80	50	......	......	85	62	......	......
Range	......	......	......	......	50°		52°		60°		71°		58°		58°		72°		56°		51°		53°	

* Minimum thermometer broken.

Maximum, minimum and mean temperatures—Continued.

STATION, ST. ANDREWS, CANADA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	74.6	46.1	80.9	50.1	65.5	47.6	79.6	52.2	38.0	24.4	35.5	9.6	27.3	2.0	30.8	2.3	40.0	(*)	40.0	28.3	45.8	32.0	72.6	48.2
2	78.1	47.7	75.9	52.8	78.8	51.1	68.5	48.6	38.3	19.8	41.5	29.4	41.0	15.8	5.0	-14.8	27.3	......	42.3	21.8	52.9	33.0	63.9	52.6
3	82.3	52.8	86.0	52.8	66.7	51.1	72.8	48.1	36.5	22.6	37.0	29.0	35.0	6.0	15.6	1.0	38.0	......	39.0	32.1	44.8	37.2	58.7	47.7
4	81.6	49.2	79.4	59.3	63.7	49.9	59.7	42.7	32.0	19.8	41.8	26.9	39.0	6.0	18.4	9.0	46.8	......	43.8	37.0	63.5	40.8	66.9	45.0
5	66.9	48.6	74.6	54.8	62.7	51.6	53.9	39.6	32.1	18.8	31.3	16.1	37.0	3.5	28.8	14.8	41.8	......	54.7	38.0	51.2	41.0	69.7	48.2
6	69.7	42.7	75.1	52.1	68.9	53.8	54.5	35.1	32.1	16.8	39.8	19.4	37.0	2.0	32.0	14.8	28.4	......	48.8	35.0	64.7	40.0	70.7	47.2
7	67.7	48.9	74.6	49.9	69.2	48.4	66.1	37.1	37.2	26.5	51.7	35.1	37.0	17.8	21.4	7.6	34.0	......	38.0	26.3	58.1	35.0	59.7	46.2
8	58.2	48.7	64.7	49.9	59.7	50.6	83.1	48.1	44.6	31.4	44.3	24.0	36.5	14.8	29.0	10.2	35.0	......	33.5	19.8	50.8	37.5	63.7	44.7
9	76.1	48.1	63.7	51.8	66.1	49.1	71.3	51.8	51.7	38.1	28.8	12.8	34.1	21.8	30.8	-2.0	17.9	......	40.0	21.8	56.2	41.0	67.7	51.2
10	79.1	52.4	68.9	50.1	67.9	47.1	56.7	40.1	57.5	34.1	41.0	16.8	38.8	16.8	23.2	-11.8	35.0	......	44.6	35.0	56.7	42.8	76.1	49.2
11	79.2	53.8	72.6	46.7	66.7	42.6	49.5	37.1	44.6	32.1	49.8	34.7	24.8	7.0	23.8	(*)	18.9	......	47.8	26.8	72.6	43.2	74.6	54.1
12	76.8	50.1	78.6	54.8	64.9	43.1	51.7	40.1	43.3	37.1	40.0	17.8	39.0	17.8	40.0	......	23.8	1.6	28.8	16.8	63.2	45.2	72.6	55.1
13	82.6	51.8	77.6	51.1	68.7	46.1	55.9	42.1	41.1	30.4	22.6	8.5	31.0	2.0	42.8	......	19.9	1.6	44.3	23.7	46.8	37.0	76.1	56.1
14	69.7	53.3	70.4	53.0	60.7	51.6	58.7	36.1	45.8	30.4	31.0	14.8	14.9	-8.0	38.5	......	28.8	10.6	47.8	31.0	48.3	38.1	62.2	55.1
15	83.6	52.3	65.5	45.1	62.3	46.1	54.7	40.3	54.7	41.6	33.0	22.4	36.5	6.0	22.3	......	28.8	9.6	43.3	32.0	59.7	39.5	69.7	49.7
16	79.6	56.6	64.2	43.1	55.7	45.1	62.7	44.1	57.7	37.7	31.0	12.8	32.0	13.8	29.3	......	27.3	19.8	53.2	36.2	67.7	42.7	68.7	47.2
17	74.7	47.6	58.7	46.9	61.3	49.6	57.7	41.7	44.8	28.4	24.0	11.0	35.1	24.4	34.0	......	26.0	16.8	41.0	26.8	53.7	44.2	73.6	49.2
18	66.2	41.7	57.7	51.5	64.7	42.1	54.7	41.3	33.1	22.4	15.4	- 8.0	39.1	30.4	44.8	......	27.8	10.6	43.8	27.3	62.2	41.0	77.6	48.2
19	66.7	47.1	57.7	48.1	63.7	44.6	57.9	31.4	33.8	20.8	14.9	5.0	36.1	23.9	44.8	......	33.5	24.7	51.2	28.3	55.7	42.2	79.6	52.1
20	71.6	45.2	67.7	49.1	61.0	39.9	42.8	28.0	36.3	25.4	30.8	zero.	30.8	18.8	24.8	......	37.3	26.7	48.8	39.0	65.7	44.2	73.1	52.3
21	69.2	49.9	72.0	49.9	62.7	40.9	59.9	28.8	31.0	5.8	- 3.2	-21.5	22.8	6.0	34.0	......	35.1	28.2	56.7	35.0	63.7	46.0	59.7	50.2
22	70.7	49.3	64.7	51.9	58.7	41.1	55.9	39.1	26.6	5.2	27.8	-23.5	22.8	- 3.0	32.2	......	38.5	22.7	54.7	35.0	59.7	47.2	62.4	49.2
23	63.7	49.3	68.7	51.1	60.2	49.1	57.1	48.1	41.8	21.9	26.3	- 3.0	42.3	18.3	35.0	......	40.0	25.2	46.2	34.0	63.2	48.2	63.3	52.1
24	74.6	53.6	74.1	50.9	63.0	42.8	53.7	28.4	35.0	12.0	30.8	8.0	36.0	17.8	29.3	......	34.0	24.7	47.3	26.3	57.7	45.0	67.2	48.2
25	71.8	49.1	69.7	51 1	52.9	35.1	34.5	22.4	40.0	12.5	24.8	- 4.0	27.3	11.0	32.1	......	30.8	18.8	51.7	29.8	66.7	47.7	69.2	47.2
26	69.7	46.3	63.9	49.6	54.7	30.4	48.8	22.4	34.0	17.8	4.0	-20.7	34.5	15.8	36.5	......	28.3	12.8	42.3	38.0	65.9	44.2	70.0	52.1
27	62.7	49.1	61.7	47.2	58.2	37.1	52.1	30.4	33.5	13.8	8.0	-14.2	41.5	22.4	46.1	......	35.5	10.6	54.7	39.0	81.6	46.5	82.1	54.1
28	66.7	49.6	69.2	46.4	60.7	39.6	53.7	34.1	48.1	28.9	28.3	- 6.0	47.8	31.4	38.0	......	32.0	22.7	47.8	30.3	75.6	56.6	72.1	51.4
29	66.5	50.1	67.2	48.1	61.2	47.1	53.7	35.1	51.3	28.8	38.0	21.8	36.3	- 1.0	44.8	......	35.0	24.0	51.5	33.0	66.2	47.2	65.2	52.1
30	69.2	50.1	67.7	44.1	74.1	50.1	53.9	35.1	36.0	12.5	37.3	-12.7	36.4	- 5.0	......	......	33.3	22.3	47.8	41.0	64.7	47.2	74.6	56.1
31	72.6	50.1	78.4	51.1	......	......	44.8	30.6	......	......	20.9	-23.5	44.8	23.9	......	......	37.0	30.3	......	......	54.2	47.7	......	......
Range	41°.9		42°.9		48°.4		60°.7		55°.5		73°.3		55°.8		......	......	......	......	39°.9		49°.6		37°.4	

* Minimum thermometer out of order.

Maximum, minimum and mean temperatures—Continued.

STATION, ST. JOHN'S, NEWFOUNDLAND.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	59.0	49.0	78.0	51.0	54.0	48.0	65.0	55.0	46.0	37.0	37.0	25.0	24.0	— 3.0	37.0	15.0	......	......	34.0	26.0	40.0	32.0	63.0	35.0
2	47.0	44.0	72.5	55.0	53.0	45.5	64.0	54.0	41.0	31.0	28.0	25.0	28.0	6.0	35.0	7.0	......	......	32.0	20.0	45.0	31.0	72.0	42.0
3	70.0	44.0	82.0	52.0	53.0	46.0	58.0	36.0	45.0	34.0	34.0	25.0	34.0	5.0	12.0	3.0	......	......	38.0	25.0	47.0	28.0	60.0	45.0
4	74.5	50.0	75.0	58.0	54.0	49.0	64.0	50.0	53.0	42.0	33.0	28.0	25.0	2.0	38.0	6.0	......	......	42.0	25.0	46.0	34.0	60.0	40.0
5	58.0	40.5	74.0	54.0	58.0	50.0	50.0	39.0	44.0	31.0	37.0	27.0	33.0	15.0	30.0	14.0	......	......	40.0	25.0	44.0	25.0	51.0	38.0
6	64.0	42.0	75.0	54.0	59.0	52.0	42.0	34.0	34.0	26.0	28.0	22.0	18.0	9.5	15.0	10.0	......	......	38.0	32.0	54.0	31.0	50.0	38.0
7	55.0	39.0	63.0	49.0	57.0	53.0	44.0	33.0	34.0	23.0	38.0	19.0	37.0	10.0	25.0	6.0	30.0	17.0	42.0	30.0	48.0	27.0	52.0	43.0
8	50.0	45.0	59.0	49.0	62.0	52.0	47.0	30.5	34.0	19.5	44.0	31.0	29.0	8.0	8.0	— 3.0	31.0	11.0	34.0	20.0	39.0	28.0	50.0	43.0
9	64.0	40.5	60.0	49.0	71.0	52.0	47.0	34.0	39.0	31.0	35.0	22.0	15.0	5.0	31.0	— 2.0	26.0	— 4.0	32.0	16.0	45.0	27.5	45.0	43.0
10	62.0	48.0	58.0	50.0	69.0	58.0	44.0	40.0	39.0	35.5	25.0	21.5	33.0	10.0	30.0	— 9.0	22.0	— 4.0	32.0	13.0	44.5	27.0	54.0	41.5
11	65.0	47.0	68.0	53.0	58.0	50.0	40.0	36.0	44.0	31.0	34.0	23.0	38.0	20.0	10.0	—10.0	24.0	5.0	34.0	27.0	34.5	32.0	59.5	45.0
12	67.0	49.0	71.0	52.0	57.0	50.0	40.0	36.0	34.0	29.0	45.0	33.0	30.0	17.0	10.0	— 2.0	6.0	— 4.0	42.0	30.0	48.0	32.0	63.0	46.0
13	62.0	49.0	72.0	52.0	59.0	52.0	44.0	37.0	35.0	29.0	35.0	24.5	34.0	28.0	20.0	6.0	7.0	— 4.0	30.0	20.0	37.0	32.0	62.0	44.0
14	77.0	51.0	74.0	50.0	67.0	49.0	48.0	32.0	36.0	26.0	25.0	15.0	35.0	23.0	17.0	13.0	7.0	4.0	32.0	15.0	41.0	35.0	62.0	44.0
15	64.0	55.0	74.0	56.0	65.0	47.0	49.0	39.0	48.0	30.0	31.0	12.0	30.0	20.0	18.0	3.0	14.0	— 1.0	32.0	18.0	36.0	30.5	46.0	39.0
16	68.0	48.5	63.0	48.0	66.0	53.0	44.0	41.0	56.0	37.0	40.0	28.0	29.0	20.0	25.0	11.0	15.0	— 1.0	40.0	26.0	42.0	31.0	50.0	35.0
17	62.0	47.5	66.5	52.0	75.5	52.0	42.0	39.0	38.0	34.0	30.0	24.0	22.0	16.0	27.0	15.0	22.0	5.0	32.0	23.0	43.0	32.0	60.0	40.0
18	52.0	47.0	64.0	44.0	71.0	53.0	50.0	39.0	38.0	28.0	30.0	10.0	24.0	15.0	20.0	10.0	18.0	9.0	30.0	23.0	55.0	35.0	63.0	32.0
19	62.0	48.0	67.0	48.0	69.0	48.0	58.0	40.0	31.0	24.0	15.0	4.0	31.0	17.0	39.0	10.0	16.0	3.0	32.0	26.0	44.0	29.0	75.0	45.0
20	63.0	48.5	54.0	48.0	63.0	52.0	50.0	39.0	33.0	26.0	25.0	2.0	38.0	23.0	39.0	7.0	27.0	6.0	50.0	23.0	45.0	29.0	78.0	46.0
21	62.0	49.0	57.5	47.0	64.0	51.5	45.0	35.0	49.0	35.0	28.0	— 2.0	30.0	15.5	23.0	5.0	28.0	15.0	44.0	35.0	60.0	43.0	68.0	48.0
22	72.0	47.5	55.0	48.0	60.0	44.0	51.0	31.5	37.0	28.0	14.0	— 4.0	34.0	26.0	34.0	15.0	32.0	21.0	38.0	33.0	58.0	34.0	51.0	41.0
23	73.5	55.0	57.0	40.0	57.0	40.0	56.0	37.0	30.0	18.0	34.0	10.0	30.0	16.0	35.0	25.0	35.0	23.0	44.0	32.0	53.0	34.0	43.0	40.0
24	74.0	56.0	70.0	49.0	65.0	48.0	55.0	48.0	41.0	24.0	22.0	6.0	40.0	26.0	34.0	25.0	35.0	18.0	40.0	28.0	50.0	33.0	52.0	40.0
25	72.0	59.0	63.0	47.0	65.0	53.0	55.0	34.0	42.0	29.0	33.0	10.5	36.0	23.0	33.0	28.0	27.0	17.0	40.0	22.0	42.0	31.5	52.0	41.0
26	67.0	55.0	50.0	44.0	52.0	35.0	35.0	27.0	38.0	29.0	21.0	6.0	26.0	20.0	42.0	30.0	38.0	25.0	40.0	21.0	43.0	31.5	52.5	42.0
27	56.0	47.0	57.0	40.0	57.0	31.0	40.0	25.0	38.0	27.0	15.0	5.0	25.0	17.0	44.0	34.0	32.0	14.0	47.0	22.0	55.0	35.0	62.0	41.0
28	64.0	48.0	62.0	48.0	60.0	40.0	46.0	33.5	28.0	23.5	28.0	2.0	37.0	22.0	40.0	26.0	30.0	12.0	46.0	29.0	52.0	45.0	61.0	46.0
29	55.0	46.0	61.0	42.0	62.0	42.0	43.0	30.5	34.0	25.0	42.0	25.5	38.0	7.0	(*)	(*)	29.0	20.0	42.0	24.0	72.0	45.0	78.5	47.0
30	67.0	40.0	68.0	51.0	65.0	47.0	48.0	39.0	38.0	30.0	43.0	27.0	10.0	— 4.0	......	......	37.0	18.0	52.0	27.0	......	......	74.0	54.0
31	75.0	55.0	61.0	49.0	......	......	54.0	44.0	......	......	29.0	— 1.0	37.0	6.0	......	......	34.0	29.0	......	......	......	......	......	......
Range	37°.0		42°.0		44°.5		40°.0		38°.0		49°.0		44°.0		......	......	......	......	39°.0		47°.0		46°.5	

* Record incomplete.

Maximum, minimum and mean temperatures—Continued.

STATION, SAINT LOUIS, MO.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	83	68	95	72	85	69	88	65	41	26	59	35	50	28	35	23	44	23	56	38	73	44	67	57
2	93	71	97	73	75	64	90	71	48	32	61	42	55	44	32	19	59	35	68	52	78	52	74	57
3	93	73	97	76	82	63	76	65	37	25	58	34	68	52	38	18	76	45	76	56	76	53	78	58
4	90	67	99	76	78	59	88	64	49	25	49	37	62	53	44	16	69	56	75	54	74	58	74	60
5	90	69	97	74	80	55	90	68	61	42	61	49	60	49	46	22	62	40	70	52	83	57	84	70
6	94	74	92	72	79	61	83	66	66	51	57	38	62	54	55	24	49	39	61	39	88	63	79	61
7	94	76	85	71	77	61	72	66	66	53	43	35	57	51	47	24	45	34	46	30	88	64	76	59
8	96	78	76	62	70	51	86	64	72	56	43	30	58	47	59	27	45	27	50	36	83	60	80	65
9	98	78	79	59	69	51	89	67	60	48	63	38	64	60	49	25	54	35	65	37	77	61	89	68
10	100	79	82	62	62	51	86	70	66	47	61	30	51	33	56	40	38	32	60	44	76	67	93	70
11	100	79	86	64	78	57	87	68	77	64	41	18	68	37	60	44	44	33	47	33	75	61	92	73
12	96	73	86	67	73	60	89	70	74	56	29	15	44	32	60	36	38	27	61	35	83	60	92	75
13	91	73	88	67	69	53	83	66	82	53	36	17	48	27	39	23	35	26	81	51	83	63	89	75
14	95	73	78	69	71	49	83	66	71	54	44	28	52	33	34	14	35	24	83	60	74	58	91	75
15	98	73	71	65	74	53	86	67	59	47	40	12	47	26	54	25	30	23	69	56	75	54	76	61
16	98	79	74	60	81	51	76	64	62	42	59	27	61	35	58	36	35	23	60	49	82	57	78	57
17	84	65	78	55	78	55	66	54	54	38	53	19	56	42	62	46	40	24	67	41	86	62	82	62
18	80	62	79	58	71	60	66	47	43	35	28	18	72	41	51	27	54	32	84	61	86	66	82	64
19	87	64	83	61	68	50	61	44	55	30	35	24	62	52	31	23	52	36	73	42	84	62	82	68
20	91	70	89	64	72	49	57	41	33	21	38	20	61	38	36	23	50	37	68	43	70	60	88	63
21	89	73	89	68	76	49	63	39	37	24	46	21	53	35	47	35	55	34	74	51	70	61	87	67
22	94	72	92	69	78	52	77	49	62	29	50	25	41	34	68	38	60	40	80	60	79	59	90	68
23	85	74	85	70	83	58	56	38	50	29	35	25	48	28	54	39	63	45	85	64	84	64	91	70
24	81	69	73	65	63	50	57	35	57	26	39	8	52	33	69	43	50	33	86	68	89	64	83	71
25	87	69	82	60	66	41	57	34	57	41	17	−1	60	39	63	50	55	40	74	57	84	70	86	69
26	86	69	83	62	74	48	66	37	60	45	29	6	60	38	71	48	63	46	66	49	86	68	88	69
27	80	69	84	65	79	63	68	43	63	52	42	24	67	38	65	50	65	44	66	42	76	61	84	64
28	87	67	84	66	80	62	66	48	60	31	53	30	45	30	61	23	52	40	61	50	76	60	78	65
29	87	67	86	65	84	67	69	50	35	25	53	29	46	30	29	18	54	36	59	52	80	61	78	63
30	87	67	89	66	88	60	55	38	46	25	33	22	60	29	......	......	62	38	58	40	76	60	84	64
31	92	67	81	69	......	......	46	32	......	......	34	30	44	23	......	......	56	43	......	......	86	62	......	......
Range	38°		44°		44°		58°		61°		64°		49°		57°		53°		56°		45°		36°	
Monthly mean	80°.9		75°.0		65°.0		62°.5		47°.1		32°.8		45°.9		39°.9		43°.6		58°.2		70°.3		74°.3	

Elevation of thermometers above ground, 104 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, SAINT MARK'S, FLA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	91	71	75	71	83	74	89	73	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
2	87	73	88	71	83	75	86	70	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
3	89	70	85	72	87	72	81	72	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
4	93	69	88	71	89	68	83	72	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
5	93	73	89	70	89	70	75	70	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
6	93	70	90	71	84	73	75	71	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
7	93	71	90	74	86	71	77	72	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
8	91	71	88	75	86	73	85	72	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
9	95	72	90	72	90	70	85	71	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
10	96	76	89	70	86	71	86	67	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
11	97	79	87	70	82	70	85	67	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
12	95	78	89	68	84	66	84	69	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
13	96	76	91	68	81	67	83	70	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
14	91	73	89	70	83	70	82	70	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
15	92	72	87	71	87	68	75	72	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
16	91	71	89	72	86	66	78	72	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
17	91	70	88	71	88	67	84	74	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
18	91	72	88	71	87	67	82	69	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
19	89	72	89	65	82	72	74	68	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
20	84	72	90	71	75	69	77	67	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
21	87	74	87	71	74	68	74	66	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
22	88	73	86	71	71	67	82	70	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
23	88	73	83	73	75	69	81	69	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
24	87	72	87	77	83	70	70	52	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
25	87	75	88	74	83	64	63	52	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
26	83	76	86	71	78	64	66	51	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
27	89	73	87	69	82	60	62	57	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
28	92	71	84	71	83	64	66	54	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
29	85	74	81	70	82	67	72	49	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
30	90	74	77	72	89	74	......	(*)	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
31	85	70	83	72	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Range	28°		26°		30°		......		......		......		......		......		......		......		......		......	
Monthly mean	80°.9		77°.7		75°.1		71°.5		......		......		......		......		......		......		......		......	

*Station removed to Cedar Keys, Fla.

Elevation of thermometers above ground, 11 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, SAINT PAUL, MINN.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	81	62	87	65	77	58	83	57	29	17	39	16	42	14	7	-17	32	- 4	50	31	86	45	70	49
2	82	68	78	64	78	58	73	56	30	18	35	27	37	21	25	- 5	50	10	50	34	91	50	71	48
3	81	64	80	58	76	58	78	46	27	10	34	25	46	26	18	3	48	35	49	37	85	59	75	54
4	87	60	87	65	70	47	80	51	30	12	37	30	40	24	12	-18	36	27	48	35	78	59	67	56
5	80	64	88	60	66	48	87	61	51	24	40	34	40	26	12	- 8	40	19	41	32	80	60	69	59
6	80	64	84	64	70	49	85	66	61	39	37	23	39	27	17	- 3	50	21	40	26	86	58	75	55
7	88	67	75	55	62	42	81	68	58	43	25	12	38	26	27	- 9	35	7	45	22	69	48	77	50
8	87	61	78	52	65	43	77	62	46	33	25	11	43	36	33	5	35	8	54	27	64	42	69	55
9	90	64	81	55	66	42	73	67	49	27	37	22	39	11	22	-13	33	3	72	37	63	48	73	62
10	86	67	90	61	70	48	72	50	46	32	34	11	42	8	36	5	34	9	54	34	70	45	79	63
11	91	66	89	67	64	54	74	53	48	40	11	- 3	39	5	41	27	22	4	52	28	76	43	84	67
12	91	68	75	59	68	47	72	53	49	41	2	-15	15	- 4	33	13	20	4	68	33	62	57	85	66
13	90	71	76	54	57	44	79	62	53	43	34	- 4	38	1	23	4	24	11	74	45	66	52	79	58
14	92	74	70	57	64	37	83	65	54	38	30	6	37	7	37	19	15	- 7	70	33	74	52	66	51
15	86	71	76	55	69	53	82	63	48	32	6	-11	40	6	40	17	23	2	53	23	77	50	77	47
16	85	62	79	50	66	50	74	63	42	27	16	1	43	32	44	26	22	- 4	56	38	78	54	78	54
17	81	60	77	48	58	42	63	46	40	24	2	-13	40	32	40	11	43	7	64	37	83	62	84	62
18	80	61	68	56	62	38	61	42	32	25	4	-17	48	33	16	- 1	39	31	68	44	80	64	78	65
19	81	61	82	58	63	40	61	38	39	19	14	2	40	29	20	- 3	46	24	48	34	76	52	82	61
20	92	68	83	65	64	36	69	42	25	10	11	- 1	32	25	40	13	43	23	64	34	63	47	84	64
21	88	70	87	68	66	50	68	44	31	17	20	- 6	36	25	35	14	51	33	79	43	67	40	86	67
22	91	68	89	62	70	46	54	41	45	25	17	- 7	35	22	43	26	62	28	58	38	72	48	87	69
23	76	62	85	65	61	43	49	34	30	14	5	-11	26	9	46	23	47	27	52	41	59	47	87	65
24	74	57	78	62	67	36	51	28	49	17	4	-19	36	14	59	37	40	28	46	36	76	55	88	62
25	79	60	78	60	68	38	57	35	35	20	- 5	-39	43	16	45	28	38	28	47	36	84	67	85	64
26	79	59	84	60	71	47	64	44	35	25	15	-20	44	26	44	28	48	35	61	34	74	59	88	62
27	86	59	86	64	72	60	57	41	34	29	23	8	27	15	36	23	44	39	62	35	68	45	78	65
28	81	62	87	69	68	54	51	38	30	20	25	12	15	- 3	23	11	52	36	56	49	85	47	77	59
29	87	54	92	68	77	55	48	35	26	13	18	1	21	3	11	- 3	54	31	54	37	69	56	78	58
30	88	63	90	63	77	60	44	26	37	15	16	- 6	21	zero.	......	......	57	35	59	32	73	53	77	56
31	89	63	80	62	......	......	35	17	......	......	25	9	24	-12	......	......	48	36	......	......	67	48	......	......
Range	38°		44°		42°		70°		51°		79°		60°		77°		69°		57°		51°		41°	
Monthly mean	73°.5		70°.2		57°.1		57°.2		32°.6		11°.9		26°.1		20°.9		29°.2		45°.2		63°.1		68°.0	

Elevation of thermometers above ground, 32 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, SYDNEY, CANADA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	60.0	46.8	81.3	59.1	60.6	54.0	73.7	57.3	42.7	33.4	26.8	20.6	26.0	— 2.0	29.0	12.0	42.3	19.0	32.4	27.0	52.0	34.2	67.1	46.5
2	67.2	45.0	83.0	62.4	60.8	54.2	73.4	57.0	38.7	26.3	38.0	23.0	35.0	9.3	16.4	— 3.8	21.1	7.3	35.3	19.7	50.4	30.8	67.2	46.0
3	77.1	46.8	83.3	60.4	65.6	53.0	70.0	47.5	36.8	26.0	39.4	30.3	34.6	— 6.6	20.6	— 3.4	20.3	7.6	51.9	12.4	54.6	36.0	49.0	43.8
4	75.0	48.7	71.1	52.5	59.6	54.1	65.0	41.9	40.2	31.4	49.1	36.0	36.0	—13.6	32.5	8.0	36.0	15.0	45.0	33.0	47.0	30.2	47.4	39.6
5	57.0	39.3	78.0	48.3	64.9	55.0	52.5	38.4	37.2	21.5	38.0	27.7	36.0	13.4	21.4	6.6	32.6	19.0	48.5	37.0	51.7	27.1	44.1	39.0
6	60.3	33.4	73.6	55.0	63.0	58.0	46.6	34.6	36.2	20.8	34.6	21.3	29.8	— 5.8	31.1	— 3.3	24.8	14.6	45.0	27.8	50.6	36.8	50.6	39.6
7	65.0	33.9	67.0	54.5	66.0	56.3	48.0	30.8	35.4	24.2	52.6	34.1	36.0	9.4	22.0	— 9.5	22.0	2.0	34.0	19.8	39.9	28.7	54.4	40.1
8	73.6	36.6	65.0	50.3	77.0	57.6	51.0	46.2	39.8	19.5	46.2	33.0	31.9	7.0	12.6	—11.8	33.5	— 0.8	28.5	11.8	42.3	28.0	54.0	42.8
9	60.0	55.4	65.3	50.8	68.0	54.0	55.6	48.0	46.0	36.4	33.8	23.5	26.3	— 1.0	36.2	1.0	8.4	—11.9	32.4	10.0	53.0	30.0	63.7	42.7
10	69.5	51.4	65.0	54.7	68.6	50.0	49.7	38.0	53.8	40.2	28.8	22.6	43.0	9.0	4.9	— 7.2	22.8	— 7.0	41.3	24.4	51.0	36.3	62.6	46.0
11	70.0	51.0	73.0	49.6	62.7	48.5	42.7	34.2	42.0	33.4	48.6	27.2	36.8	15.2	22.7	— 2.4	17.9	— 7.6	44.0	30.0	68.7	36.2	75.2	45.0
12	74.4	51.3	74.0	47.3	64.6	43.1	46.5	36.3	40.2	32.4	46.0	31.0	33.2	12.0	32.2	— 8.7	10.0	—24.2	36.4	21.3	67.2	33.0	61.4	43.6
13	75.9	49.3	79.1	47.4	68.6	42.3	49.9	34.7	36.9	32.0	32.6	20.6	32.2	19.5	43.3	23.0	12.1	—14.7	34.1	17.6	45.4	35.0	68.2	42.7
14	74.2	54.1	73.6	57.0	69.1	43.0	49.0	40.9	40.1	27.2	27.5	20.1	20.8	4.0	26.0	16.0	20.5	—17.0	37.4	20.6	38.6	32.4	61.2	44.0
15	73.3	56.5	70.3	48.0	68.5	54.7	48.0	41.2	55.1	36.5	35.9	23.6	23.0	1.8	18.9	0.6	22.4	— 8.7	36.0	18.8	46.2	32.4	46.9	42.7
16	59.2	50.5	67.8	44.1	67.0	49.7	53.0	43.0	55.7	32.7	35.8	24.3	27.6	17.8	25.6	15.0	26.7	— 9.4	46.9	27.4	58.0	31.2	60.5	41.3
17	58.5	47.0	64.0	50.6	72.0	57.6	49.0	35.2	43.8	29.4	26.9	20.2	32.1	22.6	22.0	1.4	23.1	8.6	33.0	23.7	51.9	26.9	70.1	39.8
18	58.2	49.4	64.6	44.5	65.9	50.0	59.1	32.7	37.8	31.0	23.0	10.5	37.5	30.3	37.8	2.2	29.1	— 3.3	29.6	25.6	58.0	27.0	76.4	35.8
19	58.2	47.5	61.0	52.0	66.3	47.2	63.4	40.4	33.0	29.4	18.6	7.2	44.1	28.0	44.0	16.2	31.4	— 7.0	38.8	24.4	54.0	22.8	77.9	48.0
20	59.3	42.5	62.4	43.5	61.5	52.0	42.2	34.3	49.1	25.0	32.0	4.0	31.6	15.0	16.7	4.0	25.0	4.2	48.7	28.3	53.1	35.7	79.9	48.6
21	68.4	37.0	72.0	47.6	63.8	41.5	43.5	32.7	40.7	29.0	26.0	— 1.0	34.6	14.8	32.0	9.1	26.5	7.7	48.0	27.0	70.9	45.0	70.1	53.5
22	70.4	54.2	74.6	55.4	59.9	37.8	58.4	33.6	30.0	16.0	20.0	— 0.6	31.0	7.5	38.0	14.8	35.0	2.0	56.4	22.6	56.6	38.0	54.7	45.4
23	75.1	54.0	65.1	55.1	61.8	46.7	60.9	42.5	45.6	13.5	33.1	18.7	41.0	1.2	28.5	9.5	35.0	19.0	47.2	28.6	74.0	38.9	50.2	43.6
24	67.7	57.0	77.3	58.0	68.2	53.3	60.0	39.8	47.0	32.4	25.2	16.5	41.8	32.4	29.0	2.0	32.7	24.0	40.0	24.6	72.3	45.0	57.9	41.8
25	68.7	51.0	69.0	55.7	61.3	42.0	49.5	28.5	33.8	26.8	33.0	15.5	33.3	11.7	32.6	26.6	37.3	26.5	47.2	20.5	48.1	37.0	62.4	39.6
26	72.0	45.5	61.1	44.6	52.3	32.5	42.0	27.0	37.9	29.9	16.0	— 2.6	29.9	3.3	45.4	29.0	27.1	16.6	46.2	23.0	46.4	37.4	72.9	43.0
27	60.8	40.8	66.2	40.7	58.0	31.7	52.8	28.0	32.6	27.9	11.9	— 1.8	36.0	8.0	41.9	31.4	23.5	1.0	54.9	31.2	62.8	40.5	09.0	48.7
28	63.1	46.3	68.2	38.2	66.2	55.1	53.5	29.8	40.9	25.0	31.0	— 1.6	43.0	33.4	37.3	28.4	32.9	— 0.7	41.5	26.6	71.9	45.5	76.7	45.0
29	70.1	41.3	58.5	44.8	69.1	52.8	50.3	37.8	53.5	40.0	38.9	28.6	39.8	5.8	45.5	29.6	27.6	18.0	52.7	25.3	61.7	38.0	77.6	52.8
30	76.0	56.0	64.5	54.6	72.1	56.3	55.1	42.8	50.7	25.0	37.4	6.0	24.0	5.1	......	......	34.0	21.0	49.0	32.0	60.7	33.0	85.0	56.2
31	76.7	60.0	64.7	54.3	......	......	48.7	39.6	......	......	8.5	— 9.0	41.3	23.3	......	......	35.2	29.3	....	....	59.9	33.3	......	......
Range	43°.7		45°.1		45°.3		46°.7		42°.2		61°.6		57°.7		57°.3		66°.5		46°.4		51°.2		49°.2	

Maximum, minimum and mean temperatures—Continued.

STATION, THATCHER'S ISLAND, MASS.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	74	57	78	63	76	59	81	58	44	30	43	19	34	10	34	2	39	32	49	20	48	31	78	53
2	77	57	83	66	77	63	70	59	48	28	54	35	47	30	19	—4	39	26	60	32	50	42	62	49
3	85	62	85	66	67	62	80	56	46	30	57	42	41	25	35	9	47	27	51	38	60	41	65	52
4	85	63	76	65	63	59	67	53	36	27	54	41	46	31	28	14	57	39	52	38	75	45	65	50
5	67	55	79	64	67	56	72	52	36	24	44	39	45	24	31	18	66	39	61	42	74	46	69	50
6	70	52	85	65	71	55	64	51	43	28	50	38	42	24	37	24	47	29	56	38	74	44	62	52
7	64	55	77	57	72	59	65	50	43	37	56	44	41	32	34	19	41	30	40	29	55	41	62	54
8	61	54	67	60	74	63	80	58	56	36	48	40	43	31	32	15	36	24	44	27	66	43	57	49
9	76	53	69	60	72	54	71	59	59	46	46	33	43	35	32	7	34	19	47	28	64	46	60	49
10	76	52	74	54	72	56	62	54	60	42	47	34	48	30	34	6	44	20	54	37	64	43	70	49
11	82	50	74	56	70	56	57	50	52	41	54	44	46	26	41	20	29	23	50	27	72	49	74	54
12	78	60	78	59	67	54	60	51	54	48	43	32	53	35	43	30	35	22	35	25	68	44	82	61
13	78	58	78	62	67	56	65	53	52	40	34	26	35	20	47	38	31	20	56	32	62	43	81	59
14	74	58	78	59	65	60	67	45	52	45	42	30	32	19	48	34	37	20	44	35	51	41	66	56
15	81	58	69	51	70	51	67	50	60	45	48	35	39	29	40	27	46	30	54	33	62	42	67	56
16	86	60	64	55	59	55	75	54	60	45	38	29	40	35	40	27	42	31	52	39	65	47	73	57
17	75	56	63	55	70	55	61	57	52	40	40	27	47	31	47	30	39	27	42	34	74	47	75	54
18	75	56	60	57	66	50	62	55	50	34	27	12	42	34	50	37	41	23	52	32	63	48	73	59
19	70	57	72	57	66	54	60	39	44	30	39	22	45	35	47	18	44	29	50	37	60	46	74	61
20	70	55	72	58	67	52	52	34	42	24	42	26	45	32	28	5	47	31	57	40	70	52	75	57
21	71	56	73	58	60	49	64	42	24	14	31	7	42	20	41	22	43	29	56	39	70	50	77	57
22	70	54	75	61	60	54	59	52	38	12	39	12	42	20	46	27	48	26	55	40	64	52	67	57
23	67	56	82	62	64	54	63	55	46	34	34	17	47	36	41	31	48	27	53	39	67	51	75	54
24	76	55	78	61	66	52	56	34	36	26	42	32	40	31	35	20	37	19	55	36	73	49	78	53
25	74	52	70	61	56	40	39	29	46	31	39	20	39	31	46	26	30	15	52	38	70	57	79	60
26	65	60	64	55	63	46	55	28	43	32	20	4	45	30	47	36	36	19	52	41	78	55	86	61
27	74	55	60	57	61	47	56	43	46	36	23	10	46	35	51	33	44	30	56	44	80	62	84	62
28	70	60	64	56	61	47	56	46	52	42	42	20	60	35	47	36	34	28	52	40	86	59	77	63
29	78	59	69	54	64	53	58	46	52	31	46	36	40	19	60	40	37	27	58	42	70	55	86	62
30	77	62	69	58	79	54	57	44	32	20	44	20	45	19	......	......	36	29	65	39	60	50	84	59
31	80	64	78	57	......	......	49	35	......	......	29	13	50	30	......	......	45	32	......	......	62	53	......	......
Range	36°		34°		39°		53°		48°		53°		50°		64°		51°		45°		55°		37°	
Monthly mean	64°.9		65°.5		59°.8		55°.3		40°.6		35°.1		36°.8		32°.4		34°.1		44°.0		57°.1		64°.7	

Elevation of thermometers above ground, 7 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, TOLEDO, OHIO.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	82	63	90	69	83	65	82	64	46	29	50	34	41	25	34	17	39	25	56	42	64	38	62	57
2	89	69	91	73	74	64	84	68	42	31	51	42	44	36	30	11	48	32	59	43	75	54	71	54
3	90	73	86	70	74	66	73	61	36	24	53	41	57	33	29	19	53	41	64	57	79	57	71	58
4	85	68	81	69	74	60	74	51	40	19	48	37	57	38	32	19	62	50	64	54	78	60	75	60
5	76	56	84	69	68	49	83	63	37	27	61	40	40	32	34	19	61	40	59	49	81	61	76	66
6	84	60	78	66	73	57	82	66	44	32	64	43	56	37	38	20	51	35	52	37	73	61	77	66
7	81	72	84	68	69	53	83	65	64	41	59	36	42	35	36	26	51	33	39	32	85	58	71	58
8	86	71	72	58	62	49	77	67	69	55	47	32	42	36	44	22	33	17	47	30	86	69	73	60
9	81	65	68	50	59	45	80	67	65	47	54	33	59	40	42	18	45	26	59	35	80	68	74	62
10	82	68	76	54	61	44	83	68	52	40	65	40	42	33	49	22	36	23	61	33	73	61	87	66
11	93	71	81	63	68	51	78	66	70	47	40	23	62	37	52	31	41	26	39	30	71	57	92	73
12	76	63	80	64	69	54	83	66	69	51	29	22	40	31	55	45	38	19	53	30	74	53	90	76
13	82	65	77	65	71	53	71	64	70	51	32	19	38	25	47	32	39	22	72	42	63	47	85	68
14	91	71	78	63	59	51	67	64	65	60	39	28	42	27	43	32	38	28	76	57	57	46	69	54
15	93	71	68	56	64	48	74	64	62	49	35	21	37	29	38	31	39	25	68	50	62	46	66	54
16	91	71	67	52	69	53	75	62	57	42	34	15	52	36	51	33	37	27	59	41	77	50	74	52
17	75	60	70	47	68	49	75	68	49	33	29	19	57	45	57	46	39	25	59	37	83	59	75	56
18	75	57	71	53	61	52	68	50	39	31	23	11	51	39	56	28	46	30	59	43	86	63	78	54
19	74	58	75	56	62	43	54	43	43	30	31	19	56	37	28	18	44	37	68	46	85	66	81	59
20	81	57	79	59	61	45	60	40	32	22	32	19	38	34	35	18	46	35	61	42	77	63	84	63
21	88	60	85	65	61	45	60	46	29	20	29	15	44	35	41	32	50	30	71	50	67	57	86	67
22	80	70	87	70	71	54	65	54	40	21	40	25	45	35	49	32	55	36	71	44	70	55	87	67
23	86	70	83	67	74	54	63	39	42	28	36	19	37	32	41	35	55	30	44	40	80	60	89	70
24	76	64	72	65	52	44	44	33	38	21	44	30	44	30	52	34	32	20	46	40	83	64	90	71
25	78	65	70	59	59	40	53	31	44	34	30	9	47	34	57	50	46	25	55	43	84	69	85	72
26	82	68	70	52	65	45	59	35	42	27	13	3	51	38	59	43	51	36	64	47	85	66	84	69
27	82	66	75	56	63	54	61	45	59	39	36	10	56	38	57	42	58	45	56	43	84	64	84	71
28	84	67	80	61	75	60	55	46	58	37	41	28	56	31	64	44	50	35	65	46	73	59	80	70
29	83	69	86	66	78	62	62	46	40	30	48	39	33	21	58	27	42	34	62	50	67	59	75	64
30	82	62	90	69	80	61	53	38	38	24	42	25	56	32	......	......	48	33	54	40	73	58	78	61
31	85	64	90	69	......	......	42	32	......	......	37	26	37	26	......	......	56	34	......	......	78	56	......	......
Range	37°		44°		43°		53°		51°		62°		41°		53°		45°		46°		48°		40°	
Monthly mean	75°.7		71°.4		60°.5		61°.0		42°.5		33° 6		40°.5		36°.5		38°.4		50°.9		68°.1		72°.3	

Elevation of thermometers above ground, 63 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, TORONTO, CANADA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	78.4	49.5	86.4	60.5	85.1	62.5	69.6	54.5	......	......	43.8	30.9	36.2	26.6	29.4	4.3	30.2	23.4	51.1	28.8	46.1	27.8	61.3	43.0
2	84.9	56.0	83.1	65.4	73.3	65.5	65.4	43.0	33.2	23.6	42.6	32.3	40.9	26.2	21.8	3.9	36.9	23.0	44.3	29.6	62.2	39.5	63.2	41.5
3	78.1	56.5	79.0	63.7	71.0	64.9	66.6	42.4	30.6	21.4	37.5	26.8	36.2	19.6	18.3	12.7	43.6	30.6	52.1	40.5	70.5	40.9	67.5	50.9
4	78.0	58.8	76.1	53.1	71.2	57.7	62.0	39.2	28.4	19.0	31.8	24.3	43.1	32.5	26.7	7.9	50.1	35.5	55.3	40.5	63.2	50.3	63.7	44.8
5	71.1	54.9	82.5	60.3	71.1	48.8	71.1	48.1	34.4	22.6	43.1	25.8	35.6	25.8	28.4	14.8	49.1	31.3	47.2	31.6	71.5	43.5	65.0	52.8
6	79.8	55.3	81.2	57.5	69.2	45.5	72.5	55.5	35.6	24.9	48.9	40.5	39.9	31.9	24.8	11.7	37.4	27.5	38.2	27.8	65.0	43.5	71.7	55.3
7	78.0	62.7	75.1	56.5	66.4	48.0	71.9	52.7	46.2	25.5	45.3	35.3	37.0	30.1	27.3	11.8	41.1	21.0	34.7	22.1	49.5	42.0	63.8	48.8
8	81.1	61.7	67.9	52.8	61.6	51.5	70.3	57.2	57.1	38.5	36.2	29.0	38.0	33.5	36.2	8.2	21.5	6.7	39.3	23.6	67.0	43.3	68.2	45.9
9	80.2	56.9	67.2	48.7	60.6	41.0	73.6	62.5	64.0	42.1	39.8	28.4	48.1	34.5	29.1	3.3	31.2	15.7	49.5	30.0	75.9	50.5	70.1	52.9
10	76.3	61.7	67.5	45.5	58.8	39.1	72.3	62.0	49.5	35.0	50.1	38.7	41.2	28.8	28.9	4.9	30.2	11.8	53.7	26.2	71.1	54.5	70.5	55.5
11	69.7	60.3	72.9	53.3	63.2	39.9	71.8	59.7	57.1	36.5	41.7	25.4	53.6	32.1	38.3	11.8	32.2	11.8	29.2	19.6	68.0	47.5	80.4	59.3
12	77.4	61.5	75.1	57.0	66.5	43.5	75.1	59.0	58.0	44.5	26.2	21.0	35.5	21.6	51.6	35.5	31.4	10.8	39.2	22.6	66.5	45.3	79.9	63.7
13	82.9	59.1	78.1	61.5	67.4	48.5	67.2	46.0	48.8	42.5	29.0	17.7	33.2	18.0	37.1	27.0	30.7	13.8	58.2	33.3	55.7	39.5	78.8	57.3
14	89.5	62.5	69.9	56.5	56.2	45.0	61.4	44.5	58.0	45.5	34.4	26.0	37.6	32.5	30.2	21.6	33.8	24.9	48.1	36.7	52.5	39.3	63.8	52.0
15	86.9	65.1	63.0	51.0	60.0	37.3	72.7	49.7	54.5	37.5	35.2	27.4	35.2	24.5	35.2	27.5	36.4	22.6	65.0	38.5	63.0	37.5	71.1	55.1
16	82.7	62.3	56.8	51.1	66.6	53.1	74.5	54.3	48.1	36.7	28.3	15.7	41.2	28.0	41.3	26.0	29.2	25.8	40.1	29.3	81.1	50.3	79.0	58.9
17	71.6	56.5	64.4	54.7	63.2	46.0	71.8	58.5	42.3	31.7	21.8	11.8	43.9	34.5	46.9	32.1	29.6	16.2	46.5	31.4	76.9	53.0	78.0	58.0
18	73.2	57.0	71.9	54.7	59.3	43.9	66.0	51.5	33.2	27.0	18.3	9.2	40.1	33.5	46.6	21.6	35.6	13.7	41.9	29.6	65.0	52.5	81.3	50.9
19	71.6	54.5	75.1	54.0	59.3	40.3	52.5	39.1	39.1	28.0	20.5	14.7	41.2	32.8	23.8	13.8	38.7	23.6	63.2	39.5	72.9	48.5	81.0	54.7
20	78.1	53.5	77.8	52.9	59.2	38.5	63.0	38.0	34.2	8.9	30.0	2.9	36.9	18.2	26.8	9.8	37.6	22.2	57.0	37.2	75.1	55.5	83.4	62.5
21	82.5	56.9	76.9	57.7	57.6	35.5	59.9	35.7	21.8	3.8	16.3	— 8.9	30.7	14.0	37.2	24.4	39.1	16.7	63.2	40.5	67.0	54.5	79.9	65.0
22	74.1	64.5	81.9	64.7	63.8	45.0	62.6	54.5	36.3	18.6	36.7	16.0	38.2	28.8	36.0	23.2	45.9	29.3	64.4	40.0	63.8	51.8	72.1	59.5
23	81.1	65.5	80.9	57.9	71.1	48.9	58.2	34.0	36.6	22.6	32.8	13.6	35.7	26.2	34.4	20.8	48.5	19.6	41.1	31.4	72.1	45.7	87.9	57.2
24	70.1	58.9	73.6	53.3	57.0	37.3	35.2	24.6	36.2	23.1	36.2	22.6	30.7	21.6	36.2	20.6	20.6	9.6	46.6	36.7	77.1	57.5	89.9	65.7
25	69.5	57.5	67.5	51.5	54.0	34.0	45.1	21.0	40.5	33.7	23.1	1.2	39.2	27.8	43.3	35.0	28.8	9.1	44.5	38.1	82.9	54.3	78.5	66.7
26	78.1	64.5	72.3	56.0	58.8	33.5	(*)	(*)	38.2	30.6	14.3	2.4	40.3	26.8	45.9	32.7	37.1	21.6	59.0	40.5	85.7	61.8	82.7	64.3
27	80.3	61.8	72.1	57.5	62.0	42.0	......	......	48.9	31.9	29.2	6.9	41.8	32.0	48.1	32.3	37.3	31.5	52.1	37.0	82.4	60.5	80.4	60.9
28	80.6	57.5	78.1	53.5	61.6	36.4	......	......	52.9	34.9	34.8	25.3	38.2	23.6	46.3	34.9	38.2	28.8	63.2	38.0	67.6	47.9	81.4	64.8
29	79.9	60.5	77.8	56.5	65.0	37.1	......	......	36.0	19.6	40.2	27.8	24.9	11.2	51.1	25.0	36.0	25.6	53.3	42.7	66.0	43.3	75.1	59.5
30	76.6	55.0	74.4	59.8	66.6	49.7	......	......	32.0	13.0	28.2	4.4	46.1	23.4	......	......	42.8	26.2	47.3	30.8	67.8	50.5	74.5	58.3
31	81.9	57.5	82.7	56.9	......	......	......	......	......	......	30.2	3.9	38.6	25.6	......	......	51.9	30.3	......	......	71.1	55.3	......	......
Range	40°.0		40°.9		51°.6		......	......	......	......	59°.0		42°.4		48°.3		45°.2		45°.4		57°.9		48°.4	

* Report missing.

Maximum, minimum and mean temperatures—Continued.

STATION, TUCSON, ARIZ.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	100	72	99	84	98	77	83	70	77	52	74	44	63	42	48	30	70	35	76	47	86	51	99	60
2	95	67	91	77	98	80	80	70	78	50	70	40	65	38	58	29	78	39	76	46	89	49	106	62
3	100	70	95	78	99	79	85	74	76	50	67	40	65	40	57	30	78	40	76	45	89	57	102	66
4	92	70	90	74	99	79	86	75	78	54	64	40	62	40	45	20	70	40	76	48	93	59	97	68
5	96	79	95	76	96	77	81	72	77	46	63	34	70	40	55	25	70	42	87	52	93	59	96	72
6	95	83	90	78	98	75	82	72	76	45	66	38	64	44	58	26	68	47	83	55	88	57	100	69
7	94	79	85	75	93	76	82	69	78	48	68	42	72	52	65	30	70	41	79	49	88	57	102	70
8	94	80	92	77	97	78	71	58	68	42	72	44	75	49	71	38	70	37	81	46	89	59	101	68
9	84	75	88	76	94	77	70	45	65	52	70	40	67	47	70	35	76	42	81	59	91	55	99	72
10	85	76	88	74	90	78	79	53	60	51	61	(*)	66	43	70	42	70	42	83	57	93	58	95	72
11	81	77	92	75	97	76	85	58	58	40	57	......	60	41	72	33	70	43	86	53	93	59	98	63
12	90	70	91	74	95	76	91	59	65	41	61	......	60	33	52	30	71	47	88	55	87	59	98	63
13	86	75	95	72	94	79	85	69	65	42	74	......	72	50	68	30	68	39	81	49	79	54	95	64
14	93	74	96	76	90	79	62	56	60	41	59	......	69	40	60	29	62	37	73	46	78	44	99	63
15	94	73	96	78	90	74	64	44	70	40	69	......	72	40	70	30	55	38	69	52	86	50	105	65
16	92	78	96	82	91	73	69	44	70	44	72	......	73	39	70	30	63	35	78	45	93	54	108	68
17	95	74	96	80	93	74	78	46	65	45	74	......	73	38	62	40	60	43	76	45	87	53	110	72
18	93	74	91	76	93	74	85	61	55	50	72	......	76	50	65	30	55	40	58	41	90	54	109	80
19	95	79	94	79	93	78	83	61	70	45	74	......	77	42	70	40	62	35	69	36	94	55	91	79
20	97	81	94	80	95	76	82	59	75	54	64	......	76	42	70	50	72	34	80	39	104	58	93	73
21	99	82	94	79	92	77	85	53	75	43	65	......	70	40	77	38	72	35	80	51	99	65	97	76
22	94	80	95	80	92	77	85	53	75	44	65	44	63	37	65	48	87	38	84	51	99	62	101	78
23	97	79	94	77	91	73	85	53	75	46	58	38	70	35	59	50	84	42	75	48	96	66	103	79
24	100	83	93	75	92	74	85	65	66	39	50	30	77	32	60	44	80	45	68	44	96	68	104	78
25	100	84	97	76	90	72	82	54	68	40	46	22	77	32	58	33	75	59	76	39	89	67	105	75
26	100	84	98	79	88	74	78	51	70	50	63	29	78	34	66	35	61	45	83	45	83	67	105	73
27	88	82	93	81	79	68	74	59	56	45	69	39	53	40	65	37	72	35	85	49	88	63	106	70
28	98	79	93	82	74	64	81	57	60	31	63	49	59	34	68	38	82	43	84	49	89	62	109	73
29	100	82	94	80	78	69	70	59	68	38	70	37	41	30	70	37	79	46	85	53	100	60	108	71
30	96	80	95	76	31	69	72	54	73	42	58	40	40	14	......	......	74	44	81	50	100	62	110	68
31	98	81	92	79	......	......	75	53	......	......	55	30	55	18	......	......	77	52	......	......	99	60	......	......
Range	33°		27°		35°		47°		47°		......	......	64°		57°		52°		52°		60°		50°	

*Minimum thermometer unserviceable.

Elevation of thermometers above ground, 6 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, UMATILLA, OREG.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	86.0	52.0	84.0	51.0	82.5	66.0	70.5	47.0	50.0	17.0	48.0	35.5	44.5	37.0	45.0	20.0	64.5	35.5	54.0	30.0	82.0	50.0	81.0	56.5
2	86.5	54.0	90.0	48.0	83.0	52.0	68.0	42.0	52.0	19.0	50.5	40.0	52.5	30.0	46.0	16.0	51.0	28.5	48.0	39.0	72.0	55.0	76.0	50.0
3	81.0	57.0	94.0	53.5	89.0	52.0	72.0	52.0	57.0	22.5	54.0	36.0	45.0	34.0	46.0	18.0	48.0	31.0	55.0	41.0	65.0	43.0	68.0	51.0
4	73.0	53.0	99.0	52.0	90.0	55.0	73.0	49.0	55.3	32.5	49.0	33.0	56.5	30.0	46.0	20.0	45.0	27.0	53.0	35.0	59.5	42.0	75.0	47.0
5	75.0	41.0	99.0	58.0	95.0	54.5	65.5	47.0	61.5	43.5	49.0	37.0	41.0	33.0	48.0	22.0	53.0	39.0	56.0	30.0	59.0	41.0	71.0	50.5
6	84.0	50.5	100.0	61.5	88.0	57.0	61.0	37.0	58.0	44.0	45.5	33.0	60.0	31.0	47.0	20.0	53.5	39.0	65.0	29.0	62.0	40.0	77.0	56.5
7	90.0	48.0	103.0	61.0	88.0	59.0	56.5	38.0	51.0	30.0	44.0	29.0	63.0	41.0	47.0	24.0	55.0	40.0	71.0	32.0	61.5	47.5	69.0	56.0
8	95.0	51.0	102.0	72.0	85.0	57.5	59.0	38.5	50.0	33.0	37.5	22.0	47.0	33.0	48.0	17.0	52.5	24.0	77.0	34.0	62.0	42.5	68.0	51.0
9	92.0	60.0	104.0	72.0	72.0	52.0	60.0	46.0	50.0	38.0	37.5	23.0	58.0	32.5	53.0	21.0	55.0	25.5	84.5	44.0	63.0	41.0	72.0	47.0
10	82.0	61.0	103.0	68.0	73.0	45.5	61.0	45.0	51.0	29.0	35.5	23.0	39.0	27.5	45.0	24.0	60.0	32.0	70.5	50.5	60.0	45.0	72.0	52.5
11	78.0	60.0	97.0	66.0	80.0	41.0	57.0	40.0	52.0	40.0	37.5	24.5	38.0	22.0	48.0	16.0	46.0	30.5	62.0	46.5	64.0	47.0	83.0	51.0
12	71.5	44.0	98.0	66.0	85.0	45.0	62.0	34.5	54.0	34.0	44.0	19.0	33.0	20.0	53.0	32.0	33.5	17.0	54.0	43.5	59.5	41.5	86.5	52.0
13	84.0	43.5	98.0	69.0	86.0	52.0	61.0	32.5	52.0	29.0	58.0	37.0	55.0	28.0	47.5	31.0	39.0	17.5	58.0	41.5	63.5	46.0	74.0	52.5
14	86.5	57.0	99.0	60.0	90.0	57.0	64.0	40.0	56.0	38.0	58.0	49.0	58.0	35.0	51.0	38.0	44.0	11.5	62.5	40.0	67.0	40.0	74.5	49.0
15	78.0	56.0	100.0	66.0	94.0	58.0	65.0	46.0	53.0	34.0	58.0	45.0	58.0	41.0	47.0	32.0	46.0	15.0	58.0	38.5	70.5	46.0	83.5	44.5
16	83.5	47.5	94.0	67.5	92.5	58.0	62.0	37.0	50.5	27.0	55.0	31.0	56.0	40.0	41.5	24.0	45.0	33.0	57.0	34.5	78.5	44.5	82.0	50.0
17	88.5	53.0	90.5	61.5	91.5	56.0	75.0	40.0	48.5	24.0	43.5	31.0	61.5	45.0	40.0	16.0	50.0	35.0	59.0	34.0	76.0	46.0	75.0	54.0
18	88.0	57.0	92.0	55.0	90.0	54.0	70.0	35.0	43.0	18.0	38.5	26.0	51.0	33.0	44.5	31.0	58.0	37.0	62.0	38.5	73.0	48.0	72.0	57.0
19	92.0	56.0	90.0	60.0	90.0	53.5	73.5	37.0	42.0	19.0	28.5	15.0	48.0	36.0	40.0	25.0	57.5	29.5	59.0	43.0	79.5	49.0	66.5	50.0
20	91.0	67.5	82.0	61.0	94.0	58.0	70.0	49.0	41.0	17.0	23.0	11.5	51.5	38.0	34.0	14.0	60.0	30.0	62.0	38.0	72.5	58.0	72.0	51.0
21	90.0	60.5	81.5	63.5	90.0	56.5	64.0	41.5	42.0	15.5	19.0	8.5	(*)	(*)	34.0	22.5	66.0	32.0	62.0	46·0	62.5	48.0	79.0	53.5
22	92.0	66.5	79.0	57.0	91.5	52.0	61.0	32.0	34.5	17.5	18.0	— 8.0	......	......	35.0	24.0	67.0	36.0	62.0	41.0	66.0	50.0	90.0	50.0
23	93.5	62.5	79.0	52.0	88.0	51.0	59.3	28.0	33.0	26.0	—2.0	—22.0	50.0	31.0	41.5	26.0	66.0	32.5	65.0	45.5	62.0	45.0	97.0	56.0
24	97.0	62.5	78.5	50.0	79.0	53.0	64.3	40.0	36.0	25.5	8.5	—15.0	58.0	39.5	47.0	32.5	69.0	35.0	68.0	45.0	69.0	42.5	103.0	59.0
25	94.5	70.5	87.5	45.5	81.5	56.0	66.0	47.0	35.0	27.0	15.5	— 2.0	44.0	31.0	52.0	40.5	55.0	35.0	73.0	41.0	78.0	41.5	96.0	61.0
26	100.0	68.0	84.0	51.5	82.0	54.0	70.0	37.0	39.0	24.0	26.0	11.0	43.0	26.0	47.5	30.0	56.5	37.5	77.0	45.0	80.5	42.0	93.0	61.0
27	104.0	69.0	76.0	61.5	76.0	57.0	72.0	40.0	37.0	17.0	32.5	17.0	39.0	25.0	31.5	15.0	62.5	40.0	78.0	42.0	89.5	50.5	96.0	59.0
28	104.0	62.0	76.0	57.0	71.0	55.0	70.0	37.0	36.0	25.0	28.0	13.5	39.0	21.5	38.0	15.5	52.0	34.0	82.5	41.0	78.0	55.0	97.0	61.0
29	99.0	70.5	82.5	55.0	67.0	43.0	57.0	44.5	37.0	21.0	23.5	10.0	40.0	22.0	52.5	32.0	50.5	23.5	87.5	45.0	67.0	46.5	93.0	69.0
30	91.0	64.0	88.0	57.5	60.0	40.0	54.5	20.5	43.0	29.0	37.0	5.0	45.0	18.0	......	......	52.0	34.0	89.0	50.5	77.5	45.0	91.0	63.0
31	88.0	62.0	92.0	60.5	......	......	51.0	17.0	......	......	53.0	20.0	44.0	19.0	......	......	52.0	38.5	......	......	81.0	45.0	......	......
Range	63°		58°.5		55°		58°		46°		80°		......		39°		57°.5		60°		49°.5		58°.5	
Monthly mean	73°.3		75°.5		68°.6		51°.7		37°.6		30°.5		......		34°.3		41°.8		52°.8		57°.9		67°.5	

* Record incomplete.

Elevation of thermometers above ground, 7 feet.

The daily means are obtained by dividing the sum of the 7 a.m., 2 p.m. and *twice* the 9 p.m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, UNALASKA ISLAND, ALASKA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	......	......	......	......	......	......	......	......	......	......	35	32	31	26	32	31	33	29	35	31	42	30	(†)	......
2	......	......	......	......	......	......	......	......	......	......	33	30	30	26	32	30	44	31	37	31	46	33	......	......
3	......	......	......	......	......	......	......	......	......	......	32	27	29	25	32	29	46	38	34	32	43	34	......	......
4	......	......	......	......	......	......	......	......	......	......	29	23	28	24	32	29	39	34	33	29	42	31	......	......
5	......	......	......	......	......	......	......	......	......	......	27	23	29	25	32	29	34	32	32	28	42	29	......	......
6	......	......	......	......	......	......	......	......	......	......	30	25	27	19	33	30	33	30	32	28	35	30	......	......
7	......	......	......	......	......	......	......	......	......	......	28	23	28	24	33	29	34	30	35	32	39	30	......	......
8	......	......	......	......	......	......	......	......	......	......	27	25	28	23	32	30	33	29	33	26	49	34	......	......
9	......	......	......	......	......	......	......	......	......	......	27	25	28	25	32	29	31	28	31	25	49	34	......	......
10	......	......	......	......	......	......	......	......	......	......	29	25	28	25	32	30	34	30	33	26	49	33	......	......
11	......	......	......	......	......	......	......	......	......	......	30	28	32	24	31	29	33	27	34	30	48	36	......	......
12	......	......	......	......	......	......	......	......	......	......	32	27	33	32	30	29	41	26	33	82	49	37	......	......
13	......	......	......	......	......	......	......	......	......	......	31	26	33	30	31	29	38	35	30	32	49	38	......	......
14	......	......	......	......	......	......	......	......	......	......	32	27	31	27	31	27	37	34	34	31	52	37	......	......
15	......	......	......	......	......	......	......	......	(*)	......	33	28	31	26	31	29	37	32	35	31	41	36	......	......
16	......	......	......	......	......	......	......	......	31.0	24.0	33	30	30	25	31	28	37	31	35	31	39	33	......	......
17	......	......	......	......	......	......	......	......	34	27	33	31	32	30	32	27	37	31	34	30	41	34	......	......
18	......	......	......	......	......	......	......	......	32	26	34	32	33	32	33	30	33	27	33	29	37	35	......	......
19	......	......	......	......	......	......	......	......	32	25	33	31	33	31	33	30	30	25	33	30	41	35	......	......
20	......	......	......	......	......	......	......	......	32	27	34	31	31	26	31	30	30	24	34	29	39	33	......	......
21	......	......	......	......	......	......	......	......	35	29	34	30	27	20	31	29	31	28	35	30	42	35	......	......
22	......	......	......	......	......	......	......	......	34	29	33	32	27	24	32	30	31	26	34	26	44	34	......	......
23	......	......	......	......	......	......	......	......	34	33	33	31	31	26	42	32	33	28	40	31	38	36	......	......
24	......	......	......	......	......	......	......	......	34	31	34	30	31	30	43	37	34	29	47	37	42	36	......	......
25	......	......	......	......	......	......	......	......	36	31	33	29	34	31	41	34	33	27	50	39	44	34	......	......
26	......	......	......	......	......	......	......	......	35	32	33	30	34	32	34	30	32	26	52	30	46	30	......	......
27	......	......	......	......	......	......	......	......	36	33	33	28	33	30	32	30	34	27	42	28	48	37	......	......
28	......	......	......	......	......	......	......	......	34	28	34	30	33	30	32	29	32	30	45	33	52	38	......	......
29	......	......	......	......	......	......	......	......	34	32	33	28	35	30	32	27	32	31	46	34	52	37	......	......
30	......	......	......	......	......	......	......	......	33	30	31	27	33	29	......	......	33	31	46	32	......	......	......	......
31	......	......	......	......	......	......	......	......	......	......	33	28	32	31	......	......	33	30	......	......	......	......	......	......
Range	......	......	......	......	......	......	......	......	......	......	12°		16°		16°		22°		22°		13°		......	......

*Previous record incomplete.

†June report not yet received.

Elevation of thermometers above ground, 15 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, UVALDE, TEX.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	101	73	99	70	98	63	86	66	66	42	73	33	72	50	55	32	61	46	78	61	65	58	98	78
2	101	74	99	71	100	60	86	62	70	34	72	52	72	57	56	28	71	50	82	60	76	58	96	80
3	98	73	95	69	99	58	(*)	......	73	38	77	51	69	50	52	30	77	58	88	46	72	64	97	77
4	97	74	95	68	100	59	89	64	75	49	81	52	67	47	52	32	89	58	96	45	94	68	98	74
5	(*)	(*)	95	71	95	62	87	68	82	56	74	38	67	52	51	28	85	59	92	63	87	66	95	77
6	......	......	100	72	95	60	88	63	84	45	78	30	71	54	47	33	86	62	87	64	89	67	97	77
7	100	71	95	71	94	59	88	63	82	56	76	43	73	56	48	32	73	56	78	43	82	70	97	79
8	99	73	97	69	94	61	89	68	84	63	77	51	69	53	56	37	70	42	64	39	88	70	98	78
9	99	71	84	62	89	60	90	68	85	52	81	62	72	51	59	42	73	41	71	39	90	73	98	77
10	101	68	72	61	91	66	87	69	82	68	73	41	78	52	66	47	72	52	76	31	(*)	......	100	79
11	102	72	(*)	......	90	68	87	67	(*)	......	63	26	74	52	76	56	72	56	83	37	93	71	100	78
12	104	69	85	62	80	64	85	67	84	43	58	18	76	42	75	49	73	38	81	43	91	73	90	76
13	104	68	87	64	81	62	86	64	85	44	53	30	65	33	63	32	67	33	83	53	91	70	(*)	......
14	102	67	91	62	86	56	85	61	84	66	69	38	63	43	60	28	63	21	87	61	91	70	92	74
15	100	73	91	69	86	54	87	66	87	49	66	29	68	40	67	21	62	23	91	62	92	70	94	73
16	103	74	95	62	88	53	87	61	85	61	73	32	75	38	75	39	60	16	94	58	90	68	94	74
17	103	72	99	65	87	53	83	52	80	46	72	36	73	53	78	46	(*)	......	95	62	90	72	95	74
18	102	72	91	63	87	53	84	40	60	33	68	42	73	52	67	45	......	......	97	72	92	72	90	73
19	101	72	89	67	89	57	81	39	65	19	67	44	74	56	59	42	79	33	82	65	90	73	93	68
20	101	72	91	68	90	58	81	36	68	29	78	40	(*)	......	60	38	70	46	83	49	92	68	92	71
21	101	71	92	65	89	56	82	40	68	23	74	57	......	......	76	40	70	45	83	57	93	68	93	72
22	104	71	93	63	93	54	85	39	74	22	71	57	......	......	76	45	70	44	85	57	98	70	92	67
23	103	72	99	65	92	53	86	42	75	35	85	59	72	30	71	51	69	52	97	70	93	71	96	66
24	102	71	101	65	90	57	73	35	73	51	73	18	66	39	83	58	68	53	98	74	91	67	98	71
25	101	71	101	68	86	66	72	33	74	53	38	11	66	27	74	54	78	56	90	69	91	68	102	74
26	101	73	99	68	84	65	71	34	76	58	(*)	......	73	26	79	50	86	61	94	55	92	76	98	77
27	101	72	98	70	84	73	76	50	81	57	61	10	76	26	79	60	74	51	83	66	92	76	98	76
28	101	70	97	68	85	66	80	33	68	45	76	37	72	51	81	40	80	38	83	64	85	77	96	77
29	101	72	96	62	86	66	85	31	63	26	81	51	78	59	64	37	81	48	83	58	88	74	99	78
30	97	72	94	61	88	67	74	46	67	28	81	59	69	43	......	......	70	53	70	56	96	75	97	73
31	98	70	94	63	......	......	70	41	......	......	78	50	63	33	......	......	72	58	......	......	96	77	......	......
Range	......	......	......	......	47°		......	......	......	......	......	......	......	......	60°		......	......	69°		......	......	......	......

* Observer on repair duty.

Maximum, minimum and mean temperatures—Continued.

STATION, VICKSBURG, MISS.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	93	71	91	71	73	70	88	71	63	45	61	36	71	54	42	37	59	43	76	58	68	52	86	73
2	90	73	95	72	86	68	91	70	66	41	70	47	77	58	40	33	72	51	73	61	71	59	85	70
3	91	72	96	72	90	68	87	70	63	39.5	69	59	76	58	51	31	80	64	83	63	73	57	85	66
4	93	73	97	75	88	67	89	69	62	36	72	58	75	62	48	31	82	66	87	71	82	62	91	66
5	93	72	95	73	87	66.5	88	71	58	45.5	67	53	71	66	50	37	85	67	87	67	86	63	92	73
6	97	73	92	74	87	63	80	69	68	54	63	42	74	67	58	34	84	68	84	67	87	63	82	70
7	94	73	95	75	93	68	83	67	77	53	69	43	70	63	58	39	83	62	73	43	86	64	88	66
8	95	76	91	74	90	68	89	69	78	58	76	56	71	61	64	43	64	55	54	41	87	68	91	72
9	96	76	77	69	90	69	90	75	82	68	78	67	67	60	64	44	57	51	63	44	86	67	93	72
10	98	77	88	66	86	63	91	71.5	80	65	71	47	74	59	68	51	66	50	73	45	90	68	92	73
11	98	78	83	65	89	69	87	70	80	70	50	37	76	62	71	58	67	58	67	53	90	70	91	69
12	96	78	85	67	85	68	87	68	81	68	46	29	77	46	77	65	70	51	66	43	90	71	91	71
13	95	76	75	70	79	67	84	66	81	70	42	30	52	41	71	48	57	48	76	46	91	72	93	72
14	96	78	85	68	79	59	85	69	82	69	47	39	62	36	56	37	49	45	81	58	90	72	92	74
15	98	75	91	68	80	57	86	69	83	67	53	37	66	52	60	37	47	43	84	65	88	70	94	73
16	96	76	81	67	80	57	81	69	80	63	63	38	68	54	67	41	45	38	83	65	85	67	80	69
17	94	73	82	62	85	64	82	63	79	56	70	47	70	57	67	50	50	36	85	68	87	63	83	63
18	94	75	85	62	90	65	73	52	56	47	62	53	72	49	72	48	56	45	84	70	85	64	87	68
19	92	77	87	65	86	65	64	47	54	38	73	57	71	49	53	40	62	48	75	65	88	65	90	66
20	91	74	89	63	81	63	69	44.5	53	39	71	59	75	59	50	42	65	48	73	55	82	67	89	67
21	90	74	92	69	82	57	69	55	53	31	74	62	76	61	54	45	69	53	80	55	86	67	88	66
22	93	75	82	73	83	63	78	59.5	62	35	74	67	63	42	66	37	72	54	84	65	86	65	82	71
23	92	75	86	74	76.5	65	67	51	70	42	78	67	53	36	75	55	74	52	85	70	93	68	81	69
24	95	75	90	74	84	69	60	42	69	45	78	43	58	35	77	55	76	54	89	71	88	71	87	67
25	88	76	90	73	81	62	67	36	73	53	43	23	52	43	80	59	77	53	83	71	86	72	88	70
26	89	77	86	67	83	60	60	54	74	52	38	19	62	37	77	58	82	61	78	64	82	71	84	70
27	96	76	84	66	82	62	70	52	71	62	49	27	70	42	80	64	74	60	78	59	86	70	91	68
28	93	74	85	66.5	82	59	75	50	74	49	60	41	71	51	82	60	73	52	71	61	89	71	89	73
29	84	73	84	65	84	63	80	50	58	36	71.5	59	73	52	60	43	66	49	72	61	90	74	88	74
30	90	73	87	69	86	67	78	56	57	37	70	55	73	57	......	......	71	48	70	56	86	70	91	70
31	89	68	81	69	......	......	59	49	......	......	75	57	67	42	......	......	74	52	......	......	90	74	......	......
Range	30°		35°		36°		55°		52°		59°		42°		51°		49°		48°		41°		31°	
Monthly mean	83°.1		78°.0		74°.3		68°.4		60°.3		55°.6		59°.8		54°.5		60°.5		68°.5		76°.2		78°.4	

Elevation of thermometers above ground, 32 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, VIRGINIA CITY, MONT.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	65	43	75	52	80	48	61	36	50	20	44	32	37	27	31	10	42	23	35	16	41	69	62	35
2	68	50	80	47	71	53	66	32	52	30	42	35	38	27	23	5	37	21	46	25	57	41	70	40
3	68	50	81	50	72	45	71	41	57	28	35	19	36	28	22	6	31	12	46	24	58	32	59	46
4	84	57	83	55	73	46	72	40	48	29	28	6	32	14	24	14	27	11	40	23	56	34	47	35
5	74	52	75	58	73	48	71	58	50	35	37	15	35	29	33	12	31	8	35	20	50	26	55	35
6	72	45	81	55	80	48	63	40	49	24	27	15	38	27	32	13	31	21	42	19	38	25	63	44
7	79	47	78	55	79	52	46	32	30	15	24	3	40	22	33	17	39	11	48	22	43	27	63	42
8	83	55	86	53	79	55	33	27	28	9	13	zero.	37	24	32	8	30	10	54	21	40	27	53	36
9	85	60	88	59	73	60	38	27	35	15	15	—3	35	13	34	17	32	10	53	29	42	23	48	30
10	79	54	82	59	55	35	41	24	39	20	10	1	34	10	35	12	33	21	62	33	50	26	48	33
11	83	53	82	58	64	30	44	23	42	23	19	—4	16	7	26	8	22	—15	63	40	68	43	48	38
12	73	59	77	61	66	40	62	39	30	10	30	19	24	12	23	—4	—8	—22	63	40	70	44	60	37
13	70	47	81	53	77	42	59	44	29	14	30	26	40	20	20	10	1	—22	50	21	53	37	68	40
14	74	53	85	60	73	46	56	33	31	18	40	27	40	22	35	16	12	—9	36	21	40	32	73	44
15	85	56	85	62	78	45	45	30	33	20	40	37	47	38	37	20	15	—2	42	20	56	33	61	35
16	84	54	86	59	78	44	49	25	29	13	37	—4	40	30	20	—2	27	4	35	23	62	34	73	43
17	85	55	79	59	70	50	57	33	29	10	17	—5	47	34	12	—7	25	10	35	18	53	37	82	47
18	83	55	80	50	69	43	64	34	40	9	22	—2	47	29	21	—5	30	18	34	21	54	34	86	53
19	79	57	80	55	73	48	64	36	40	17	zero	—11	41	31	27	6	33	20	36	20	62	38	73	54
20	76	53	78	60	73	52	64	35	43	22	4	—10	39	22	29	9	33	15	48	32	66	39	68	38
21	80	50	82	52	71	44	52	34	48	23	17	—5	28	20	38	15	42	21	50	35	56	36	66	38
22	84	61	74	59	68	44	47	28	44	26	—4	—17	31	26	38	23	48	25	43	28	55	31	72	43
23	74	55	79	51	64	43	57	29	47	19	—14	—32	30	24	40	20	50	26	32	24	45	29	75	43
24	73	52	68	50	75	43	60	35	45	24	—4	—36	41	24	32	27	50	30	30	22	40	26	79	53
25	67	51	81	41	75	50	45	27	42	19	18	—5	37	5	30	27	44	27	40	18	38	31	80	51
26	73	50	85	53	67	43	54	25	21	6	35	12	12	—6	27	—4	28	18	48	26	54	35	78	51
27	78	53	83	56	60	42	62	32	15	5	36	22	10	—7	—4	—28	39	14	49	31	65	36	60	44
28	81	53	69	44	61	39	60	40	37	12	24	—1	1	—18	14	—14	45	26	49	33	65	40	72	43
29	86	57	53	41	53	33	43	18	37	21	12	—5	12	—2	27	7	35	15	60	33	50	33	72	52
30	83	61	67	36	62	29	25	12	45	25	22	2	12	—15	......	......	28	15	66	37	43	30	69	48
31	82	55	77	43	......	......	38	8	......	......	32	9	21	—2	......	......	33	10	......	......	59	28	......	......
Range	43°		52°		51°		64°		62°		80°		67°		68°		72°		50°		47°		56°	
Monthly mean	66°.0		68°.8		58°.1		42°.5		28°.8		14°.0		24°.1		17°.8		21°.4		35°.3		52°.2		54°.7	

Elevation of thermometers above ground, 24 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, VISALIA, CAL.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	88	56	106.5	65	98	62	83	55	69	42	60	48	47	31	54	27	68	42	63	48	81	52	96	57
2	95.5	57	105.5	65	99	59	90	55	70	45	63.5	48	41	29	55	28	61	45	63	51	74	52	97.5	61
3	98	60	103	69.5	100.5	62	94	53	71	43	58	48	42	33	56	30	57	41	62	50	77	51	89	57
4	92	63	103.5	67.5	98.5	61.5	95.5	57	70	42	57	39	47	40	57	30	51	33	64	51.5	75	47	86	53
5	93	54	102	63	95.5	58.5	81	56	71	42	60.5	40	44	40	64	32	53	31	65	50	67	51.5	91	54
6	97	53	104	58	93	54.5	72	51	69	43	58	47	47	36	63	36	57	33	65	50	70	43	95	55
7	92	55	107	61.5	87	58	65	49	60	43	55.5	37	60.5	29	63	34	61	36	68	45	74	45	92	63
8	91	54	107.5	61	92.5	55	67	41.5	62	43	55	43	56	42	63	36	58	40	77	52.5	77	47	86	58
9	95	57	107.5	65	93.5	60	73	40	60	47	50	29	52	35	55	44	59	38	77	54	77	53	80	54
10	98	57	106	67	89.5	60	75	39.5	57	45	53.5	40	52	39	57	41	65	42	67	49	79	46	81	51
11	95.5	57	106	67.5	95.5	59	77	38	61	39	54	46	47	27	51	37	68	39	68	45	75	47	84	49
12	91	57	108	67	99.5	60	68	48	54.5	37	54	45	50	28	50	29	58	43	66	48	62	41	88	57
13	94	61	106.5	64	99.5	61	65	49	58	41	57	42	52	29	53	30	54	31	59	43	63	42	91	57
14	93.5	57	107	62	97	60	62	40	63	43	60	34	53	30	58	33	54	32	59	43	68.5	40.5	90	58
15	93.5	57.5	106.5	62.5	98.5	61	67	40	64	51	62	35	57	30	60	32	58	32	60	45	71	43	93	56
16	98	60	104.5	63.5	102	63	72	42	59	40	61	33	59	33	51	39	58	35	65	50	64	51	94	58
17	102	59	102.5	64.5	99	61	78	45	62	35	59	32	70	34	52	24.5	58	38	54	41	72	43	94	58
18	100	64	101	62	98	58	83	46	65	35	58	32	68	35	55	34	57	38	58	39	79	48	85	57
19	93	56	96	58	97.5	62	83	46	64	34	65	44	63	36	61	45	61	35	61	35	84	53	81	51
20	92	60	95.5	57.5	91	56.5	81.5	48	64	34	60	48	64	36	51	45	65	40	64	48	87	58	86	47
21	96	63.5	92	61	87.5	58	81	48	64	34	62	34	57	35	47	35	69	39.5	58	52	89	60.5	92	53
22	101	57	88	63	83	56	84.5	47	65	35	48	33	61	35	53	34	71.5	42	62	43	89	58	91	56
23	104.5	59	94	65	81.5	55	80	45	65	34	39.5	32	59	35	55	37	75	45	61	40	84	56	90	53
24	104.5	62	99.5	61	82	54.5	75	44	63	33	39	24	65	35	56	36	64	37	67	41	79	53	90	56
25	104	61	102.5	65	79.5	54	79	46	61	34	43	23	56	44	55	40	57	43	72	45	82	49	91	56
26	105	62.5	96	58	78	55	82.5	44	50	32	47	23.5	46	29	60	45.5	58	36	71	47	88	54	93	60
27	105.5	61	81	57	81	54	84	45.5	58	32	44	35.5	45	33	61	49	65	37	74	47	92	54	98	60
28	104.5	63	83.5	54.5	83.5	53	84	51.5	61.5	33	55	41	41	32	59	37	66	44	80	51	94	58	99	63
29	106	63	91	48.5	81.5	59	82	50	67	40	45.5	33	46	30	61	41	57	40	81	53	95	61	95	60
30	106	64	100	56	85	55	82	47	59	50	46	37	49	27	......	......	58	35	84	54	85	62	94	59
31	107	68	103	62	......	......	66.5	42	......	......	49	30.5	50	27	......	......	64	34	......	......	91.5	50	......	......
Range	54°.0		59°.5		49°.0		57°.5		39°.0		42°.0		43°.0		39°.5		44°.0		49°.0		54°.5		52°.0	
Monthly mean	81°.2		83°.5		74°.7		60°.2		49°.5		44°.9		42°.4		45°.8		39°.4		57°.3		65°.8		74°.8	

Elevation of thermometers above ground, 22 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, WASHINGTON, D. C.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	86	61	90	71	87.5	65	86.5	53.5	48	29.5	45	28.5	47	32	40	23	52	37	69	32	61	38	87	59
2	90	64.5	94	69	79	70	88	57	51	33.5	55	30	55	36	24	15	52.5	30	71	39	80	46.5	63	52
3	95.5	68	94	71	87	69.5	92	64	42	31.5	63	41	56	38	36	22	50	37	66	51	78	55	78	49.5
4	99	73	92	75	80	67	78	57	39	26	64	53	60.5	33	37	23	77	48	80	58	80	56.5	81	56
5	82	65	93	72	83	62	83	57	42	20	55	43	60	41	35	14	79	59	80	54	76	56	81	60
6	84	59	89	75	83	63.5	86.5	60	44	36	64	47	45	37	46	27	61	44	70	49	86	58.5	84	66.5
7	83.5	64	91	73	85	65.5	76	63	55	32	60	49	46	43	46	26	46	34	50	39	78	60	85	69
8	86.5	70	87	71	78	61	81	62	61	36	55	41	45	36.5	40	20	49	37.5	47	31.5	87	54	82	65
9	86	71	71	62	69	53.5	87	67	72	55.5	49	40.5	44	36	47	27	39	30	57	31	90	63.5	72	62
10	91.5	66.5	75	55	69	51.5	84	68	76	57	55	45	56	39	35	19	49	31	69	38	88	67.5	70	63
11	95.5	69	82	56	71.5	48	72	64	70.5	55	61	40	49	34.5	49	25.5	42	29	55	33	87	67.5	89	67
12	83	69	82	62	75	48	74	60	77	58	41	29	56	33	60	41	33	28	50	28.5	79	58	95	70
13	84	66.5	83	61	73	61	83	57	80	60	38	23	34	21	67	53	31	24	70	36	67	52.5	92	70
14	91	63	87	65	71	56	77	64	76.5	52	42.5	32	38	14	55	42	38	30	81.5	51.5	63	43.5	81.5	69
15	98.5	70.5	86	67	73	50	81	62	77	61	52	36	41	25.5	45	34	40.5	35.5	80.5	55	65	42	69	59
16	102	76	86	68	77	51	83	59	62	45	42.5	31	43	26.5	58	29	43	35	82	60	80	45.5	75	57
17	90	74	77	69	77	56	81.5	58	56	34	53	37	46	26	60	37	44	34	71.5	54	89	61	81	55
18	82	64	70	63	77	49	75.5	67	52	39	39	29	56	37	60	42	42	27	70	41.5	92.5	63	85	61
19	83	63	81	58.5	72	58	67	47	39	30	43	31	58	31	42	23	44	38	77.5	49	83	58.5	83	60
20	82	63	85	60	72	58	64	40	35	22	44	36	64	46	35.5	17.5	55	40	67	44	91	68	87	60
21	86.5	64	85	67	61	55	61	43.5	28	20	42	24.5	52	40	48	27	49	34	71	39	86	69.5	87	65
22	93	69	89.5	70	64	53	65.5	56	37	15.5	36	24.5	46	37	51	28.5	58	28	73	45	75.5	62	90	70
23	93	74	88.5	70	69	52.5	73	51	55	32	38	34	48	36	50	34	62	33	71.5	50	70	68.5	93	68
24	91.5	74	83	70	72	53	51	37	40	27	53	35	46	31	52	30	50	29	50	44	87	64	96.5	72
25	81	72	83	62	60	43.5	49	35	58	27	51	32	43	26	66	38	44	21.5	52	43	94.5	69	94	72
26	83	71	67	59	63	38	54	28	50	34	33	16	47	25	64	53.5	44	28	80.5	51	96	70	90.5	72
27	90	70	75	59	70	40	58	36	53	33	31.5	13	50	39	70	43	59	40	64	50	95	71	89	72
28	87	73	78	62	73	48	65	46	65	44	43	28	66	45	59	51	60	37	65	46	88	70	95	73
29	85	72	85	62	75	48	69	45	60	34	50.5	36	47	36	70	51	44	32.5	60	49	75	64	90.5	72
30	79	73	86	72	81	48	65	46	37	27	66	39	42	31	......	......	54	33	60	43	75	64.5	85	69
31	84.5	71	85	69	......	......	52	36	......	......	40	29	52	40	......	......	58	35	......	......	84	66	......	......
Range	43°.0		39°.0		49°.5		64°.0		64°.5		51°.0		52°.0		56°.0		57°.5		53°.5		58°.0		47°.0	
Monthly mean	78°.4		74°.2		64°.6		62°.5		45°.8		41°.5		42° 0		41°.3		42°.2		55°.7		70°.9		74°.8	

Elevation of thermometers above ground, 68 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, WICKENBURG, ARIZ.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	95	52	104	76	(*)	(*)	86	60	77	43	65	33	61	36	51	25	67	27	72	35	83	45	96	51
2	94	51	98	72	......	......	91	58	77	44	66	33	61	34	56	24	66	28	62	40	86	56	101	54
3	98	56	103	71	......	......	93	53	75	46	61	33	58	33	51	28	62	30	73	38	85	46	97	52
4	99	51	99	69	......	......	90	55	77	45	62	33	60	32	48	21	60	29	74	38	90	46	95	55
5	99	69	104	71	......	......	84	65	77	35	62	31	61	30	51	22	61	29	80	37	88	48	96	54
6	100	70	95	73	......	......	81	58	77	36	64	31	59	33	51	21	63	31	72	50	81	46	97	49
7	104	69	92	69	......	......	79	50	68	35	64	30	67	36	57	22	65	28	76	36	82	41	100	54
8	100	71	(*)	(*)	......	......	69	50	64	39	59	29	57	42	62	27	67	29	82	45	86	41	97	54
9	96	78	......	......	......	......	71	38	58	42	56	36	60	31	65	29	70	26	79	45	89	45	95	62
10	96	76	......	......	......	......	79	41	54	42	55	23	57	31	56	37	65	42	80	39	89	48	90	60
11	96	74	......	......	......	......	82	40	56	34	56	28	56	33	50	33	64	29	84	42	89	47	90	46
12	100	71	......	......	......	......	86	45	59	34	64	29	59	28	50	25	64	30	82	41	89	46	97	48
13	100	64	......	......	......	......	78	61	56	36	60	30	64	31	55	23	60	33	74	34	75	40	90	48
14	101	72	......	......	......	......	72	48	60	33	61	29	64	29	55	28	63	36	67	33	75	38	97	52
15	99	77	......	......	......	......	65	35	64	33	64	29	66	34	63	28	55	21	69	33	84	40	100	54
16	106	70	......	......	......	......	75	36	66	35	66	29	67	34	60	24	57	20	72	35	84	39	104	54
17	101	71	......	......	98	65	76	39	63	33	66	28	69	33	55	26	57	30	67	39	84	42	106	60
18	101	69	......	......	100	57	86	43	62	33	65	29	68	41	59	24	60	28	62	36	87	40	105	63
19	102	65	......	......	99	57	85	47	68	30	64	29	67	35	62	26	62	28	67	30	94	47	94	74
20	102	65	......	......	100	59	84	45	71	33	61	36	70	36	66	24	65	29	74	36	96	54	97	73
21	104	65	......	......	99	63	85	43	73	34	56	41	68	32	66	39	65	38	78	48	95	55	98	60
22	99	81	......	......	98	62	84	43	70	32	50	31	70	32	61	31	72	35	77	42	96	52	101	52
23	103	71	......	......	98	62	85	42	68	34	44	33	68	32	60	37	74	30	67	41	95	54	102	64
24	106	72	......	......	95	60	83	45	67	30	37	20	60	30	57	26	72	31	74	35	94	54	101	57
25	108	72	......	......	93	55	85	47	64	29	47	13	60	24	60	27	70	40	75	36	83	52	96	52
26	107	72	......	......	91	51	81	51	60	32	53	22	56	36	61	27	62	36	80	37	84	48	102	57
27	99	78	......	......	72	59	82	47	54	30	52	39	50	32	62	27	70	29	81	37	88	56	102	56
28	104	71	......	......	77	54	82	42	60	27	52	42	45	32	61	30	75	30	81	41	91	61	103	62
29	107	75	......	......	81	58	80	47	65	30	52	41	37	28	63	27	72	30	82	44	96	62	101	58
30	104	74	......	......	84	60	74	44	69	32	49	36	39	21	......	......	69	31	85	56	95	62	101	58
31	106	78	......	......	......	......	76	42	......	......	59	34	39	27	......	......	70	30	......	......	93	61	......	......
Range	57°		......	......	......	......	58°		50°		53°		49°		48°		49°		49°		56°		58°	

* Office closed.

Elevation of thermometers above ground, 5 feet.

Maximum, minimum and mean temperatures—Continued.

STATION, WILMINGTON, N. C.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	84	65	89	77	86	69	85	64	54	48	62	28	58	47	62	47	65	57	76	45	64	45	87	72
2	84	63	88	77	86	73	85	63	64	46	70	37	74	43	47	35	66	47	76	57	71	46	79	60
3	87	65	88	73	87	77	85	65	60	39	70	50	71	43	59	40	68	46	73	63	72	60	77	57
4	87	68	89	72	91	70	84	65	47	30	67	57	74	46	52	32	80	63	74	64	67	62	77	55
5	89	70	93	74	89	67	86	65	54	30	68	52	76	51	54	34	82	62	83	59	71	62	79	62
6	75	69	97	77	87	68	85	67	67	36	72	60	72	52	48	32	72	54	80	64	80	60	80	68
7	84	64	98	79	86	67	85	69	74	48	69	51	64	55	59	33	82	53	64	52	88	63	84	73
8	94	73	98	74	92	68	84	69	74	53	72	45	60	50	52	36	68	50	53	36	86	64	87	69
9	96	77	84	64	77	62	85	68	76	62	69	48	57	48	61	38	56	47	51	35	80	63	82	65
10	95	77	78	60	74	60	86	69	81	55	69	49	62	51	67	38	60	42	66	37	80	65	84	69
11	96	75	80	61	75	55	77	67	77	57	74	64	64	49	65	40	60	49	70	46	80	66	89	71
12	103	80	81	64	77	56	78	66	80	60	65	40	70	50	72	54	58	45	56	34	86	66	98	73
13	89	76	82	69	81	59	81	63	83	65	48	39	60	33	74	62	52	42	66	41	80	62	98	74
14	83	74	90	67	74	66	80	63	81	64	68	45	53	25	68	55	61	43	76	52	67	55	98	76
15	90	68	89	73	71	63	80	66	80	65	68	49	65	41	60	46	64	53	78	59	67	45	100	72
16	91	72	86	73	84	62	81	64	77	61	55	37	60	38	58	34	79	62	77	62	75	47	74	64
17	96	76	87	76	90	67	82	64	68	52	66	40	68	40	66	41	66	49	87	63	85	55	78	59
18	86	73	89	68	84	66	83	66	78	46	58	42	64	49	72	52	59	42	73	60	85	61	81	56
19	85	65	83	70	81	66	79	56	47	32	70	39	68	40	64	43	72	48	78	66	82	63	81	57
20	83	63	84	70	73	67	67	54	42	27	71	48	70	50	45	30	63	44	70	54	81	65	83	57
21	82	65	86	70	72	65	73	57	40	24	64	44	65	48	57	34	64	44	62	50	79	68	85	60
22	85	67	84	72	68	63	74	64	51	26	69	46	69	50	61	35	65	47	69	45	78	69	88	65
23	90	72	88	75	71	62	72	66	64	36	74	59	59	47	69	45	71	47	79	45	82	69	93	67
24	90	76	86	77	78	63	67	46	51	38	78	55	53	41	59	37	59	48	84	63	83	66	94	71
25	82	74	89	77	70	54	54	36	68	82	75	63	49	38	72	44	55	34	73	63	83	67	87	72
26	86	73	82	66	69	47	64	38	66	38	65	33	54	41	73	60	60	41	90	68	87	65	90	73
27	86	73	76	64	76	50	68	50	65	42	46	24	69	52	78	59	70	58	81	63	88	66	97	74
28	89	76	77	59	81	57	72	57	74	62	64	36	65	54	76	53	70	56	70	52	83	65	97	77
29	85	73	82	58	82	59	74	48	68	43	73	50	68	47	81	60	57	42	73	61	83	66	97	74
30	88	72	86	62	83	64	79	53	46	27	73	51	70	43	......	......	54	35	79	60	83	69	87	68
31	89	77	92	68	......	......	65	49	......	......	60	51	75	60	......	......	62	37	......	......	92	70	......	......
Range	40°		40°		45°		50°		59°		54°		51°		51°		48°		56°		47°		45°	
Monthly mean	79°.2		76°.8		71°.2		67°.5		55°.1		55°.9		55°.3		53°.3		56°.2		63°.5		70°.9		76°.6	

Elevation of thermometers above ground, 52 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, WINNEMUCCA, NEV.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	80	45	90	57	88	48	68	46	62	20	50	35	42	14	42	6	55	32	48	34	76	38	79	39
2	80	46	95	52	88	44	79	31	63	20	50	39	46	36	35	11	50	35	50	38	68	51	83	43
3	87	46	95	52	89	50	81	35	65	26	48	36	47	31	37	5	37	29	50	35	71	36	76	49
4	83	51	94	58	90	53	84	38	60	27	45	31	46	16	44	12	32	20	51	28	73	42	60	41
5	78	43	95	59	92	50	74	50	67	38	51	41	48	29	48	12	41	16	50	31	55	36	72	30
6	84	39	96	48	93	46	62	43	55	41	50	36	48	34	45	13	45	22	54	33	54	23	79	44
7	89	52	97	57	92	57	53	31	43	19	44	26	53	33	46	13	52	19	60	26	57	35	78	53
8	90	53	99	61	93	45	52	29	43	27	28	13	47	30	45	17	38	25	66	30	57	40	65	42
9	82	54	100	53	82	52	59	38	46	31	27	11	47	34	48	13	41	17	72	36	58	36	57	35
10	87	47	99	62	67	40	58	36	46	33	39	23	42	20	41	32	51	14	74	40	71	38	63	31
11	87	55	97	65	46	35	64	23	57	36	44	24	31	12	35	20	49	25	71	36	67	42	65	41
12	74	58	95	59	85	34	57	35	42	26	40	28	31	8	37	5	27	11	64	41	44	31	71	39
13	78	46	94	59	90	36	44	33	41	17	48	33	44	24	40	24	27	2	45	29	43	31	81	42
14	84	51	94	50	89	42	49	28	48	37	47	26	46	27	49	23	30	4	44	22	49	24	83	43
15	87	59	97	54	88	48	55	32	46	32	48	23	51	26	50	27	39	8	50	34	64	32	77	39
16	93	48	94	53	88	45	58	26	37	18	52	33	51	32	30	12	47	6	43	27	66	41	85	41
17	92	57	90	59	89	45	64	32	41	17	53	34	51	26	31	5	39	26	41	24	67	38	90	39
18	90	56	92	52	88	49	69	35	44	18	53	37	54	21	45	13	46	24	45	23	72	35	85	40
19	89	60	88	61	89	50	73	30	51	18	55	32	50	25	43	28	44	22	47	23	76	43	66	36
20	86	61	86	58	88	48	74	32	50	18	48	32	52	33	41	24	46	17	56	34	82	43	71	29
21	93	48	82	50	85	46	67	31	50	14	34	25	51	30	43	20	57	18	57	36	72	47	80	40
22	94	60	73	50	85	53	65	34	50	10	33	20	45	26	37	22	60	21	46	29	76	36	87	41
23	91	54	86	40	81	39	72	26	48	7	22	— 3	45	26	37	26	62	30	47	26	66	40	88	50
24	93	57	84	51	81	39	65	30	47	11	10	—20	54	31	40	29	65	23	54	32	56	33	89	57
25	95	59	92	52	75	39	64	28	50	15	18	— 6	45	25	42	30	43	29	59	28	58	31	93	54
26	91	58	89	48	75	43	65	30	38	19	26	3	30	10	43	32	43	19	59	33	67	33	92	54
27	90	57	72	50	74	42	68	34	37	5	37	16	27	15	33	17	60	26	58	31	73	38	91	58
28	96	57	66	42	74	40	68	26	40	9	38	27	24	3	37	12	47	31	65	30	79	39	94	52
29	97	60	73	33	65	43	67	25	40	28	29	12	26	3	47	24	37	26	71	37	72	41	89	59
30	94	65	80	44	74	33	61	32	45	33	29	2	29	zero.	......	......	42	15	74	40	62	33	86	54
31	92	53	89	50	......	......	63	29	......	......	34	7	33	7	......	......	45	27	......	......	67	31	......	......
Range	34°.5		36°.6		39°.3		31°.9		26°.1		17°.9		20°.9		22°.9		24°.5		24°.2		28°.3		35°.7	
Monthly mean	73°.7		73°.7		66°.8		48°.1		34°.0		29°.8		32°.2		29°.6		32°.8		44°.4		52°.4		65°.8	

Elevation of thermometers above ground, 19 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 a. m. observations by *four*. The monthly means are obtained by dividing the sum of daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, WOOD'S HOLL, MASS.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	73	59	77	68	71	64	71	61	44	38	46	25	39	25	39	14	44	34	46	36	51	36	73	59
2	72	59	77	73	71	65	70	60	45	36	48	42	48	30	18	3	38	31	53	36	52	45	63	51
3	72	64	80	69	75	65	69	59	49	35	53	46	42	32	43	18	49	36	52	43	54	45	68	49
4	72	65	80	68	73	65	67	58	37	28	54	39	49	36	33	26	48	44	52	45	56	49	68	53
5	67	53	78	68	72	60	67	59	39	26	45	35	43	35	32	28	58	44	57	43	64	47	67	53
6	67	51	83	68	67	57	64	55	48	32	55	42	47	38	38	28	47	38	47	41	65	51	66	57
7	63	56	74	62	72	61	63	53	48	39	55	49	47	35	36	26	46	35	43	31	55	45	70	58
8	65	61	74	62	71	66	70	61	54	38	54	45	46	34	37	22	44	26	40	26	60	47	63	52
9	81	61	72	62	70	59	75	63	58	53	45	35	44	38	39	13	33	26	42	35	60	50	67	50
10	76	66	72	60	68	56	65	59	59	51	53	35	47	38	38	8	38	29	51	41	62	53	65	51
11	77	64	72	61	70	57	59	53	53	43	56	48	44	31	38	30	30	24	47	33	59	53	67	56
12	75	63	74	65	68	55	63	53	60	53	48	33	49	38	53	38	39	28	41	28	68	53	82	59
13	77	59	73	65	67	57	66	56	56	45	34	29	38	21	51	43	31	27	51	37	55	46	74	63
14	72	66	74	66	71	63	63	50	58	49	53	34	33	20	51	35	40	28	57	42	54	42	74	60
15	75	67	72	64	70	59	67	56	62	56	53	39	45	32	42	32	42	33	53	38	60	45	74	58
16	76	67	69	61	63	59	77	58	58	51	39	35	43	35	41	30	40	33	52	44	61	49	73	55
17	79	68	69	62	69	59	62	58	52	46	45	32	44	37	50	37	39	30	48	38	69	52	78	58
18	70	60	74	62	67	56	67	55	51	38	32	20	45	37	52	45	38	26	55	36	58	49	75	59
19	71	58	76	61	66	57	61	43	46	32	38	28	44	35	51	22	41	33	50	40	63	48	71	60
20	70	58	68	61	66	51	57	38	47	25	43	36	43	39	30	18	41	32	50	45	65	53	71	61
21	71	61	70	63	64	53	63	52	25	16	39	13	43	25	43	29	43	28	56	40	65	54	74	63
22	74	63	72	63	58	53	65	57	43	20	48	18	42	24	41	34	45	32	55	43	68	57	74	61
23	74	68	71	67	63	56	64	58	50	41	38	23	48	40	42	33	44	36	48	42	63	57	83	58
24	75	63	70	66	69	57	58	37	41	30	44	36	41	32	34	24	43	23	44	35	62	56	76	63
25	72	63	70	66	57	45	40	32	55	32	47	24	39	31	44	28	35	18	52	35	76	55	79	65
26	70	64	62	57	61	45	50	35	46	36	24	11	47	33	51	39	42	21	53	43	79	58	80	66
27	75	63	63	57	61	47	57	49	47	33	31	18	53	38	48	39	42	30	62	47	74	62	83	68
28	78	66	64	54	67	53	57	50	56	46	44	29	53	40	52	43	36	30	52	43	71	59	79	66
29	75	68	67	54	66	58	57	48	56	37	48	44	40	23	52	44	35	31	55	45	70	56	79	67
30	76	68	69	59	67	62	58	48	37	25	47	23	48	23	......	......	37	33	60	41	62	53	79	68
31	80	69	71	59	......	......	51	43	......	......	40	22	48	33	......	......	44	33	......	......	73	59	......	......
Range	30°		29°		30°		45°		46°		45°		33°		50°		40°		36°		43°		34°	
Monthly mean	68°.2		67°.7		62°.9		58°.1		43°.7		39°.1		39°.0		36°.1		36°.8		45°.2		56°.9		65°.1	

Elevation of thermometers above ground, 6 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

STATION, YANKTON, DAK.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	80	66	97	72	81	55	88	66	39	18	45	27	50	21	23	4	38	19	66	35	87	52	74	47
2	81	68	80	61	79	49	73	56	23	7	28	11	44	18	30	6	66	33	43	37	90	47	87	54
3	82	63	80	59	74	55	79	46	35	20	42	14	58	36	17	— 3	54	24	65	37	88	58	87	61
4	82	59	84	62	77	44	83	58	47	20	39	28	46	24	26	11	33	18	50	28	83	61	94	71
5	88	60	87	62	74	54	89	53	59	28	34	18	51	33	32	7	46	19	50	28	91	58	78	55
6	89	74	79	62	78	45	89	66	73	31	40	16	42	10	35	13	55	30	39	25	83	66	68	52
7	85	68	78	52	68	39	70	68	60	39	18	4	48	25	40	— 1	32	— 3	53	20	67	51	65	57
8	91	57	78	54	75	37	89	64	46	31	19	2	52	22	18	7	50	15	59	21	66	49	74	56
9	95	73	91	60	80	51	75	60	56	28	31	11	44	5	38	zero.	31	5	81	41	60	47	73	59
10	97	73	89	55	79	57	71	43	48	37	12	3	50	16	50	20	46	20	59	30	70	43	79	58
11	88	68	87	65	68	56	79	56	54	37	6	—12	32	zero.	(*)	......	25	6	52	23	84	45	90	67
12	92	64	79	56	80	45	85	51	53	41	(*)	......	28	1	......	......	13	2	74	41	94	63	79	64
13	93	69	77	51	66	42	88	64	48	38	......	......	47	8	......	......	13	— 3	79	55	87	68	72	59
14	94	77	88	56	79	41	88	68	57	30	......	......	39	11	......	......	23	—16	71	34	91	67	70	58
15	82	61	81	54	73	50	82	66	51	34	......	......	51	13	......	......	21	zero.	44	25	88	61	71	53
16	77	61	78	53	72	55	80	54	45	21	......	......	57	27	53	31	35	— 4	67	29	82	63	68	54
17	73	61	83	53	79	47	62	45	35	17	......	......	55	27	30	13	39	15	77	48	93	67	80	61
18	82	66	84	62	62	41	63	39	44	15	......	......	67	31	29	3	34	26	56	24	80	60	80	58
19	82	64	91	63	65	47	77	39	40	13	......	......	40	21	37	10	39	18	50	23	78	54	83	64
20	85	70	88	66	70	45	80	43	24	1	......	......	42	19	51	19	47	21	70	38	65	45	85	65
21	87	71	89	63	76	54	77	42	42	17	14	— 1	40	20	61	16	49	25	82	40	76	43	88	70
22	90	74	89	59	73	46	57	39	49	23	1	—10	35	16	56	22	62	35	79	50	73	60	88	68
23	82	61	88	62	61	44	52	30	35	16	2	—18. 5	45	18	66	21	49	30	69	47	71	52	89	66
24	84	59	88	64	67	32	57	28	55	31	—18. 5	—27	47	26	66	39	56	31	47	41	75	54	83	61
25	83	57	85	63	72	50	64	40	43	18	5	—34	54	21	52	21	68	35	49	35	74	58	90	68
26	83	58	84	64	85	50	63	39	47	33	32	— 7	50	19	54	30	52	40	58	34	68	53	96	68
27	86	57	87	66	83	54	68	42	37	20	32	16	24	9	38	— 2	40	36	73	36	72	47	78	60
28	78	56	97	68	79	60	76	37	23	8	*	......	12	— 2	— 2	— 8	68	32	64	46	80	54	74	52
29	85	53	93	68	74	51	58	32	29	4	......	......	14	2	25	— 9	66	36	65	31	74	54	80	56
30	91	63	82	64	73	51	36	26	52	25	......	......	22	3	......	......	66	42	72	31	65	48	85	63
31	98	67	84	58	......	......	32	13	......	......	......	......	35	7	......	......	66	32	......	......	68	44	......	......
Range	45°		46°		53°		76°		72°		......	......	69°		......	......	84°		62°		51°		47°	
Monthly mean	75°. 9		73°. 4		60°. 7		59°. 0		34°. 2		......	......	28°. 3		......	......	31°. 2		47°. 4		67°. 4		71°. 1	

* Observer sick.

Elevation of thermometers above ground, 20 feet.

The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

Maximum, minimum and mean temperatures—Continued.

YARMOUTH, NOVA SCOTIA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	......	......	68.1	56.3	66.0	46.2	66.0	49.6	46.0	36.2	36.4	21.4	29.9	8.6	40.0	14.4	42.5	27.3	37.6	22.3	46.0	35.0	64.1	45.9
2	......	......	70.9	54.3	63.0	52.1	68.6	55.6	41.9	30.1	45.4	34.7	40.9	21.8	19.0	3.3	30.8	20.8	41.0	19.9	44.8	35.2	57.5	46.6
3	......	......	72.1	57.8	72.9	50.9	61.5	44.0	39.1	28.5	46.1	35.1	41.4	19.4	38.9	6.8	39.6	21.8	44.8	25.3	52.0	37.7	68.6	44.7
4	......	......	68.3	53.8	63.8	54.1	58.6	52.1	39.1	29.5	50.5	37.1	42.7	13.4	43.0	20.3	43.8	34.4	48.0	38.2	60.8	40.0	63.1	39.4
5	......	......	70.1	49.9	64.0	55.6	59.4	42.7	33.9	28.5	43.1	27.3	42.9	26.8	31.9	22.3	44.0	28.8	49.8	38.2	56.2	39.1	64.3	41.7
6	......	......	70.1	56.5	66.0	54.6	59.8	41.0	36.4	26.3	40.1	22.5	32.9	8.4	36.4	27.3	32.3	20.5	47.2	33.2	55.5	42.0	62.6	45.9
7	......	......	63.0	53.1	63.2	48.1	53.2	32.1	40.1	28.1	56.0	33.6	45.9	31.1	30.9	14.3	32.8	20.3	37.6	29.3	47.1	35.7	65.0	43.4
8	......	......	61.8	47.6	64.0	50.6	66.0	50.1	47.4	25.5	48.8	42.2	43.4	21.3	33.9	14.8	36.8	15.0	34.8	24.3	52.5	34.7	64.6	42.4
9	......	......	67.3	56.1	62.2	54.1	76.1	55.6	52.2	42.4	45.9	27.5	40.9	27.3	39.9	10.4	23.6	6.4	42.0	29.8	55.2	40.7	71.0	43.2
10	......	......	61.5	51.9	64.0	51.1	59.4	50.1	54.0	48.6	35.4	19.0	42.9	35.1	27.4	5.4	36.3	19.9	46.0	31.7	70.1	43.7	66.6	45.3
11	......	......	68.6	46.6	66.6	45.4	53.8	37.1	51.0	32.6	51.0	32.6	43.4	23.3	33.4	12.9	27.8	12.2	52.0	29.3	50.6	41.2	64.3	47.9
12	......	......	68.1	53.7	64.5	44.4	52.0	37.2	43.9	30.6	51.0	32.1	40.9	20.3	44.0	60.3	28.8	7.9	33.8	22.8	64.1	38.4	64.3	48.1
13	......	......	69.1	55.7	64.8	48.1	56.8	45.7	45.9	36.6	37.9	22.5	42.4	24.1	42.2	37.3	22.3	9.2	41.2	27.1	51.0	35.7	67.6	46.8
14	......	......	67.6	54.1	67.1	48.2	53.0	42.3	43.9	32.6	39.1	17.0	28.6	10.6	44.8	20.3	28.8	12.9	45.2	32.4	50.5	36.0	67.0	49.2
15	......	......	62.8	54.1	64.8	46.0	55.1	45.2	54.2	41.4	45.2	28.3	33.9	10.4	28.8	17.3	31.8	18.4	48.5	35.4	56.0	35.2	63.8	44.0
16	......	......	67.1	42.1	59.1	48.1	55.2	44.6	54.0	42.2	51.0	30.2	33.9	23.3	31.9	21.8	29.8	17.9	56.5	37.0	55.5	34.0	64.0	43.4
17	......	......	61.0	49.9	61.0	54.1	62.9	42.6	48.8	38.0	36.9	26.8	37.9	27.3	36.4	22.3	31.8	19.2	46.5	30.4	54.2	40.7	65.5	44.3
18	......	......	64.4	56.1	62.9	52.1	57.5	35.6	45.9	30.6	33.4	12.9	38.9	27.3	45.0	34.1	28.8	20.8	38.8	29.3	64.5	39.0	66.2	40.7
19	......	......	70.1	53.6	61.3	53.6	58.0	47.3	36.9	27.3	29.1	9.4	38.1	31.6	46.0	14.2	36.8	25.8	44.5	27.5	59.0	35.7	68.1	51.1
20	......	......	63.4	51.3	67.0	44.2	46.1	34.3	37.1	28.8	38.9	3.3	39.9	27.3	27.0	11.4	40.5	22.1	48.5	37.2	56.5	46.0	66.0	52.2
21	......	......	64.2	48.9	62.2	38.2	54.2	38.7	38.4	23.5	40.9	1.1	40.9	22.3	36.7	19.3	38.3	18.6	58.0	37.0	56.5	43.7	64.9	50.6
22	......	......	63.0	54.1	59.8	46.2	57.5	45.2	25.4	16.4	13.8	— 4.8	25.8	12.4	36.9	27.3	36.8	30.7	56.0	31.2	57.0	46.3	60.0	48.1
23	......	......	58.2	54.1	68.7	54.6	61.0	50.9	44.9	24.5	43.9	11.4	46.5	19.3	36.9	24.1	36.8	24.5	47.5	28.5	60.5	48.3	60.2	48.1
24	......	......	71.7	53.3	61.2	51.4	59.1	37.2	46.5	25.8	36.7	19.0	45.5	33.6	31.1	22.8	36.3	26.8	44.5	27.8	54.0	45.2	62.9	45.8
25	......	......	71.6	53.6	57.0	45.2	43.1	31.1	41.7	19.5	40.9	19.5	38.0	24.8	37.9	22.1	35.0	22.3	44.5	27.4	68.3	43.7	74.1	47.1
26	......	......	69.1	54.3	53.0	31.6	45.9	24.0	45.9	34.1	26.3	5.1	39.9	22.8	42.8	28.1	28.8	19.8	47.0	36.7	55.8	44.0	73.3	56.1
27	......	......	71.3	56.6	55.8	31.3	54.0	42.7	37.1	25.8	17.6	5.1	42.5	25.8	44.0	34.1	34.3	19.2	50.5	36.2	65.1	46.3	77.1	50.2
28	......	......	67.3	51.4	60.0	40.2	57.0	46.7	48.1	29.2	40.4	10.4	49.0	36.1	47.0	28.1	31.0	16.2	44.0	32.4	66.6	48.6	72.9	56.1
29	......	......	68.9	53.1	62.0	47.4	58.5	45.2	54.0	45.4	43.1	34.6	41.5	12.9	48.0	38.7	40.0	18.6	48.5	32.4	60.1	45.2	67.8	57.0
30	......	......	63.8	48.9	60.5	52.1	54.0	45.4	54.2	22.0	43.4	28.3	27.6	9.4	......	......	36.8	16.4	52.5	39.2	66.6	40.4	75.6	53.9
31	......	......	70.6	50.9	......	......	52.2	41.4	......	......	31.9	— 0.8	50.0	25.5	......	......	36.3	28.4	......	......	61.5	46.1	......	......
Range	......	......	30°.0		41°.6		52°.4		37°.8		60°.8		41°.6		44°.7		37°.6		38°.1		36°.1		37°.7	

Maximum, minimum and mean temperatures—Continued.

STATION, YORK FACTORY, BRITISH AMERICA.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	67.0	59.0	63.0	47.0	60.0	40.0	45.0	35.0	4.0	1.5	—1.0	—25.0	......	......	......	......	......	......	......	......	......	......	......	......
2	65.0	59.0	67.0	48.0	63.5	37.0	42.0	38.0	14.0	—6.0	—21.0	—31.0	......	......	......	......	......	......	......	......	......	......	......	......
3	66.5	60.5	78.0	51.5	60.5	35.5	38.0	33.0	15.0	3.0	—16.0	—29.0	......	......	......	......	......	......	......	......	......	......	......	......
4	67.0	54.0	81.0	46.0	58.0	33.0	42.0	32.0	26.0	12.0	—12.0	—23.0	......	......	......	......	......	......	......	......	......	......	......	......
5	65.5	50.0	49.5	40.0	57.0	32.0	37.5	31.0	24.0	18.0	5.0	—14.0	......	......	......	......	......	......	......	......	......	......	......	......
6	64.0	56.0	59.5	39.0	65.0	34.0	38.0	30.0	30.0	14.5	5.0	—9.0	......	......	......	......	......	......	......	......	......	......	......	......
7	69.0	51.0	58.0	41.0	58.0	36.0	39.0	28.0	34.0	21.0	(*)	......	......	......	......	......	......	......	......	......	......	......	......	......
8	72.0	55.0	58.5	40.0	64.0	37.0	37.0	27.0	30.0	14.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......
9	77,0	50.0	57.0	39.0	63.0	38.0	36.0	26.0	20.5	8.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......
10	71.0	53.0	59.0	41.0	60.0	42.0	35.0	25.5	29.0	15.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......
11	70.0	54.5	61.0	40.0	59.0	41.0	36.0	24.0	30.0	12.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......
12	68.0	52.0	69.5	44.0	60.0	39.0	30.0	24.0	29.5	20.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......
13	62.0	44.0	59.0	39.0	52.0	38.0	32.0	21.0	33.0	20.5	......	......	......	......	......	......	......	......	......	......	......	......	......	......
14	54.0	45.0	57.0	41.0	50.0	33.0	35.0	26.0	21.0	9.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......
15	87.0	50.0	52.0	37.0	48.0	32.5	36.0	27.0	10.0	5.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......
16	86.0	54.0	50.0	36.0	50.0	31.0	38.0	26.0	8.0	zero.	......	......	......	......	......	......	......	......	......	......	......	......	......	......
17	63.0	50.0	86.0	40.0	52.0	33.0	37.0	25.0	4.0	—7.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......
18	99.0	56.0	82.0	51.0	54.0	37.5	38.0	26.0	8.0	—10.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......
19	102.0	66.0	73.0	55.0	52.0	36.0	34.0	25.0	8.0	—4.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......
20	87.0	62.0	64.0	51.0	50.0	34.5	37.0	26.0	—1.0	—10.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......
21	69.0	53.0	62.0	50.0	44.0	34.0	39.0	28.0	—4.0	—16.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......
22	72.0	54.0	67.0	48.0	57.0	39.0	40.0	29.0	—1.0	—9.5	......	......	......	......	......	......	......	......	......	......	......	......	......	......
23	70.0	53.0	60.0	46.5	60.0	46.0	35.0	30.0	zero.	—8.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......
24	69.0	55.0	58.0	40.0	44.0	38.0	32.0	27.0	1.0	—10.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......
25	68.0	53.0	54.0	38.0	39.0	32.0	30.0	24.0	1.0	—12.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......
26	67.0	50.0	56.0	38.5	40.0	31.0	28.0	16.0	—2.0	—14.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......
27	59.0	44.0	52.0	38.0	39.0	31.5	25.0	14.0	5.0	—10.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......
28	58.0	53.0	56.0	37.0	41.0	32.0	27.0	13.0	2.0	—6.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......
29	59.0	46.0	59.0	40.0	42.0	31.5	18.0	8.0	14.0	—5.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......
30	61.0	47.0	60.0	39.5	39.0	31.0	28.5	8.5	14.0	—1.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......
31	60.0	46.0	64.0	41.0	......	......	16.5	zero.	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Range	58°.0		50°.0		34°.0		45°.0		50°.0		......	......	......	......	......	......	......	......	......	......	......	......	......	......

* No reports of maximum and minimum temperature received since December 6, 1879.

Maximum, minimum and mean temperatures—Continued.

STATION, YUMA, ARIZ.

Day of month.	1879.												1880.											
	July.		August.		September.		October.		November.		December.		January,		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	104	71	112	88	111	72	96	68	82	56	73	44	65	50	63	25	75	41	82	48	94	59	102	67
2	101	61	105	83	113	75	98	68	91	54	72	49	68	46	67	35	77	40	77	55	95	60	105	65
3	105	64	109	80	113	76	102	70	79	58	73	42	65	43	59	40	70	49	81	52	93	58	102	67
4	106	68	108	82	111	81	100	70	82	53	69	48	66	44	59	34	67	49	85	51	99	59	105	74
5	108	73	115	80	105	69	92	73	83	50	71	42	67	43	63	33	68	50	88	53	96	67	95	69
6	109	72	108	83	109	69	82	67	86	53	72	44	66	48	62	35	72	43	78	61	86	61	103	67
7	112	70	106	83	107	76	80	58	75	53	71	44	68	47	65	38	74	41	84	51	90	77	106	68
8	106	82	108	80	106	75	74	55	73	45	71	43	71	50	68	39	81	40	90	58	94	59	103	67
9	103	80	107	78	107	75	77	50	68	56	65	46	67	42	71	42	71	50	89	64	98	59	100	69
10	105	79	110	80	106	71	82	49	65	50	66	37	71	41	67	48	70	46	92	57	97	61	90	68
11	107	74	109	78	109	72	88	54	69	41	64	43	62	47	58	37	76	43	92	58	96	61	95	63
12	106	75	110	77	107	77	90	55	71	46	71	45	61	43	60	29	73	47	94	56	80	63	92	64
13	106	74	110	79	106	78	79	59	66	49	71	42	67	47	64	29	62	47	74	56	74	54	96	61
14	107	73	111	77	102	80	71	54	70	44	74	43	67	46	67	40	59	47	77	49	80	51	103	65
15	111	76	115	78	105	74	72	44	78	45	71	45	71	51	69	41	63	37	74	51	89	53	104	69
16	114	77	112	81	108	73	81	50	74	48	72	44	74	54	67	38	67	39	78	47	84	54	108	71
17	108	78	111	79	104	74	85	55	67	50	70	42	75	48	62	42	64	41	70	52	87	55	110	74
18	110	75	109	80	107	72	93	57	72	51	69	41	74	49	64	40	66	39	68	46	94	57	108	75
19	106	73	109	79	109	71	94	60	73	51	69	44	74	47	68	36	71	39	76	44	101	61	100	81
20	106	75	108	77	106	72	93	64	77	52	70	46	77	45	71	38	74	46	82	47	103	65	104	80
21	112	71	105	72	106	73	98	58	76	54	63	49	73	51	69	46	76	50	84	52	104	67	105	73
22	111	86	104	68	103	71	90	54	77	47	62	43	75	49	65	44	79	46	81	60	102	66	104	70
23	110	80	104	67	101	70	92	59	74	43	57	41	76	44	65	46	82	43	75	52	100	69	104	69
24	111	81	106	64	100	63	93	55	75	38	48	31	70	43	65	45	82	48	78	53	98	67	105	69
25	114	79	112	74	96	62	94	61	74	39	46	27	72	39	70	40	79	49	87	47	87	68	103	70
26	115	80	113	78	96	59	88	73	69	48	49	39	64	48	73	40	70	43	91	54	89	61	105	68
27	107	80	111	83	89	69	89	62	61	44	54	44	61	41	73	43	78	42	89	51	93	70	108	72
28	108	81	102	74	93	67	89	62	65	40	63	40	55	43	65	46	84	46	89	54	99	63	109	68
29	113	80	104	73	95	70	91	62	69	40	60	47	53	30	71	44	76	54	93	59	103	66	109	72
30	114	84	106	76	96	67	86	57	71	46	57	37	50	32	......	......	76	46	90	62	101	64	107	70
31	116	84	108	69	......	......	89	59	......	......	61	43	49	34	......	......	80	43	......	......	99	66	......	......
Range	55°		51°		54°		58°		53°		47°		47°		48°		47°		50°		53°		49°	

Elevation of thermometers above ground, 5 feet.
The daily means are obtained by dividing the sum of the 7 a. m., 2 p. m. and *twice* the 9 p. m. observations by *four*. The monthly means are obtained by dividing the sum of the daily means by the number of days in the month.

PAPER 19.

Statement showing how many times the wind was observed blowing from the eight principal points of the compass during each month and season of the year ending June 30, 1880. Compiled from observations taken at the several stations of observations at 7 a. m., 2 p. m. and 9 p. m. (local time).

Station.	Wind.	July, 1879.	August.	September.	October.	November.	December.	January, '80.	February.	March.	April.	May.	June.	Spring.	Summer.	Autumn.	Winter.
Albany, N. Y	N.	12	14	6	12	10	23	10	12	14	3	10	10	27	36	28	45
	N. W.	19	24	19	22	26	24	24	18	23	10	10	14	43	57	67	66
	W.	8	2	2	4	8	4	7	8	14	29	18	15	61	25	14	19
	S. W.	0	2	0	0	1	3	12	3	4	10	12	10	26	12	1	18
	S.	31	30	41	36	31	26	27	31	17	23	33	25	73	86	108	84
	S. E.	6	6	9	4	6	2	1	0	0	0	1	1	1	13	19	3
	E.	2	2	0	1	0	2	1	1	2	3	3	4	8	8	1	4
	N. E.	3	1	2	3	2	2	8	4	14	8	5	9	27	13	7	14
	Calm.	12	12	11	11	6	7	3	10	5	4	1	2	10	26	28	20
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alpena, Mich	N.	6	5	4	2	7	10	6	4	11	9	5	6	25	17	13	20
	N. W.	12	22	19	17	15	20	23	17	13	14	13	11	40	45	51	60
	W.	17	15	21	16	21	23	12	26	17	19	8	17	44	49	58	61
	S. W.	6	7	16	16	16	14	12	13	13	8	17	5	38	18	48	39
	S.	11	10	11	9	16	5	13	9	8	5	9	9	22	30	36	27
	S. E.	26	16	11	28	10	11	22	9	18	10	21	25	49	67	49	42
	E.	7	10	2	1	3	4	1	4	6	17	11	6	34	23	6	9
	N. E.	5	5	6	1	2	6	3	4	7	4	7	3	18	13	9	13
	Calm.	3	3	0	3	0	0	1	1	0	4	2	8	6	14	3	2
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Atlanta, Ga.	N.	2	4	6	0	3	1	1	1	3	6	1	0	10	6	9	3
	N. W.	8	9	21	21	23	18	25	24	30	22	7	13	59	30	65	67
	W.	20	10	3	2	4	8	3	13	13	8	6	13	27	43	9	24
	S. W.	17	12	2	2	7	17	13	10	11	19	6	16	36	45	11	40
	S.	14	2	0	1	12	18	2	10	3	12	7	10	22	26	13	30
	S. E.	2	13	8	14	24	15	19	13	9	13	19	5	41	20	46	47
	E.	24	29	31	47	13	15	20	14	12	6	31	22	49	75	91	49
	N. E.	6	14	19	5	4	1	10	2	12	4	16	9	32	29	28	13
	Calm.	0	0	0	1	0	0	0	0	0	0	0	2	0	2	1	0
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Atlantic City, N. J..	N.	4	11	8	7	6	10	10	6	12	6	5	7	23	22	21	26
	N. W.	6	6	7	11	27	15	17	18	27	18	13	7	58	19	45	50
	W.	5	14	11	15	20	10	11	20	7	9	7	11	23	30	46	41
	S. W.	29	22	8	20	15	27	13	15	5	12	24	20	41	71	43	55
	S.	13	15	15	15	7	2	5	13	15	26	19	19	60	47	37	20
	S. E.	15	7	10	6	7	9	7	10	3	11	10	9	24	31	23	26
	E.	8	8	10	1	5	3	9	1	9	2	5	6	16	22	16	13
	N. E.	11	10	21	18	3	17	21	4	15	5	10	11	30	32	42	42
	Calm.	2	0	0	0	0	0	0	0	0	1	0	0	1	2	0	0
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Atka Island, Alaska	N.	0	0	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	N. W.	3	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	W.	24	30	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	S. W.	6	17	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	S.	17	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	S. E.	19	17	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	E.	4	0	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	N. E.	5	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	Calm.	25	17	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	Blank.	0	8	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Augusta, Ga	N.	2	2	2	1	0	0	8	5	4	5	5	4	14	8	3	13
	N. W.	12	7	1	8	12	12	7	9	10	5	1	3	16	22	21	28
	W.	3	3	2	1	2	11	4	11	9	5	0	10	14	16	5	26
	S. W.	18	18	5	7	13	8	4	5	7	13	3	8	23	44	25	17
	S.	6	5	2	6	4	5	9	10	6	13	10	16	29	27	12	24
	S. E.	23	21	10	8	14	6	4	6	3	7	21	8	31	52	32	16
	E.	4	8	13	17	1	1	2	1	1	2	11	4	14	16	31	4
	N. E.	15	18	23	32	9	7	11	6	11	6	10	12	27	45	64	24
	Calm.	10	11	32	13	35	43	44	34	42	34	32	25	108	46	80	121
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

*No reports received since those for August, 1879.

Statement showing how many times the wind was observed blowing, &c.—Continued.

Station.	Wind.	July, 1879.	August.	September.	October.	November.	December.	January, '80.	February.	March.	April.	May.	June.	Spring.	Summer.	Autumn.	Winter.
Baltimore, Md.	N.	7	16	14	7	7	13	16	7	21	4	10	6	35	29	28	36
	N. W.	9	14	11	13	20	8	13	18	22	28	12	14	62	37	44	39
	W.	16	15	10	5	17	7	9	16	12	6	10	23	28	54	32	32
	S. W.	13	9	9	17	7	16	9	9	4	5	15	7	24	29	33	34
	S.	21	16	12	14	19	14	11	17	4	23	25	13	52	50	45	42
	S. E.	14	8	20	10	11	2	8	9	6	14	8	6	28	28	41	19
	E.	9	5	2	18	8	19	14	4	5	3	5	8	13	22	28	37
	N. E.	4	10	8	4	1	10	11	5	14	6	7	11	27	25	13	26
	Calm.	0	0	4	5	0	4	2	2	5	1	1	2	7	2	9	8
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Barnegat, N. J.	N.	6	8	8	8	10	10	20	10	15	7	6	6	28	20	26	40
	N. W.	12	7	14	20	33	15	13	17	27	23	14	12	64	31	67	45
	W.	3	10	9	12	5	12	9	17	8	3	6	11	17	24	26	38
	S. W.	19	21	8	13	11	16	8	14	4	16	24	16	44	56	32	38
	S.	28	17	15	17	15	10	8	16	12	25	22	26	59	71	47	34
	S. E.	7	5	11	4	2	5	5	6	6	9	4	3	19	15	17	16
	E.	12	13	12	12	6	14	18	4	12	3	10	6	25	31	30	36
	N. E.	6	12	12	6	8	10	12	2	9	4	5	10	18	28	26	24
	Calm.	0	0	1	1	0	1	0	1	0	0	2	0	2	0	2	2
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bismarck, Dak.	N.	7	16	11	10	12	20	10	12	26	21	11	9	58	32	33	42
	N. W.	18	16	28	22	20	16	28	31	19	20	17	17	56	51	70	75
	W.	13	7	12	14	8	4	5	6	5	4	15	7	24	27	34	15
	S. W.	5	3	3	7	7	4	5	7	5	4	9	4	18	12	17	16
	S.	12	13	5	8	9	4	8	5	7	4	5	6	16	31	22	17
	S. E.	22	14	17	8	12	13	15	10	14	8	14	24	36	60	37	38
	E.	7	18	5	7	3	12	15	9	10	11	11	9	32	34	15	36
	N. E.	6	2	4	9	5	5	2	6	3	13	9	12	25	17	18	13
	Calm.	3	4	5	8	14	15	5	1	4	5	2	2	11	9	27	21
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Boise City, Idaho.	N.	16	13	9	3	4	5	1	7	8	5	11	11	24	40	16	13
	N. W.	27	26	29	33	21	39	15	22	19	24	48	42	91	95	83	76
	W.	10	13	5	4	3	10	5	8	8	4	3	5	15	28	12	23
	S. W.	2	2	5	3	4	1	3	2	7	3	1	2	11	6	12	6
	S.	8	5	5	10	9	4	4	3	2	6	3	2	11	15	24	11
	S. E.	15	15	25	24	24	23	58	31	40	31	17	7	88	37	73	112
	E.	5	6	1	9	12	4	3	2	2	6	3	8	11	19	22	9
	N. E.	5	6	2	4	4	3	0	2	4	6	4	4	14	15	10	5
	Calm.	5	7	9	3	9	4	4	10	3	5	3	9	11	21	21	18
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Boston, Mass.	N.	4	3	2	0	5	8	6	5	12	3	4	5	19	24	7	19
	N. W.	10	9	11	15	17	21	19	22	29	7	9	9	45	28	43	62
	W.	17	24	16	33	28	23	18	17	10	20	18	17	48	58	77	58
	S. W.	29	15	22	13	15	17	17	21	7	26	29	14	62	58	50	55
	S.	6	6	13	8	12	4	3	5	3	14	8	6	25	18	33	12
	S. E.	8	8	9	9	4	3	5	6	8	12	13	6	33	22	22	14
	E.	11	11	10	7	2	10	3	2	9	4	7	15	20	37	19	15
	N. E.	5	14	2	5	3	2	7	2	9	1	3	7	13	26	10	11
	Calm.	3	3	5	3	4	5	15	7	6	3	2	11	11	17	12	27
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brackettville, Tex.*	N.	0	9	10	20	11	11	14	13	18	13	....	....	....	....	41	38
	N. W.	0	2	1	8	3	4	5	1	5	2	....	....	....	....	12	10
	W.	0	1	0	4	6	5	7	9	2	4	....	....	....	....	10	21
	S. W.	1	1	1	0	2	2	0	1	0	0	....	....	....	....	3	3
	S.	0	3	1	2	1	2	1	1	1	7	....	....	....	....	4	4
	S. E.	22	17	14	17	13	15	16	12	6	30	....	....	....	....	44	43
	E.	62	41	31	32	38	45	42	38	56	27	....	....	....	....	101	125
	N. E.	7	10	17	6	4	6	6	9	5	4	....	....	....	....	27	21
	Calm.	1	9	15	4	6	3	2	3	0	3	....	....	....	....	25	8
	Blank.	0	0	0	0	6	0	0	0	0	0	....	....	....	....	0	0
Breckenridge, Minn.	N.	14	13	11	11	20	35	20	25	30	20	9	11	59	38	42	80
	N. W.	18	14	22	13	13	13	14	16	12	12	10	3	34	35	48	43
	W.	12	9	16	14	13	11	18	10	9	13	19	6	41	27	43	39
	S. W.	4	8	2	7	5	1	2	3	4	4	5	5	13	17	14	6
	S.	10	13	10	25	16	7	23	20	9	8	13	15	30	38	51	50
	S. E.	24	23	24	20	18	15	8	11	27	13	31	22	71	69	62	34
	E.	7	8	1	1	3	4	0	1	0	15	2	10	17	25	5	5
	N. E.	3	3	2	1	0	0	2	1	1	5	3	7	9	13	3	3
	Calm.	1	2	2	1	2	7	6	0	1	0	1	11	2	14	5	13
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

*Local observations discontinued May 4, 1880.

Statement showing how many times the wind was observed blowing, &c.—Continued.

Station.	Wind.	July, 1879.	August.	September.	October.	November.	December.	January, '80.	February.	March.	April.	May.	June.	Spring.	Summer.	Autumn.	Winter.
Buffalo, N. Y.	N.	5	6	6	4	4	5	5	6	10	2	3	3	15	14	14	16
	N. W.	11	16	9	3	12	5	3	5	9	5	3	1	17	28	24	13
	W.	15	16	23	19	22	26	19	20	20	17	13	11	50	42	64	65
	S. W.	40	30	20	30	17	18	23	26	25	33	61	59	119	129	67	67
	S.	1	3	9	19	20	9	22	13	5	10	2	4	17	8	48	44
	S. E.	0	1	6	4	3	5	2	9	3	5	3	2	11	3	13	16
	E.	15	8	13	7	6	7	8	3	9	8	6	5	23	28	26	18
	N. E.	4	11	3	6	6	18	11	5	12	10	2	3	24	18	15	34
	Calm.	2	2	1	1	0	0	0	0	0	0	0	2	0	6	2	0
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Burlington, Vt.	N.	17	16	9	10	13	16	13	10	35	14	12	23	61	56	32	39
	N. W.	6	9	6	13	10	2	5	10	10	14	11	2	35	17	29	17
	W.	2	7	3	8	12	8	5	6	4	12	4	9	20	18	23	19
	S. W.	16	13	12	2	3	3	11	6	3	8	15	11	26	40	17	20
	S.	35	23	42	33	37	34	40	36	24	31	43	30	98	88	112	110
	S. E.	3	1	2	8	7	9	7	7	3	4	1	4	8	8	17	23
	E.	2	7	3	2	4	3	1	2	6	2	2	4	10	13	9	6
	N. E.	6	6	5	2	4	17	11	10	8	5	5	7	18	19	11	38
	Calm.	4	11	8	15	0	1	0	0	0	0	0	0	0	15	23	1
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cairo, Ill.	N.	13	14	27	16	14	20	6	13	18	20	8	6	46	33	57	39
	N. W.	5	14	7	10	10	5	10	8	18	7	3	2	28	21	27	23
	W.	3	1	9	6	2	3	6	8	2	4	2	2	8	6	17	17
	S. W.	6	5	3	5	10	12	12	16	4	9	2	18	15	29	18	40
	S.	23	17	18	13	33	21	30	27	13	27	48	32	88	72	64	78
	S. E.	11	8	7	13	7	5	3	2	11	9	7	2	27	21	27	10
	E.	2	3	3	9	2	9	4	4	6	5	8	11	19	16	14	17
	N. E.	10	6	5	4	4	15	10	8	13	2	11	12	26	28	13	33
	Calm.	20	25	11	17	8	3	12	1	8	7	4	5	19	50	36	16
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Chincoteague, Va.	N.	....	....	....	....	....	....	....	....	....	1	3	1	....	....	....	....
	N. W.	....	....	....	....	....	....	....	....	....	19	5	5	....	....	....	....
	W.	....	....	....	....	....	....	....	....	....	5	5	9	....	....	....	....
	S. W.	....	....	....	....	....	....	....	....	....	15	33	24	....	....	....	....
	S.	....	....	....	....	....	....	....	....	....	9	18	14	....	....	....	....
	S. E.	....	....	....	....	....	....	....	....	....	27	18	15	....	....	....	....
	E.	....	....	....	....	....	....	....	....	....	2	3	7	....	....	....	....
	N. E.	....	....	....	....	....	....	....	....	....	8	8	15	....	....	....	....
	Calm.	....	....	....	....	....	....	....	....	....	0	0	0	....	....	....	....
	Blank.	....	....	....	....	....	....	....	....	....	4	0	0	....	....	....	....
Cape Hatteras, N. C.	N.	0	3	2	1	17	7	8	8	18	2	1	1	21	4	20	23
	N. W.	3	0	4	5	5	4	2	5	3	5	0	1	8	4	14	11
	W.	6	3	1	6	9	7	8	9	4	5	9	11	18	20	16	24
	S. W.	34	36	7	7	17	22	6	14	12	26	29	32	67	102	31	42
	S.	9	4	8	2	7	7	1	5	3	8	5	7	16	20	17	13
	S. E.	4	12	8	9	2	7	10	5	7	9	27	2	43	18	19	22
	E.	1	2	5	6	5	7	2	1	4	3	8	7	15	10	16	10
	N. E.	34	32	54	53	27	32	55	37	41	32	13	27	86	93	134	124
	Calm.	2	1	1	4	1	0	1	3	1	0	1	2	2	5	6	4
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cape Henry, Va.	N.	2	8	17	12	11	13	12	12	15	7	7	7	29	17	40	37
	N. W.	6	6	6	7	21	10	22	10	25	11	6	5	42	17	34	42
	W.	2	6	5	11	4	3	3	10	6	5	2	12	13	20	20	16
	S. W.	22	30	11	20	23	25	17	17	12	27	30	31	69	83	54	59
	S.	17	18	15	13	7	17	5	10	9	14	19	9	42	44	35	32
	S. E.	19	11	10	12	17	8	12	18	11	13	17	9	41	39	39	38
	E.	4	3	4	6	0	1	0	0	3	2	6	6	11	13	10	1
	N. E.	19	7	22	12	7	16	22	10	12	11	6	10	29	36	41	48
	Calm.	2	4	0	0	0	0	0	0	0	0	0	1	0	7	0	0
	Blank.	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Cape Lookout, N. C.	N.	2	4	8	10	19	11	14	8	10	1	1	2	12	8	37	33
	N. W.	3	5	4	5	7	5	8	4	16	6	3	7	25	15	16	17
	W.	5	5	4	5	8	9	7	11	6	5	9	6	20	16	17	27
	S. W.	37	37	7	9	16	22	11	22	16	40	38	41	94	115	32	55
	S.	8	6	11	2	8	9	2	8	5	8	8	2	21	16	21	19
	S. E.	3	6	7	6	3	4	6	2	3	4	13	7	20	16	16	12
	E.	7	4	21	8	5	3	1	1	8	0	4	0	12	11	34	5
	N. E.	28	25	28	46	23	30	44	31	29	26	16	25	71	78	97	105
	Calm.	0	1	0	2	1	0	0	0	0	0	1	0	1	1	3	0
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* Station opened March 16, 1880.

Statement showing how many times the wind was observed blowing, &c.—Continued.

Station.	Wind.	July, 1879.	August.	September.	October.	November.	December.	January, '80.	February.	March.	April.	May.	June.	Spring.	Summer.	Autum.	Winter.
*Cape May, N. J	N.	7	10	13	6	7	15	20	....	....	....	....	....	....	....	26	....
	N. W.	5	5	12	13	27	15	18	....	....	....	....	....	....	....	52	....
	W.	9	8	8	17	7	6	7	....	....	....	....	....	....	....	32	....
	S. W.	2	29	7	16	13	14	6	....	....	....	....	....	....	....	36	....
	S.	37	19	17	15	17	19	3	....	....	....	....	....	....	....	49	....
	S. E.	11	8	18	10	10	4	5	....	....	....	....	....	....	....	38	....
	E.	16	7	4	8	3	8	8	....	....	....	....	....	....	....	15	....
	N. E.	6	6	11	7	6	12	15	....	....	....	....	....	....	....	24	....
	Calm.	0	1	0	1	0	0	0	....	....	....	....	....	....	....	1	....
	Blank.	0	0	0	0	0	0	0	....	....	....	....	....	....	....	0	....
†Cedar Keys, Fla	N.	....	....	....	....	9	12	11	7	8	7	1	1	16	....	....	30
	N. W.	....	....	....	....	8	8	14	17	5	10	5	6	20	....	....	30
	W.	....	....	....	....	4	2	3	4	7	16	8	22	31	....	....	9
	S. W.	....	....	....	....	3	6	9	14	43	31	12	20	86	....	....	29
	S.	....	....	....	....	10	23	6	9	7	10	4	7	21	....	....	38
	S. E.	....	....	....	....	15	9	5	5	3	6	14	7	23	....	....	19
	E.	....	....	....	....	14	14	25	8	8	7	30	15	45	....	....	47
	N. E.	....	....	....	....	7	18	20	23	12	3	19	12	34	....	....	61
	Calm.	....	....	....	....	2	1	0	0	0	0	0	0	0	....	....	1
	Blank.	....	....	....	....	0	0	0	0	0	0	0	0	0	....	....	0
Charleston, S. C	N.	1	3	7	8	9	5	18	11	6	5	3	2	14	6	24	34
	N. W.	5	4	5	2	5	5	7	8	13	4	2	2	19	11	12	20
	W.	5	6	3	5	4	9	7	9	10	9	2	11	21	22	12	25
	S. W.	29	25	8	5	19	29	11	27	22	47	23	37	92	91	32	67
	S.	14	9	2	4	1	5	1	4	5	5	17	4	27	27	7	10
	S. E.	11	10	10	8	7	9	4	3	5	3	17	9	25	30	25	16
	E.	15	19	19	27	17	10	21	10	17	2	16	11	35	45	63	41
	N. E.	12	17	35	32	25	20	20	15	14	8	10	11	32	40	92	55
	Calm.	1	0	1	2	3	1	4	0	1	7	3	3	11	4	6	5
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Charlotte, N. C	N.	3	9	12	14	10	8	14	10	14	5	4	6	23	18	36	32
	N. W.	8	4	10	8	7	8	6	9	13	11	0	6	24	18	25	23
	W.	13	5	2	3	8	2	6	7	5	4	3	8	12	26	13	15
	S. W.	16	18	8	8	22	28	15	24	16	35	30	28	81	52	38	67
	S.	17	20	7	11	18	18	12	17	7	15	31	8	53	45	36	47
	S. E.	8	7	7	12	6	2	8	4	6	4	5	12	15	27	25	14
	E.	16	12	10	15	6	12	9	2	8	6	9	10	23	38	31	23
	N. E.	9	15	27	21	12	15	23	13	23	10	11	12	44	36	60	51
	Calm.	3	3	7	1	1	0	0	1	1	0	0	0	1	6	9	1
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chattanooga, Tenn	N.	5	14	9	7	8	5	6	8	10	13	7	9	30	28	24	19
	N. W.	10	9	12	10	15	12	8	10	15	8	3	11	26	30	37	30
	W.	11	2	1	5	2	4	4	4	5	9	6	8	20	21	8	12
	S. W.	18	11	6	2	9	15	9	13	11	13	5	25	29	54	17	37
	S.	9	11	11	8	21	23	22	26	13	24	15	10	52	30	40	71
	S. E.	7	11	7	14	6	8	10	5	6	5	12	4	23	22	27	23
	E.	3	1	1	7	0	3	5	1	6	3	5	3	14	7	8	9
	N. E.	12	11	14	14	15	9	15	8	18	5	15	7	38	30	43	32
	Calm.	18	23	29	26	14	14	14	12	9	10	25	13	44	54	69	40
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cheyenne, Wyo	N.	10	6	8	3	10	8	2	6	9	11	9	17	29	33	21	16
	N. W.	15	21	23	21	16	10	25	39	34	32	28	19	94	55	60	74
	W.	14	19	23	31	45	44	35	20	23	23	11	8	57	41	99	99
	S. W.	13	8	9	12	12	17	15	7	12	10	10	8	32	29	33	39
	S.	11	13	16	12	4	8	8	8	6	7	15	18	28	42	32	24
	S. E.	11	12	7	6	1	3	3	1	1	2	5	6	8	29	14	7
	E.	8	6	2	2	0	2	2	0	2	2	1	3	5	17	4	4
	N. E.	6	7	1	5	1	1	1	4	6	2	7	8	15	21	7	6
	Calm.	5	1	1	1	1	0	2	2	0	1	7	3	8	9	3	4
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chicago, Ill	N.	6	8	14	2	5	3	9	5	9	5	4	7	18	21	21	17
	N. W.	4	1	10	10	15	11	8	12	11	8	5	1	24	6	35	31
	W.	11	6	7	13	17	21	20	20	10	11	8	12	29	29	37	61
	S. W.	27	23	18	20	25	19	16	25	22	24	23	22	69	72	63	60
	S.	8	16	20	23	16	12	15	10	12	11	19	15	42	39	59	37
	S. E.	11	8	7	8	4	10	3	7	14	12	15	7	41	26	19	20
	E.	9	7	6	6	1	5	7	3	9	9	6	8	24	24	13	15
	N. E.	16	16	5	6	3	10	2	4	6	9	11	7	26	39	14	16
	Calm.	1	8	3	5	4	2	13	1	0	0	2	11	2	20	12	16
	Blank.	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0

* Local observations discontinued January 21, 1880.

† Station opened November 6, 1879.

Statement showing how many times the wind was observed blowing, &c.—Continued.

Station.	Wind.	July, 1879.	August.	September.	October.	November.	December.	January, '80.	February.	March.	April.	May.	June.	Spring.	Summer.	Autumn.	Winter.
Cincinnati, Ohio	N.	5	18	9	7	2	8	6	7	16	8	4	10	28	33	18	21
	N. W.	12	5	14	12	19	16	7	12	21	16	6	4	43	21	45	35
	W.	18	3	12	6	8	9	5	14	6	10	6	6	22	27	26	28
	S. W.	15	13	8	11	10	14	17	16	7	13	18	20	38	48	29	47
	S.	10	6	6	8	18	8	20	15	7	16	16	14	39	30	32	43
	S. E.	16	17	24	23	22	17	27	15	15	16	20	12	51	45	69	59
	E.	4	10	2	10	3	8	5	3	4	6	3	4	13	18	15	16
	N. E.	7	13	11	7	5	13	5	5	14	5	14	7	33	27	23	23
	Calm.	6	8	4	9	3	0	1	0	3	0	6	13	9	27	16	1
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cleveland, Ohio	N.	25	24	7	15	4	5	9	8	19	4	10	15	33	64	26	22
	N. W.	5	9	13	4	4	0	3	7	9	7	7	7	23	21	21	10
	W.	7	11	8	14	25	13	14	18	17	25	10	14	52	32	47	45
	S. W.	12	7	10	7	5	20	9	10	8	10	15	11	33	30	22	39
	S.	15	24	21	17	16	18	19	16	9	22	27	16	58	55	54	53
	S. E.	13	3	20	14	32	22	29	23	14	13	15	10	42	26	66	74
	E.	9	11	9	20	2	8	3	4	10	3	3	7	16	27	31	15
	N. E.	6	4	2	2	2	7	7	1	7	6	5	10	18	20	6	15
	Calm.	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Columbus, Ohio	N.	13	16	11	5	4	9	5	7	17	10	9	16	36	45	20	21
	N. W.	8	10	9	12	9	11	10	8	14	9	3	4	26	22	30	29
	W.	16	4	12	11	23	13	7	20	16	18	8	8	42	28	46	40
	S. W.	13	16	10	14	16	16	19	17	7	12	29	26	48	55	40	52
	S.	19	24	25	20	28	22	26	22	13	26	25	15	64	58	73	70
	S. E.	5	6	7	13	4	8	15	8	12	6	6	6	24	17	24	31
	E.	8	3	2	6	4	10	5	3	5	4	4	4	13	15	12	18
	N. E.	11	10	13	12	2	4	6	2	9	4	9	11	22	32	27	12
	Calm.	0	4	1	0	0	0	0	0	0	1	0	0	1	4	1	0
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corsicana, Tex	N.	1	7	9	18	12	29	24	19	18	16	4	6	38	14	39	72
	N. W.	0	1	0	4	10	6	3	9	7	3	1	1	11	2	14	18
	W.	0	0	0	3	4	1	0	2	0	0	1	0	1	0	7	3
	S. W.	6	2	0	3	8	2	7	5	3	11	1	1	15	9	11	14
	S.	54	29	23	12	33	36	38	34	31	39	41	30	111	113	68	108
	S. E.	19	15	15	23	9	5	9	6	11	8	22	23	41	57	47	20
	E.	8	16	19	10	8	2	2	4	10	2	8	13	20	37	37	8
	N. E.	1	17	11	10	2	2	0	6	4	7	5	10	16	28	23	8
	Calm.	4	6	13	10	4	10	10	2	9	4	10	6	23	16	27	22
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Davenport, Iowa	N.	6	8	9	0	4	6	6	7	6	6	5	6	17	20	13	19
	N. W.	11	7	26	16	15	21	12	14	25	22	12	5	59	23	57	47
	W.	7	5	3	8	19	16	9	13	9	17	5	11	31	23	30	38
	S. W.	25	21	12	11	11	13	20	15	10	19	26	27	55	73	34	48
	S.	11	10	14	30	14	6	16	13	13	7	17	18	37	39	58	35
	S. E.	10	11	7	5	6	9	4	5	11	5	9	7	25	28	18	18
	E.	15	8	6	7	8	11	13	3	10	12	15	11	37	34	21	27
	N. E.	8	14	3	4	6	7	10	4	8	2	3	4	13	26	13	21
	Calm.	0	9	10	12	7	4	3	7	1	0	1	1	2	11	29	14
	Blank.	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	6
Deadwood, Dak.	N.	7	4	5	3	2	0	0	0	0	6	1	2	7	13	10	0
	N. W.	0	2	0	0	1	2	0	2	1	1	2	0	4	2	1	4
	W.	10	11	6	10	8	9	8	11	3	6	6	4	15	25	24	28
	S. W.	15	12	11	22	11	6	25	21	19	16	13	15	48	42	44	52
	S.	4	6	1	3	6	3	9	4	4	2	5	6	11	16	10	16
	S. E.	4	9	1	3	0	1	0	0	0	1	0	1	1	14	4	1
	E.	2	3	1	1	0	0	2	0	3	0	0	1	3	6	2	2
	N. E.	19	8	12	11	10	15	1	5	7	13	10	16	30	43	33	21
	Calm.	32	38	47	40	52	55	48	44	56	45	56	45	157	115	139	147
	Blank.	0	0	6	0	0	2	0	0	0	0	0	0	0	0	6	2
*Delaware Breakwater, Del.	N.	....	....	....	....	....	....	....	14	14	2	7	4	23	....	....	....
	N. W.	....	....	....	....	....	....	....	17	24	25	10	7	59	....	....	....
	W.	....	....	....	....	....	....	....	7	7	7	5	9	19	....	....	....
	S. W.	....	....	....	....	....	....	....	16	11	17	22	17	50	....	....	....
	S.	....	....	....	....	....	....	....	13	8	17	20	12	45	....	....	....
	S. E.	....	....	....	....	....	....	....	10	4	10	15	19	29	....	....	....
	E.	....	....	....	....	....	....	....	0	6	5	9	9	20	....	....	....
	N. E.	....	....	....	....	....	....	....	10	19	6	5	13	30	....	....	....
	Calm.	....	....	....	....	....	....	....	0	0	1	0	0	1	....	....	....
	Blank.	....	....	....	....	....	....	....	0	0	0	0	0	0	....	....	....

* Station opened January 28, 1880.

Statement showing how many times the wind was observed blowing, &c.—Continued.

Station.	Wind.	July, 1879.	August.	September.	October.	November.	December.	January, '80.	February.	March.	April.	May.	June.	Spring.	Summer.	Autumn.	Winter.
Denison, Tex	N.	3	10	11	16	9	17	17	5	23	12	7	6	42	19	36	39
	N. W.	0	2	4	9	12	16	12	15	10	3	1	3	14	5	25	43
	W.	1	1	0	2	3	2	2	1	1	4	2	0	7	2	5	5
	S. W.	14	7	8	5	14	10	9	23	6	14	4	4	24	25	27	42
	S.	31	18	20	12	23	23	25	20	15	24	27	27	66	76	55	68
	S. E.	31	29	33	27	16	8	18	13	20	14	36	23	70	83	76	39
	E.	8	17	2	13	8	8	2	2	6	3	11	20	20	45	23	12
	N. E.	4	9	12	9	5	8	6	8	11	15	2	6	28	19	26	22
	Calm.	1	0	0	0	0	1	2	0	1	1	0	1	2	2	0	3
	Blank.	0	0	0	0	0	0	0	0	0	0	3	0	3	0	0	0
Denver, Colo	N.	16	14	19	13	14	9	9	8	12	13	10	20	35	50	46	26
	N. W.	19	11	14	12	11	13	14	8	6	15	15	12	36	42	37	35
	W.	6	3	0	4	2	8	13	7	12	13	10	6	35	15	6	28
	S. W.	0	3	3	4	5	11	10	9	5	8	11	11	24	14	12	30
	S.	22	28	38	37	36	29	37	27	25	21	18	10	64	60	111	93
	S. E.	11	12	5	11	10	7	2	14	11	7	15	11	33	34	26	23
	E.	8	9	1	5	6	6	3	6	11	8	6	12	25	29	12	15
	N. E.	10	10	8	7	5	10	5	8	11	5	7	8	23	28	20	23
	Calm.	1	3	2	0	1	0	0	0	0	0	1	0	1	4	3	0
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Des Moines, Iowa	N.	6	7	15	7	16	15	9	12	15	15	10	3	40	16	38	36
	N. W.	7	3	7	13	17	22	17	20	16	16	4	10	36	20	37	59
	W.	5	4	7	6	8	3	8	15	8	9	15	3	32	12	21	26
	S. W.	24	16	14	20	12	10	23	15	10	11	28	30	49	70	46	48
	S.	5	13	13	23	5	11	4	7	16	6	11	16	33	44	41	22
	S. E.	11	8	4	1	9	8	7	3	8	9	11	8	28	27	14	18
	E.	3	6	3	0	0	1	4	2	3	5	0	4	8	13	3	7
	N. E.	14	10	7	1	5	10	8	6	9	10	7	5	26	29	13	24
	Calm.	18	26	20	22	18	13	13	7	8	9	7	11	24	55	60	33
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Detroit, Mich	N.	3	14	9	3	7	9	4	6	9	2	3	1	14	18	19	19
	N. W.	4	10	15	7	14	8	9	11	8	16	9	4	33	18	36	28
	W.	17	8	13	23	21	19	13	21	16	15	10	28	41	53	57	53
	S. W.	36	38	24	29	29	25	28	28	20	29	44	23	93	97	82	81
	S.	6	5	11	9	10	5	13	12	9	8	6	11	23	22	30	30
	S. E.	4	2	3	6	4	5	3	3	3	0	1	3	4	9	13	11
	E.	7	6	10	9	3	12	15	3	11	10	9	6	30	19	22	30
	N. E.	16	9	4	4	0	9	8	3	17	10	10	13	37	38	8	20
	Calm.	0	1	1	3	2	1	0	0	0	0	1	1	1	2	6	1
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dodge City, Kans	N.	2	8	4	11	15	27	19	13	4	17	11	5	32	15	30	59
	N. W.	1	0	0	7	9	6	10	16	26	10	1	5	37	6	16	32
	W.	0	1	2	4	6	4	6	13	5	11	4	3	20	4	12	23
	S. W.	10	14	10	5	10	7	17	7	4	10	7	9	21	33	25	31
	S.	39	41	32	39	16	21	15	9	9	13	40	41	62	121	87	45
	S. E.	20	12	10	9	10	8	6	11	18	11	10	14	39	46	29	25
	E.	13	6	6	1	3	2	2	5	15	3	8	4	26	23	10	9
	N. E.	7	7	19	11	11	13	9	10	2	6	10	6	18	20	41	32
	Calm.	1	4	7	6	10	5	9	3	10	9	2	3	21	8	23	17
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dubuque, Iowa	N.	6	13	7	0	4	7	6	7	10	8	3	5	21	24	11	20
	N. W.	15	13	27	14	18	20	17	12	21	17	17	6	55	34	59	49
	W.	5	3	8	6	15	19	8	23	13	19	6	10	38	18	29	50
	S. W.	17	6	7	7	5	8	7	9	4	14	13	15	31	38	19	24
	S.	22	23	13	30	14	8	18	15	13	10	24	15	47	60	57	41
	S. E.	13	13	16	12	9	15	13	13	16	10	15	15	41	41	37	41
	E.	4	5	2	4	3	6	6	1	10	3	8	11	21	20	9	13
	N. E.	8	11	1	1	3	3	6	5	4	9	4	5	17	24	5	14
	Calm.	3	6	9	19	19	7	12	2	2	0	3	8	5	17	47	21
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Duluth, Minn	N,	2	4	2	4	17	7	1	0	2	2	1	6	5	12	23	8
	N. W.	10	18	26	21	19	28	19	19	22	22	6	12	50	40	66	66
	W.	10	12	14	4	20	5	9	14	8	7	10	10	25	32	38	28
	S. W.	25	21	15	26	14	25	32	26	17	16	19	6	52	52	55	83
	S.	2	1	5	1	2	2	0	0	0	1	0	1	1	4	8	2
	S. E.	0	1	0	0	3	1	1	0	0	2	0	2	2	3	3	2
	E.	1	0	9	0	4	13	3	0	1	0	0	1	1	2	13	16
	N. E.	38	32	12	24	6	5	25	22	40	38	53	45	131	115	42	52
	Calm.	5	4	7	13	5	7	3	6	3	2	4	7	9	16	25	16
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Statement showing how many times the wind was observed blowing, &c.—Continued.

Station.	Wind.	July, 1879.	August.	September.	October.	November.	December.	January, '80.	February.	March.	April.	May.	June.	Spring.	Summer.	Autumn.	Winter.
Eastport, Me	N.	7	10	4	9	6	17	16	8	24	15	16	11	55	28	19	41
	N. W.	16	18	15	26	28	29	24	20	20	12	6	13	38	47	69	73
	W.	3	5	4	10	9	8	9	14	5	6	3	2	14	10	23	31
	S. W.	16	12	21	15	11	11	12	10	5	8	5	5	18	33	47	33
	S.	43	28	26	16	15	7	16	14	12	41	45	42	98	113	57	37
	S. E.	2	1	3	0	8	10	2	3	3	1	5	5	9	8	11	15
	E.	0	8	7	1	4	4	6	4	6	2	3	3	11	11	12	14
	N. E.	4	9	7	9	9	5	5	8	14	2	6	4	22	17	25	18
	Calm.	2	2	3	7	0	2	3	6	4	3	4	5	11	9	10	11
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erie, Pa	N.	6	8	8	4	4	6	2	4	6	3	1	3	10	17	16	12
	N. W.	9	12	13	12	15	4	4	12	17	12	8	5	37	26	40	20
	W.	18	14	9	16	9	10	16	14	21	19	20	21	60	53	34	40
	S. W.	17	14	11	11	24	29	12	15	12	20	27	24	59	55	46	56
	S.	6	17	31	30	30	17	28	27	11	19	18	13	48	36	91	72
	S. E.	5	1	6	6	2	9	10	3	8	4	5	6	17	12	14	22
	E.	2	2	6	6	0	3	5	2	5	2	2	2	9	6	12	10
	N. E.	17	14	4	8	2	11	11	5	13	11	7	10	31	41	14	27
	Calm.	13	11	2	0	4	4	5	5	0	0	5	6	5	30	6	14
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Escanaba, Mich	N.	19	17	12	6	14	15	19	18	29	25	12	11	66	47	32	52
	N. W.	8	11	18	20	26	29	16	17	13	10	8	7	31	26	64	62
	W.	7	8	17	8	18	14	6	9	3	8	4	6	15	21	43	29
	S. W.	12	15	12	21	14	11	12	16	12	15	10	8	37	35	47	39
	S.	30	27	22	24	8	5	19	16	18	11	33	31	62	88	54	40
	S. E.	5	4	3	6	3	4	11	5	7	7	8	9	22	18	12	20
	E.	5	0	2	4	1	6	2	1	5	9	8	4	22	9	7	9
	N. E.	6	8	3	2	5	9	5	3	4	5	5	3	14	17	10	17
	Calm.	1	3	1	2	1	0	3	2	2	0	4	11	6	15	4	5
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fort Gibson, Ind. T.	N.	6	13	10	12	12	17	13	10	23	18	4	6	45	25	34	40
	N. W.	2	2	6	3	12	19	13	9	10	10	1	2	21	6	21	41
	W.	2	0	2	3	2	7	3	5	6	6	4	4	16	6	7	15
	S. W.	10	0	3	4	3	5	8	6	3	2	2	2	7	12	10	19
	S.	26	20	19	13	11	18	9	19	10	24	30	26	64	72	43	46
	S. E.	35	31	22	33	37	16	31	19	17	13	23	27	53	93	92	66
	E.	6	17	10	8	3	2	0	8	10	9	21	16	40	39	21	10
	N. E.	0	5	8	2	2	1	1	3	5	2	4	3	11	8	12	5
	Calm.	6	5	10	15	8	8	15	8	9	6	4	4	19	15	33	31
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Galveston, Tex	N.	1	4	8	16	11	19	10	11	13	10	2	3	25	8	35	40
	N. W.	1	4	1	6	2	1	3	4	8	0	3	3	11	8	9	8
	W.	2	2	2	1	1	3	1	3	1	1	1	2	3	6	4	7
	S. W.	14	7	0	3	3	3	9	2	2	6	0	1	8	22	6	14
	S.	58	23	6	5	28	35	25	21	13	23	12	35	48	116	39	81
	S. E.	16	21	23	23	28	21	24	18	24	32	44	35	100	79	74	63
	E.	0	14	25	15	4	4	11	12	14	14	22	6	50	45	44	27
	N. E.	1	17	25	23	13	6	7	16	18	4	9	5	31	47	61	29
	Calm.	0	1	0	1	0	1	3	0	0	0	0	0	0	1	1	4
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Haven, Mich.	N.	6	5	16	14	13	5	9	6	4	7	0	2	11	7	43	20
	N. W.	10	13	18	11	7	10	13	7	7	15	5	7	27	11	36	30
	W.	22	16	12	11	15	20	8	20	25	7	14	11	46	25	38	48
	S. W.	24	13	19	23	11	10	10	12	6	23	10	25	39	30	53	32
	S.	10	19	12	25	12	9	26	12	11	14	30	30	55	3	49	47
	S. E.	5	2	2	2	8	9	8	18	14	5	14	3	33	5	12	35
	E.	3	4	3	4	18	17	13	6	16	16	11	5	43	7	25	36
	N. E.	6	7	5	1	6	12	4	5	8	2	5	7	15	0	12	21
	Calm.	7	14	3	2	0	1	2	1	2	1	4	0	7	0	5	4
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Indianapolis, Ind	N.	9	14	10	8	5	7	7	4	12	4	9	14	25	37	23	18
	N. W.	6	4	8	7	12	15	9	14	23	19	3	7	45	17	27	38
	W.	7	6	9	9	20	13	6	13	13	12	7	9	32	22	38	32
	S. W.	16	4	3	11	5	13	14	13	6	9	12	16	27	36	19	40
	S.	13	18	11	9	26	18	20	17	8	24	33	21	65	52	46	55
	S. E.	3	6	12	6	12	9	27	18	13	12	10	12	35	21	30	54
	E.	3	2	1	6	4	8	6	2	7	5	6	2	18	7	11	16
	N. E.	11	6	4	1	1	10	3	5	10	5	9	4	24	21	6	18
	Calm.	25	33	32	36	5	0	1	1	1	0	4	4	5	62	73	2
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Statement showing how many times the wind was observed blowing, &c.—Continued.

Station.	Wind	July, 1879.	August.	September.	October.	November.	December.	January, '80.	February.	March.	April.	May.	June.	Spring.	Summer.	Autumn.	Winter.
Indianola, Tex	N.	0	5	7	24	19	15	10	16	21	6	4	2	31	7	50	41
	N. W.	1	2	2	1	2	6	1	10	0	2	0	0	2	3	5	17
	W.	0	1	0	1	0	0	0	3	2	5	1	1	8	7	1	3
	S. W.	1	5	0	0	3	2	6	2	2	11	0	0	13	6	3	10
	S.	68	27	5	9	38	43	30	21	23	36	15	50	74	145	52	94
	S. E.	16	15	26	21	11	11	26	11	13	16	31	17	60	48	58	48
	E.	4	21	21	20	6	6	10	8	14	8	34	16	56	41	47	24
	N. E.	0	16	26	13	8	5	7	15	18	6	7	4	31	20	47	27
	Calm.	3	1	3	4	3	5	3	1	0	0	1	1	1	5	10	9
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jacksonville, Fla	N.	0	1	6	12	8	9	11	6	3	2	0	0	5	1	26	26
	N. W.	0	1	6	5	20	12	9	12	9	10	2	1	21	2	31	33
	W.	4	8	1	1	1	3	5	4	4	8	0	0	12	12	3	12
	S. W.	35	11	4	3	10	4	6	17	30	22	2	32	54	78	17	27
	S.	13	11	5	2	4	8	4	9	15	11	1	10	27	34	11	21
	S. E.	14	22	5	12	14	16	6	7	5	20	18	17	43	53	31	29
	E.	10	13	14	23	6	2	6	4	2	1	20	4	23	27	43	12
	N. E.	17	25	49	34	25	32	43	21	23	11	36	26	70	68	108	96
	Calm.	0	1	0	1	2	7	3	7	2	5	14	0	21	1	3	17
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Keokuk, Iowa	N.	8	8	22	9	9	15	13	9	19	17	12	4	48	20	40	37
	N. W.	8	4	11	12	19	23	14	18	13	11	5	8	29	20	42	55
	W.	7	8	5	7	11	11	8	12	10	14	3	10	27	25	23	31
	S. W.	15	11	6	13	15	8	22	15	6	14	16	20	36	46	34	45
	S.	21	20	22	25	16	9	13	15	11	14	29	23	54	64	63	37
	S. E.	10	11	9	17	10	13	12	6	18	10	19	13	47	34	36	31
	E.	7	3	8	3	7	7	4	3	8	4	6	8	18	16	18	14
	N. E.	7	20	5	3	2	7	5	2	7	5	2	2	14	29	10	14
	Calm.	10	8	2	4	1	0	2	7	1	1	1	4	3	22	7	9
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Key West, Fla	N.	7	6	3	3	10	6	8	10	4	4	0	0	8	13	16	24
	N. W.	6	3	0	1	1	0	4	7	6	3	1	1	10	10	2	11
	W.	2	1	0	0	0	1	4	2	0	0	1	6	1	9	0	7
	S. W.	5	3	2	2	0	0	2	1	4	0	3	7	7	19	4	3
	S.	5	13	11	5	0	0	9	7	8	4	7	1	19	19	16	16
	S. E.	31	30	22	20	1	18	2	12	40	40	23	36	103	107	43	32
	E.	25	32	38	43	31	39	22	22	22	33	50	30	105	87	112	83
	N. E.	12	5	13	19	47	28	42	26	9	6	8	3	23	20	79	96
	Calm.	0	0	1	0	0	1	0	0	0	0	0	6	0	6	1	1
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kitty Hawk, N. C	N.	1	3	2	4	15	8	4	9	13	1	0	0	14	4	21	21
	N. W.	3	3	1	3	11	4	2	2	5	3	4	2	12	8	15	8
	W.	4	11	2	7	11	9	7	13	5	0	12	19	17	34	20	39
	S. W.	44	30	16	6	22	26	4	14	12	39	40	28	91	102	44	44
	S.	1	1	4	5	5	11	12	9	4	6	8	3	18	5	14	32
	S. E.	1	5	8	4	5	4	7	11	8	4	7	5	19	11	17	22
	E.	11	9	5	16	5	8	10	5	12	5	8	10	25	30	26	23
	N. E.	28	29	50	44	15	23	45	23	32	32	13	23	77	80	109	91
	Calm.	0	2	2	4	1	0	2	1	2	0	1	0	3	2	7	3
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Knoxville, Tenn	N.	5	7	9	5	9	7	5	5	12	6	2	5	20	17	23	17
	N. W.	5	1	9	8	7	6	4	2	9	8	3	3	20	9	24	12
	W.	20	9	7	5	14	13	7	13	16	12	13	19	41	39	26	33
	S. W.	20	25	23	11	26	28	32	36	13	32	24	31	69	76	60	96
	S.	0	2	1	1	1	2	0	0	1	4	3	1	8	3	3	2
	S. E.	6	7	4	7	3	8	8	4	4	3	8	2	15	15	14	20
	E.	9	10	7	14	8	2	8	2	2	5	6	2	13	21	29	12
	N. E.	25	20	22	33	16	17	18	17	29	14	22	16	65	61	71	52
	Calm.	3	12	8	9	6	10	11	8	7	6	12	11	25	26	23	29
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
La Crosse, Wis	N.	11	11	11	5	20	16	13	16	16	19	6	8	41	30	36	45
	N. W.	8	7	19	15	13	14	6	11	12	10	11	5	33	20	47	31
	W.	7	7	8	8	8	13	6	7	6	14	7	7	27	21	24	26
	S. W.	9	10	8	4	7	3	6	15	6	10	9	13	25	32	19	24
	S.	38	32	35	50	22	16	30	23	24	15	40	40	79	110	107	69
	S. E.	8	1	1	3	6	8	4	0	14	11	12	8	37	17	10	12
	E.	1	0	2	1	1	2	1	0	1	3	2	3	6	4	4	3
	N. E.	6	5	3	1	1	4	5	3	8	7	4	5	19	16	5	12
	Calm.	5	20	3	6	12	17	22	12	6	1	2	1	9	26	21	51
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Statement showing how many times the wind was observed blowing, &c.—Continued.

Station.	Wind.	July, 1879.	August.	September.	October.	November.	December.	January, '80.	February.	March.	April.	May.	June.	Spring.	Summer.	Autumn.	Winter.
La Mesilla, N. Mex	N.	6	2	2	11	3	9	8	8	3	2	5	1	10	9	16	25
	N. W.	5	0	3	6	8	7	9	2	1	3	1	2	5	7	17	18
	W.	10	3	5	5	9	15	5	8	16	19	22	17	57	30	19	28
	S. W.	6	2	0	7	4	7	3	13	20	21	11	4	52	12	11	23
	S.	24	11	4	4	9	9	4	1	7	5	6	5	18	40	17	14
	S. E.	3	13	23	19	3	1	7	10	10	8	6	9	24	25	45	18
	E.	3	8	2	3	3	2	0	1	0	2	3	3	5	14	8	3
	N. E.	1	2	0	1	0	0	1	0	0	0	1	0	1	3	1	1
	Calm.	35	52	51	37	51	43	56	44	36	30	38	49	104	136	139	143
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leavenworth, Kans	N.	14	18	24	14	16	24	11	18	25	23	20	6	68	38	54	53
	N. W.	3	2	14	13	20	22	16	16	12	15	4	6	31	11	47	54
	W.	0	1	1	2	7	3	3	7	2	4	2	3	8	4	10	13
	S. W.	4	7	2	3	1	0	4	7	5	3	2	2	10	13	6	11
	S.	35	44	24	41	28	24	38	27	21	24	38	47	83	126	93	89
	S. E.	16	9	14	14	11	13	8	7	14	11	15	17	40	42	39	28
	E.	9	3	3	1	3	5	2	3	4	2	6	3	12	15	7	10
	N. E.	8	4	4	3	2	2	5	0	7	7	1	3	15	15	9	7
	Calm.	4	5	4	2	2	0	6	2	3	1	5	3	9	12	8	8
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Little Rock, Ark	N.	2	8	11	12	7	10	10	8	16	9	5	8	30	18	30	28
	N. W.	6	7	8	14	14	13	4	12	10	9	3	5	22	18	36	29
	W.	4	2	2	4	5	3	4	7	3	3	0	2	6	8	11	14
	S. W.	21	5	5	2	5	9	14	14	7	11	8	13	26	39	12	37
	S.	22	5	6	5	16	19	20	25	11	20	26	21	57	48	27	64
	S. E.	8	10	7	14	20	15	10	4	13	16	14	12	43	30	41	29
	E.	8	7	10	16	5	6	8	5	15	2	12	7	29	22	31	19
	N. E.	7	13	16	16	11	15	5	8	16	8	11	9	35	29	43	28
	Calm.	15	36	24	10	7	3	18	4	2	12	14	14	28	65	41	25
	Blank.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
Los Angeles, Cal	N.	2	1	3	12	17	22	27	15	21	7	3	2	31	5	32	64
	N. W.	0	3	3	5	4	6	5	6	9	11	2	2	22	5	12	17
	W.	36	30	26	19	14	8	16	18	16	20	28	28	64	94	59	42
	S. W.	17	22	17	19	10	13	6	6	19	31	31	35	81	74	46	25
	S.	6	4	2	4	3	1	2	7	5	6	7	9	18	19	9	10
	S. E.	8	7	4	2	2	4	3	8	5	3	2	4	10	19	8	15
	E.	5	1	8	3	6	12	9	8	2	4	10	5	16	11	17	29
	N. E.	7	5	6	19	23	23	19	17	15	7	9	0	31	12	48	59
	Calm.	12	20	21	10	11	4	6	2	1	1	1	5	3	37	42	12
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Louisville, Ky	N.	10	11	16	8	7	13	9	9	24	8	9	20	41	41	31	31
	N. W.	6	8	8	10	9	10	5	3	7	14	1	6	22	22	27	18
	W.	7	9	9	2	10	11	5	16	18	10	6	8	34	22	21	32
	S. W.	28	14	14	14	9	15	11	15	5	9	20	21	34	63	37	41
	S.	21	10	12	16	30	21	28	26	10	27	26	17	63	48	58	75
	S. E.	8	11	10	2	12	9	22	11	9	13	9	8	31	27	24	42
	E.	2	7	0	7	5	3	10	2	13	6	6	1	25	10	12	15
	N. E.	10	23	10	8	5	9	3	5	7	3	13	9	23	42	23	17
	Calm.	1	0	11	26	3	2	0	0	0	0	3	0	3	1	40	2
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lynchburg, Va	N.	10	7	4	10	1	4	2	3	8	1	3	3	7	20	15	9
	N. W.	8	7	9	15	19	10	11	17	18	17	2	3	37	18	43	38
	W.	5	7	7	4	8	7	11	13	16	10	7	21	33	33	19	31
	S. W.	7	17	5	13	19	25	16	20	17	14	28	25	59	59	37	61
	S.	14	18	12	4	17	9	14	18	6	23	30	8	59	40	33	41
	S. E.	11	7	6	7	4	5	3	4	4	6	7	3	17	21	17	12
	E.	9	2	10	8	6	4	8	1	3	4	7	6	14	17	24	13
	N. E.	10	11	12	8	3	20	18	6	20	9	5	11	34	32	23	44
	Calm.	9	17	25	24	13	9	10	6	6	6	4	10	16	36	62	25
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Madison, Wis	N.	7	7	7	4	6	10	8	7	8	10	4	7	22	21	17	25
	N. W.	12	18	16	15	19	8	15	18	18	16	12	10	46	40	50	41
	W.	12	10	20	10	17	22	9	13	15	18	10	14	43	36	47	44
	S. W.	25	13	6	8	11	12	11	15	9	10	20	19	39	57	25	38
	S.	17	21	21	29	19	9	25	16	12	16	24	17	52	55	69	50
	S. E.	9	11	14	19	9	10	14	8	11	4	9	12	24	32	42	32
	E.	7	8	2	5	4	11	6	5	14	10	12	7	36	22	11	22
	N. E.	4	5	3	3	5	11	5	5	6	6	2	3	14	12	11	21
	Calm.	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Statement showing how many times the wind was observed blowing, &c.—Continued.

Station.	Wind.	July, 1879.	August.	September.	October.	November.	December.	January, '80.	February.	March.	April.	May.	June.	Spring.	Summer.	Autumn.	Winter.
Marquette, Mich	N.	15	8	10	3	5	2	8	9	9	16	9	12	34	35	18	19
	N. W.	18	27	18	23	25	27	19	28	29	27	19	21	75	66	66	74
	W.	8	9	21	12	26	26	17	10	11	12	15	11	38	28	59	53
	S. W.	23	14	11	31	15	10	15	12	8	7	12	10	27	47	57	37
	S.	2	8	11	16	4	8	13	12	11	6	9	10	26	20	31	33
	S. E.	4	6	8	5	7	10	16	8	9	5	13	10	27	20	20	34
	E.	6	7	5	0	2	2	1	2	7	10	9	9	26	22	7	5
	N. E.	11	9	4	0	3	6	4	2	9	7	7	7	23	27	7	12
	Calm.	6	5	2	3	3	2	0	4	0	0	0	0	0	11	8	6
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Memphis, Tenn	N.	2	11	17	15	5	5	3	7	16	9	2	5	27	18	37	15
	N. W.	9	17	21	10	14	18	9	10	13	8	7	9	28	35	45	37
	W.	6	4	4	4	8	9	8	14	11	8	7	10	26	20	16	31
	S. W.	23	8	5	5	5	6	14	11	7	14	6	12	27	43	15	31
	S.	14	8	4	5	11	8	10	8	6	11	12	8	29	30	20	26
	S. E.	19	15	15	16	34	31	30	25	14	21	32	26	67	60	65	86
	E.	8	6	10	21	5	5	11	5	5	8	11	10	24	24	36	21
	N. E.	9	17	7	8	8	11	8	7	21	11	16	9	48	35	23	26
	Calm.	3	7	7	9	0	0	0	0	0	0	0	1	0	11	16	0
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Milwaukee, Wis	N.	10	7	5	5	3	6	7	6	14	9	9	7	32	24	13	19
	N. W.	10	9	25	13	18	22	19	18	10	8	7	5	25	24	56	59
	W.	12	10	12	14	22	22	11	19	19	19	15	16	53	38	48	52
	S. W.	20	21	21	17	21	15	19	20	11	20	19	21	50	62	59	54
	S.	9	15	9	19	16	9	9	12	10	4	16	14	30	38	44	30
	S. E.	14	13	9	15	2	11	17	7	14	11	15	15	40	42	26	35
	E.	5	3	4	5	2	7	3	2	8	8	8	4	24	12	11	12
	N. E.	13	15	5	3	6	0	8	3	7	11	4	7	22	35	14	11
	Calm.	0	0	0	2	0	1	0	0	0	0	0	1	0	1	2	1
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mobile, Ala	N.	10	29	38	34	31	23	15	30	33	22	10	15	65	54	103	68
	N. W.	7	6	6	0	1	2	2	4	6	1	1	3	8	16	7	8
	W.	19	4	2	2	3	1	1	1	5	0	0	1	5	24	7	3
	S. W.	16	5	1	5	9	6	1	6	8	11	0	7	19	28	15	13
	S.	19	16	4	13	19	43	37	24	23	46	33	34	102	69	36	104
	S. E.	11	9	16	6	18	4	11	5	3	1	22	10	26	30	40	20
	E.	5	7	9	10	4	2	7	1	4	0	8	8	12	20	23	10
	N. E.	4	16	14	21	5	7	11	8	11	6	18	6	35	26	40	26
	Calm.	2	1	0	2	0	5	8	8	0	3	1	6	4	9	2	21
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Montgomery, Ala	N.	3	15	16	13	14	9	12	14	19	16	4	7	39	25	43	35
	N. W.	6	10	6	6	12	13	8	14	11	6	1	6	18	22	24	35
	W.	18	8	3	3	5	10	4	10	9	12	0	8	21	34	11	24
	S. W.	19	6	2	1	3	2	11	2	12	13	2	17	27	42	6	15
	S.	17	9	3	1	17	23	21	23	19	29	19	20	67	46	21	67
	S. E.	7	11	4	11	16	16	15	14	7	10	23	12	40	30	31	45
	E.	18	16	30	34	19	12	12	8	6	2	32	15	40	49	83	32
	N. E.	4	16	14	13	2	3	10	2	10	2	12	5	24	25	29	15
	Calm.	1	2	12	11	2	5	0	0	0	0	0	0	0	3	25	5
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Morgantown, W. Va.	N.	5	7	2	2	1	4	3	2	14	4	8	2	26	14	5	9
	N. W.	0	6	5	16	14	12	3	9	21	14	8	3	43	9	35	24
	W.	2	5	4	1	4	1	4	2	9	16	9	10	34	17	9	7
	S. W.	37	24	24	17	41	34	37	41	19	35	23	30	77	91	82	112
	S.	1	4	3	4	0	1	2	2	0	4	5	6	9	11	7	5
	S. E.	1	2	4	3	0	6	3	0	6	2	5	1	13	4	7	9
	E.	0	2	1	3	1	1	3	1	1	0	1	1	2	3	5	5
	N. E.	6	3	3	1	4	16	12	7	12	1	1	10	14	19	8	35
	Calm.	41	40	44	46	25	18	26	23	11	14	33	27	58	108	115	67
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mt. Washington, N. H	N.	2	3	2	1	0	2	4	1	3	0	3	8	6	13	3	7
	N. W.	72	66	60	73	65	68	58	56	61	58	65	51	184	189	199	182
	W.	11	6	9	6	11	14	15	19	9	17	11	7	37	24	26	48
	S. W.	3	7	7	8	5	3	5	1	4	7	5	8	16	18	20	9
	S.	2	3	9	0	2	6	2	3	0	1	2	6	3	11	11	11
	S. E.	1	0	3	3	3	0	3	1	2	2	1	2	5	3	9	4
	E.	0	2	0	1	1	0	1	3	3	0	1	2	4	4	2	4
	N. E.	1	5	0	1	2	0	4	3	10	3	5	6	18	12	3	7
	Calm.	1	1	0	0	0	0	1	0	1	2	0	0	3	2	0	1
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Statement showing how many times the wind was observed blowing, &c.—Continued.

Station.	Wind.	July, 1879.	August.	September.	October.	November.	December.	January, '80.	February.	March.	April.	May.	June.	Spring.	Summer.	Autumn.	Winter.
Nashville, Tenn	N.	2	10	17	10	5	8	7	8	17	15	9	13	41	25	32	23
	N. W.	8	8	5	10	16	12	3	5	9	13	7	9	29	25	31	20
	W.	12	4	16	6	4	10	8	10	7	5	8	12	20	28	26	28
	S. W.	11	8	3	6	5	6	3	6	2	6	7	10	15	29	14	15
	S.	0	12	9	3	26	16	11	12	5	26	26	16	57	28	38	39
	S. E.	19	7	3	14	7	16	12	9	5	10	19	9	34	35	24	37
	E.	12	9	2	12	1	5	2	4	8	3	3	4	14	25	15	11
	N. E.	5	8	4	9	6	3	0	3	4	9	8	9	21	22	19	6
	Calm.	24	27	31	23	20	17	47	30	36	3	6	8	45	59	74	94
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Haven, Conn	N.	7	19	19	13	12	20	16	12	25	7	13	12	45	38	44	48
	N. W.	5	7	11	16	25	10	9	13	23	18	6	11	47	23	52	32
	W.	4	5	8	14	8	11	7	14	4	12	9	9	25	18	30	32
	S. W.	23	27	19	23	17	17	17	13	8	14	14	12	36	62	59	47
	S.	26	9	19	9	13	3	5	12	7	21	27	28	55	63	41	20
	S. E.	6	1	2	7	1	3	6	3	1	8	7	4	16	11	10	12
	E.	2	3	1	2	1	0	4	2	3	2	8	0	13	5	4	6
	N. E.	12	16	8	8	10	23	24	12	20	6	6	11	32	39	26	59
	Calm.	8	6	3	1	3	6	5	6	2	2	3	3	7	21	7	17
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New London, Conn	N.	8	14	18	6	15	21	24	10	18	7	9	10	34	32	39	55
	N. W.	7	14	14	20	28	17	13	28	32	18	11	7	61	28	62	58
	W.	6	11	7	14	8	13	17	12	5	10	8	9	23	26	29	42
	S. W.	28	25	20	17	18	16	11	18	14	27	27	19	68	72	55	45
	S.	15	1	8	4	9	2	6	4	1	4	10	16	15	32	21	12
	S. E.	13	2	9	9	3	1	1	6	2	14	10	5	26	20	21	8
	E.	3	6	3	1	3	7	7	1	4	4	8	2	16	11	7	15
	N. E.	7	8	4	8	3	10	7	3	14	4	2	6	20	21	15	20
	Calm.	6	12	7	14	3	6	7	5	3	2	8	16	13	34	24	18
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Orleans, La	N.	3	12	14	27	12	10	15	10	18	11	6	3	35	18	53	35
	N. W.	4	10	7	9	8	6	3	8	7	5	1	2	13	16	24	17
	W.	18	12	4	2	1	4	3	4	2	2	1	8	5	38	7	11
	S. W.	33	9	4	0	4	6	7	9	8	12	1	12	21	54	8	22
	S.	6	5	2	2	5	14	9	7	15	31	13	18	59	29	9	30
	S. E.	12	7	13	2	33	29	22	14	13	14	28	27	55	46	48	65
	E	11	24	28	26	12	14	20	14	17	6	32	13	55	48	66	48
	N. E.	5	14	15	23	11	8	12	19	11	7	10	6	28	25	49	39
	Calm.	1	0	3	2	4	2	2	2	2	2	1	1	5	2	9	6
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Newport, R. I	N.	4	16	9	4	9	13	12	7	15	3	4	11	22	31	22	32
	N. W.	5	7	7	18	17	12	18	13	25	7	8	7	40	19	42	43
	W.	5	7	6	19	19	20	15	23	15	19	5	3	39	15	44	58
	S. W.	33	41	28	26	20	25	21	20	12	25	38	38	75	112	74	66
	S.	22	2	19	5	11	2	7	11	5	14	19	13	38	37	35	20
	S. E.	7	1	7	8	6	3	5	6	2	12	5	6	19	14	21	14
	E.	5	4	2	4	1	6	7	1	5	2	6	5	13	14	7	14
	N. E.	10	9	10	8	7	11	7	5	13	8	7	5	28	24	25	23
	Calm.	2	6	2	1	0	1	1	1	1	0	1	2	2	10	3	3
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New York, N. Y	N.	2	8	6	3	5	6	8	4	8	2	4	3	14	13	14	18
	N. W.	12	18	19	23	30	18	16	20	31	20	18	20	69	50	72	54
	W.	12	11	6	20	12	16	9	21	8	14	14	10	36	33	38	46
	S. W.	27	23	2	22	16	17	14	12	12	16	17	21	45	71	60	43
	S.	13	9	6	5	7	4	4	8	1	8	8	15	17	37	18	16
	S. E.	10	3	11	7	9	0	3	10	5	15	16	10	36	23	27	13
	E.	4	5	5	6	5	4	7	2	7	5	5	2	17	11	16	13
	N. E.	12	15	13	7	5	24	20	9	21	8	7	8	36	35	25	53
	Calm.	1	1	2	0	1	4	12	1	0	2	4	1	6	3	3	17
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Norfolk, Va	N.	3	6	18	14	13	14	29	14	21	9	4	3	34	12	45	57
	N. W.	7	10	6	8	20	8	12	6	6	3	3	11	12	28	34	26
	W.	4	7	2	5	2	8	7	13	6	4	9	11	19	22	9	28
	S. W.	28	30	13	12	10	10	2	15	9	26	29	21	64	79	35	27
	S.	20	12	13	17	24	30	13	14	11	18	23	13	52	45	54	57
	S. E.	8	17	10	11	8	8	6	7	8	6	6	5	20	30	29	21
	E.	8	3	11	8	7	3	9	3	8	9	4	8	21	19	26	15
	N. E.	14	7	16	12	6	11	11	13	19	9	12	14	40	35	34	35
	Calm.	1	1	1	6	0	1	4	2	5	6	3	4	14	6	7	7
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Statement showing how many times the wind was observed blowing, &c.—Continued.

Station.	Wind.	July, 1879.	August.	September.	October.	November.	December.	January, '80.	February.	March.	April.	May.	June.	Spring.	Summer.	Autumn.	Winter.
North Platte, Nebr.	N.	3	3	6	8	13	10	4	8	5	5	4	9	14	15	27	22
	N. W.	5	14	15	32	28	31	46	46	36	35	25	13	96	32	75	123
	W.	2	9	3	5	15	11	12	10	13	3	5	2	21	13	23	33
	S. W.	1	3	3	5	2	5	6	6	5	5	4	6	14	10	10	17
	S.	19	17	14	27	13	4	7	8	9	13	31	18	53	54	54	19
	S. E.	31	12	13	8	9	13	10	5	9	12	11	21	32	64	30	28
	E.	17	16	13	2	3	12	2	1	8	6	3	10	17	43	18	15
	N. E.	13	16	19	4	7	7	6	3	8	10	10	10	28	39	30	16
	Calm.	2	3	4	2	0	0	0	0	0	1	0	1	1	6	6	0
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Olympia, Wash.	N.	36	42	31	19	12	7	8	14	12	26	15	12	53	90	62	29
	N. W.	9	9	8	2	3	1	4	9	3	8	6	9	17	27	13	14
	W.	9	6	2	2	2	1	2	4	6	7	13	19	26	34	6	7
	S. W.	13	11	8	13	11	11	14	13	18	15	18	22	51	46	32	38
	S.	15	13	20	42	54	59	58	31	46	21	33	17	100	45	116	148
	S. E.	1	0	0	0	3	4	1	1	4	3	2	1	9	2	3	6
	E.	4	1	3	4	1	5	1	6	1	1	2	1	4	6	8	12
	N. E.	1	6	13	11	4	4	2	9	3	8	3	9	14	16	28	15
	Calm.	5	5	5	0	0	1	3	0	0	1	1	0	2	10	5	4
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Omaha, Nebr.	N.	13	22	24	4	13	15	16	6	15	20	15	7	50	42	41	37
	N. W.	8	1	14	22	19	32	17	29	19	16	11	15	46	24	55	78
	W.	7	5	5	8	9	4	5	11	7	9	5	11	21	23	22	20
	S. W.	6	3	1	4	12	2	14	14	9	5	8	7	22	16	17	30
	S.	19	23	13	23	13	9	19	11	11	12	22	19	45	51	49	39
	S. E.	26	21	22	27	6	15	12	13	15	14	22	19	51	66	55	40
	E.	6	8	9	3	8	5	5	1	5	4	6	10	15	24	20	11
	N. E.	4	5	1	1	4	6	4	2	11	5	4	2	20	11	6	12
	Calm.	4	5	1	1	6	5	1	0	1	5	0	0	6	9	8	6
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oswego, N. Y.	N.	13	18	7	10	12	6	5	6	12	9	12	9	33	40	29	17
	N. W.	10	13	11	16	16	6	9	20	21	13	13	10	47	33	43	35
	W.	21	19	12	13	8	12	12	5	9	17	23	19	49	59	33	29
	S. W.	13	7	9	9	7	11	4	13	6	11	8	12	25	32	25	28
	S.	16	12	26	30	25	19	33	25	15	21	22	24	58	52	81	77
	S. E.	8	4	12	3	13	19	17	10	16	8	7	8	31	20	28	46
	E.	0	2	2	1	2	5	0	3	3	0	1	1	4	3	5	8
	N. E.	8	12	4	6	4	15	11	3	11	11	4	3	26	23	14	29
	Calm.	4	6	7	5	3	0	2	2	0	0	3	4	3	14	15	4
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pembina, Dak.	N.	5	5	4	13	8	20	1	5	0	9	5	12	14	22	25	26
	N. W.	23	18	23	25	28	30	31	33	35	25	19	17	79	58	76	94
	W.	22	20	19	13	11	5	10	3	4	15	8	11	27	53	43	18
	S. W.	1	2	4	4	0	1	1	1	0	1	8	2	9	5	8	3
	S.	14	11	11	19	27	23	29	26	22	12	29	32	63	57	57	78
	S. E.	9	9	16	8	10	3	9	4	8	3	8	3	19	21	34	16
	E.	4	12	2	2	0	2	1	5	6	9	6	7	21	23	4	8
	N. E.	0	2	1	0	1	1	0	0	0	7	8	2	15	4	2	1
	Calm.	15	14	10	9	5	8	11	10	18	9	2	4	29	33	24	29
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Pensacola, Fla.	N.	....	....	....	....	25	17	12	14	12	11	1	4	24	....	....	43
	N. W.	....	....	....	....	0	4	5	7	8	2	1	6	11	....	....	16
	W.	....	....	....	....	2	3	3	2	2	4	1	4	7	....	....	8
	S. W.	....	....	....	....	4	6	7	4	12	16	1	20	29	....	....	17
	S.	....	....	....	....	10	13	4	13	20	17	12	24	49	....	....	30
	S. E.	....	....	....	....	17	14	19	18	13	28	43	16	84	....	....	51
	E.	....	....	....	....	17	18	30	7	5	2	13	7	20	....	....	55
	N. E.	....	....	....	....	10	18	12	19	21	6	20	9	47	....	....	49
	Calm.	....	....	....	....	5	0	1	3	0	4	1	0	5	....	....	4
	Blank.	....	....	....	....	0	0	0	0	0	0	0	0	0	....	....	0
Philadelphia, Pa.	N.	7	10	9	6	5	9	13	4	16	4	9	10	29	27	20	26
	N. E.	7	10	12	21	26	14	14	21	23	21	13	5	57	22	59	49
	W.	13	11	11	19	14	8	9	16	9	12	12	24	33	48	44	33
	S. W.	28	29	14	17	17	27	17	19	9	25	29	21	63	78	48	63
	S.	12	9	17	10	11	6	3	14	6	14	10	10	30	31	38	23
	S. E.	5	1	6	1	4	3	4	0	1	2	5	2	8	8	11	7
	E.	8	4	6	8	4	5	5	5	4	6	6	7	16	19	18	15
	N. E.	13	19	13	8	8	20	27	8	22	6	9	11	37	43	29	55
	Calm.	0	0	2	3	1	1	1	0	3	0	0	0	3	0	6	2
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

*Station opened October 27, 1879.

Statement showing how many times the wind was observed blowing, &c.—Continued.

Station.	Wind.	July, 1879.	August.	September.	October.	November.	December.	January, '80.	February.	March.	April.	May.	June.	Spring.	Summer.	Autumn.	Winter.
Pike's Peak, Colo	N.	1	14	5	8	8	15	7	5	2	1	3	6	6	21	21	27
	N. W.	12	10	21	25	28	11	19	16	12	10	6	16	28	38	74	46
	W.	8	10	24	9	8	33	25	25	27	11	9	7	47	25	41	83
	S. W.	44	23	27	37	33	26	36	33	49	59	61	39	169	106	97	95
	S.	4	6	3	7	4	2	2	1	0	3	8	12	11	22	14	5
	S. E.	8	3	3	0	6	6	0	1	0	1	1	4	2	15	9	7
	E.	2	1	1	0	0	0	0	6	0	0	0	0	0	3	1	6
	N. E.	14	16	5	7	3	0	3	0	2	4	4	4	10	34	15	3
	Calm.	0	0	1	0	0	0	1	0	1	1	1	2	3	2	1	1
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pioche, Nev	N.	3	16	4	12	12	12	7	16	22	17	31	11	70	30	28	35
	N. W.	8	15	14	21	14	24	28	12	13	11	7	6	31	29	49	64
	W.	3	2	1	5	9	13	6	5	5	2	8	2	15	7	15	24
	S. W.	8	11	18	3	9	6	3	5	15	6	9	15	30	34	30	14
	S.	67	40	47	48	31	28	32	33	22	45	27	38	94	145	126	93
	S. E.	3	2	3	2	4	4	1	6	3	3	5	5	11	10	9	11
	E.	0	0	0	0	1	0	0	0	1	1	1	1	3	1	1	0
	N. E.	0	2	1	0	0	1	0	3	6	0	3	2	9	4	1	4
	Calm.	1	5	2	2	10	5	16	7	6	5	2	10	13	16	14	28
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pittsburgh, Pa	N.	7	15	5	4	6	8	8	5	12	11	8	7	31	29	15	21
	N. W.	15	21	19	16	17	13	7	15	35	19	21	20	75	56	52	35
	W.	14	11	15	10	15	19	18	18	8	11	13	12	32	37	40	55
	S. W.	17	22	16	10	17	13	17	21	7	23	17	18	47	57	43	51
	S.	13	5	3	8	10	12	10	8	4	10	7	9	21	27	21	30
	S. E.	3	1	6	8	7	6	12	7	6	6	2	1	14	5	21	25
	E.	14	2	5	4	4	12	10	4	15	5	1	8	21	24	13	26
	N. E.	10	8	6	2	2	5	4	2	6	3	5	10	14	28	10	11
	Calm.	0	8	15	31	12	5	7	7	0	2	19	5	21	13	58	19
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Port Huron, Mich	N.	19	15	3	7	2	5	7	6	14	10	17	11	41	45	12	18
	N. W.	0	6	14	7	17	7	10	11	7	8	0	1	15	7	38	28
	W.	9	6	17	16	17	18	9	20	19	12	9	17	40	32	50	47
	S. W.	15	16	6	13	14	22	8	12	8	18	27	19	53	50	33	42
	S.	25	17	27	38	26	11	30	26	13	18	23	18	54	60	91	67
	S. E.	3	3	7	3	7	9	15	7	11	9	3	6	23	12	17	31
	E.	0	3	6	3	1	12	5	2	5	4	3	0	12	3	10	19
	N. E.	17	21	7	4	5	7	9	3	16	11	10	16	37	54	16	19
	Calm.	5	6	3	2	1	2	0	0	0	0	0	2	0	13	6	2
	Blank.	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
Portland, Me	N.	7	9	4	7	19	30	37	14	28	11	9	7	48	23	30	81
	N. W.	16	11	9	17	19	10	5	16	17	12	14	14	43	41	45	31
	W.	8	11	9	20	12	23	18	20	10	14	15	11	39	30	41	61
	S. W.	21	17	12	13	13	7	10	9	5	13	7	14	25	52	38	26
	S.	18	15	27	12	10	2	6	15	13	26	28	18	67	51	49	23
	S. E.	11	8	5	4	1	1	1	3	7	4	5	7	16	26	10	5
	E.	5	6	8	12	3	5	2	3	4	0	8	10	12	21	23	10
	N. E.	3	6	5	1	7	6	2	2	7	7	5	4	19	13	13	10
	Calm.	4	10	11	7	6	9	12	5	2	3	2	5	7	19	24	26
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Portland, Oreg	N.	32	12	7	8	7	8	4	5	6	4	3	5	13	49	22	17
	N. W.	30	44	33	13	12	7	11	19	18	23	32	38	73	112	58	37
	W.	3	1	1	4	3	2	6	6	4	1	11	10	16	14	8	14
	S. W.	1	7	7	9	8	11	19	14	9	7	13	3	29	11	24	44
	S.	16	17	27	30	30	37	43	22	30	21	26	16	77	49	87	102
	S. E.	7	7	4	13	10	9	7	11	9	10	4	11	23	25	27	27
	E.	2	1	2	9	2	13	0	1	3	6	2	1	11	4	13	14
	N. E.	1	1	3	1	5	5	2	4	4	4	0	4	8	6	9	11
	Calm.	1	3	6	6	13	1	1	5	10	14	2	2	26	6	25	7
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Portsmouth, N.C	N.	0	8	8	9	10	12	8	1	17	2	1	2	20	10	27	21
	N. W.	2	2	3	4	16	5	7	9	8	5	1	3	14	7	23	21
	W.	2	2	0	5	4	2	1	6	2	3	5	8	10	12	9	9
	S. W.	20	20	7	4	14	13	6	16	8	22	17	26	47	66	25	35
	S.	27	24	14	7	14	19	6	10	10	9	30	14	49	65	35	35
	S. E.	4	4	6	4	2	5	3	1	6	12	13	4	31	12	12	9
	E.	0	3	5	13	4	1	3	3	4	2	4	3	10	6	22	7
	N. E.	34	25	44	43	25	28	38	28	29	22	8	18	59	77	112	94
	Calm.	2	2	3	3	1	3	2	2	1	0	2	0	3	4	7	7
	Blank.	2	3	0	1	0	5	19	11	8	13	12	12	33	17	1	35

Statement showing how many times the wind was observed blowing, &c.—Continued.

Station	Wind.	July, 1879.	August.	September.	October.	November.	December.	January, '80.	February.	March.	April.	May.	June.	Spring.	Summer.	Autumn.	Winter.
Prescott, Ariz.	N.	2	2	4	5	7	4	6	4	4	2	1	1	7	5	16	14
	N. W.	5	5	6	2	4	8	7	3	3	4	5	0	12	10	12	18
	W.	23	29	22	5	1	2	4	2	3	1	4	5	8	57	28	8
	S. W.	48	37	33	16	12	10	7	14	19	11	9	13	39	98	61	31
	S.	5	4	17	29	22	30	26	23	43	41	51	49	135	58	68	79
	S. E.	5	1	1	4	10	5	7	3	8	7	2	1	17	7	15	15
	E.	2	5	3	7	4	0	5	4	3	2	2	0	7	7	14	9
	N. E.	1	3	1	8	21	9	14	13	5	2	3	0	10	4	30	36
	Calm.	2	7	3	17	9	25	17	21	5	20	16	21	41	30	29	63
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Punta Rassa, Fla.	N.	2	9	7	4	16	8	20	9	7	5	2	2	14	13	27	37
	N. W.	3	4	0	2	11	3	5	11	6	4	4	6	14	13	13	19
	W.	15	5	2	0	1	6	6	6	3	8	5	10	16	30	3	18
	S. W.	10	8	3	1	1	1	5	6	9	12	6	6	27	24	5	12
	S.	9	11	13	4	2	20	6	14	30	24	9	15	63	35	19	40
	S. E.	11	13	16	9	1	5	5	6	6	8	6	7	20	31	26	16
	E.	20	34	22	32	22	18	11	20	19	22	41	35	82	79	76	49
	N. E.	23	8	27	41	35	32	34	14	13	7	20	9	40	40	103	80
	Calm.	0	1	0	0	1	0	1	1	0	0	0	0	0	1	1	2
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Red Bluff, Cal.	N.	13	21	16	23	35	33	53	30	29	6	13	14	48	48	74	116
	N. W.	13	8	14	27	15	14	10	13	17	15	33	26	65	47	56	37
	W.	4	5	0	3	3	0	3	4	3	4	3	4	10	13	6	7
	S. W.	5	1	3	4	0	0	2	3	1	4	0	3	5	9	7	5
	S.	27	26	19	15	13	14	13	11	19	22	19	14	60	67	47	38
	S. E.	25	22	25	12	15	17	11	17	20	36	21	28	77	75	52	45
	E.	1	1	0	4	2	1	0	1	0	0	0	1	0	3	6	2
	N. E.	2	3	1	0	3	6	0	3	0	2	3	0	5	5	4	9
	Calm.	3	6	12	5	4	8	1	5	4	1	1	0	6	9	21	14
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rochester, N. Y.	N.	3	4	3	0	1	2	4	1	2	2	2	8	6	15	4	7
	N. W.	8	14	5	8	12	8	11	11	19	11	15	13	45	35	25	30
	W.	35	30	30	38	34	32	25	29	33	42	33	28	108	93	102	86
	S. W.	15	19	18	23	21	15	18	26	8	11	20	19	39	53	62	59
	S.	4	1	8	2	5	9	13	6	3	8	6	7	17	12	15	28
	S. E.	8	4	8	6	12	16	15	6	18	3	5	6	26	18	26	37
	E.	4	6	3	1	2	8	3	5	5	9	3	3	17	13	6	16
	N. E.	11	6	9	7	1	3	4	3	4	4	8	6	16	23	17	10
	Calm.	5	9	6	8	2	0	0	0	1	0	1	0	2	14	16	0
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roseburg, Oreg.	N.	32	23	15	5	6	6	2	15	15	10	24	35	49	90	26	23
	N. W.	20	20	28	12	14	10	6	11	12	15	24	16	51	56	54	27
	W.	5	5	3	7	2	3	3	2	8	8	10	5	26	15	12	8
	S. W.	5	3	4	8	14	13	28	16	20	20	9	5	49	13	26	57
	S.	1	1	1	8	10	8	20	7	7	5	2	0	14	2	19	35
	S. E.	1	2	2	5	7	15	9	8	3	2	0	0	5	3	14	32
	E.	0	0	1	5	10	16	6	7	6	3	2	2	11	2	16	29
	N E.	5	3	2	6	6	6	5	2	3	5	6	5	14	13	14	13
	Calm.	24	36	34	37	21	16	14	19	19	22	16	22	57	82	92	49
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sacramento, Cal.	N.	5	6	3	20	25	10	13	17	15	12	14	11	41	22	48	40
	N. W.	8	14	8	10	12	17	25	20	13	6	21	14	40	36	30	62
	W.	1	4	3	3	0	1	3	1	1	1	4	0	6	5	6	5
	S. W.	31	25	32	8	3	5	4	5	15	23	16	12	54	68	43	14
	S.	46	40	33	23	13	20	12	6	22	27	20	44	69	130	69	38
	S. E.	2	0	3	12	16	26	19	25	17	18	13	8	48	10	31	70
	E.	0	1	2	2	4	2	4	8	3	2	1	1	6	2	8	14
	N. E.	0	0	2	8	9	3	4	4	1	0	1	0	2	0	19	11
	Calm.	0	3	4	7	8	9	9	1	6	1	3	0	10	3	19	19
	Blank.	0	0	0	0	0	0	0	0	[illegible]	0	0	0	0	0	0	0
Salt Lake City, Utah	N.	13	5	7	0	2	2	0	1	5	5	10	11	20	29	9	3
	N. W.	21	35	24	17	15	15	20	12	22	13	38	34	73	90	56	47
	W.	0	1	3	3	4	1	5	3	2	5	1	2	8	3	10	9
	S. W.	4	0	0	1	9	2	1	8	1	2	2	0	5	4	10	11
	S.	0	0	1	4	3	0	0	2	0	1	1	0	2	0	8	2
	S. E.	17	20	25	22	10	25	29	42	40	31	18	18	89	55	57	96
	E.	2	4	6	1	2	2	2	1	5	7	5	2	17	8	9	5
	N, E.	3	7	9	3	2	1	6	0	5	7	8	4	20	14	14	7
	Calm.	33	21	15	42	43	45	30	18	13	19	10	19	42	73	100	93
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Statement showing how many times the wind was observed blowing, &c.—Continued.

Station.	Wind.	July, 1879.	August.	September.	October.	November.	December.	January, '80.	February.	March.	April.	May.	June.	Spring.	Summer.	Autumn.	Winter.
San Antonio, Tex....	N.	1	5	11	24	8	17	17	19	21	14	3	4	38	10	43	53
	N. W.	0	1	0	0	4	3	1	4	0	0	2	0	2	1	4	8
	W.	0	1	1	1	1	1	2	3	0	3	0	0	3	1	3	6
	S. W.	2	2	1	3	6	2	3	4	0	3	2	0	5	4	10	9
	S.	3	4	4	9	5	27	23	15	9	19	18	13	46	20	18	65
	S. E.	64	25	26	22	42	20	15	14	25	19	47	42	91	131	90	49
	E.	8	19	6	11	2	5	7	11	15	14	10	15	39	42	19	23
	N. E.	0	13	17	10	11	14	12	5	16	7	9	13	32	26	38	31
	Calm.	15	23	24	13	11	4	13	12	7	11	2	3	20	41	48	29
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Diego, Cal	N.	10	4	9	13	9	15	16	15	15	12	9	4	36	18	31	46
	N. W.	21	16	23	18	10	[illegible]	17	12	18	29	18	24	65	61	51	41
	W.	33	34	22	22	25	23	14	18	21	22	33	25	76	92	69	55
	S. W.	8	17	7	10	6	3	3	11	8	9	19	18	36	43	23	17
	S.	1	5	3	7	4	4	6	3	5	7	6	10	18	16	14	13
	S. E.	1	0	1	2	1	6	3	2	0	4	3	2	7	3	4	11
	E.	2	1	1	5	9	12	10	12	13	3	1	3	17	6	15	34
	N. E.	0	1	2	7	17	10	24	14	13	3	2	2	18	3	26	48
	Calm.	17	15	22	9	9	8	0	0	0	1	2	2	3	34	40	8
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sandusky, Ohio......	N.	8	20	7	7	5	4	2	5	14	7	3	10	24	38	19	11
	N. W.	8	12	18	9	10	9	8	14	13	24	7	8	44	28	37	31
	W.	14	11	13	13	20	19	12	13	16	10	14	14	40	39	46	44
	S. W.	21	26	17	17	22	24	23	22	15	25	33	19	73	66	56	69
	S.	6	7	22	22	28	13	22	23	9	8	11	16	28	29	72	58
	S. E.	1	1	5	5	2	4	7	2	4	5	12	6	21	8	12	13
	E.	10	5	6	9	2	15	10	5	13	10	4	7	27	22	17	30
	N. E.	24	11	2	9	1	4	9	3	9	1	9	10	19	45	12	16
	Calm.	1	0	0	2	0	1	0	0	0	0	0	0	0	1	2	1
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sandy Hook, N. J....	N.	5	10	11	6	7	11	13	7	12	3	5	8	20	23	24	31
	N. W.	7	7	9	13	17	8	7	17	27	21	7	4	55	18	39	32
	W.	7	9	11	30	18	15	20	20	11	12	20	23	43	39	59	55
	S. W.	31	27	16	15	20	22	13	18	13	18	21	22	52	80	51	53
	S.	8	8	9	10	12	1	7	9	1	9	13	9	23	25	31	17
	S. E.	17	13	13	8	6	7	4	6	7	16	14	12	37	42	27	17
	E.	6	1	4	6	2	7	11	5	3	6	8	5	17	12	12	23
	N. E.	11	18	15	3	5	18	17	3	19	3	2	5	24	34	23	38
	Calm.	1	0	2	2	3	4	1	2	0	2	3	2	5	3	7	7
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Francisco, Cal...	N.	0	0	1	7	19	27	24	8	10	2	12	2	24	2	27	59
	N. W.	2	0	2	6	7	14	16	22	14	8	5	2	27	4	15	52
	W.	73	63	68	36	22	10	11	11	34	31	55	65	120	201	126	32
	S. W.	15	25	11	20	11	7	5	9	14	31	14	14	59	54	42	21
	S.	1	0	0	1	4	5	7	2	7	10	1	1	18	2	5	14
	S. E.	1	1	0	1	10	9	10	14	4	5	2	2	11	4	11	33
	E.	0	0	0	2	0	0	1	5	2	1	3	4	6	4	2	6
	N. E.	0	2	1	5	8	5	11	11	2	1	0	0	3	2	14	27
	Calm.	1	2	7	15	9	16	8	5	6	1	1	0	8	3	31	29
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Santa Fé, N. Mex...	N.	5	6	2	13	16	16	10	2	2	2	19	4	23	15	31	28
	N. W.	5	5	5	10	14	22	28	32	23	19	5	4	47	14	29	82
	W.	7	2	5	5	2	1	1	3	2	12	3	5	17	14	12	5
	S. W.	4	8	8	7	14	16	14	12	27	28	23	22	78	34	29	42
	S.	13	7	5	7	7	3	0	3	4	6	7	12	17	32	19	6
	S. E.	11	11	11	11	5	6	2	11	9	8	17	10	34	32	27	19
	E.	18	17	20	18	10	4	4	10	11	8	12	14	31	49	48	18
	N. E.	12	28	16	15	15	11	30	12	13	4	3	10	20	50	46	53
	Calm.	18	9	18	7	7	14	4	2	2	3	4	9	9	36	32	20
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Savannah, Ga........	N.	5	11	18	13	14	9	12	12	11	7	5	5	23	21	45	33
	N. W.	2	1	1	6	9	10	12	14	9	9	0	1	18	4	16	36
	W.	9	6	3	4	6	14	10	7	11	11	0	9	22	24	13	31
	S. W.	20	13	4	2	11	9	7	9	16	19	4	23	39	56	17	25
	S.	24	18	6	7	10	15	5	18	16	28	25	19	69	61	23	38
	S. E.	9	9	7	8	9	2	5	2	4	4	17	5	25	23	24	9
	E.	8	8	17	22	11	6	14	10	11	5	21	14	37	30	50	30
	N. E.	12	15	24	26	14	8	12	9	8	6	11	10	25	37	64	29
	Calm.	4	12	10	5	6	20	16	6	7	1	10	4	18	20	21	42
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Statement showing how many times the wind was observed blowing, &c.—Continued.

Station.	Wind.	July, 1879.	August.	September.	October.	November.	December.	January, '80.	February.	March.	April.	May.	June.	Spring.	Summer.	Autumn.	Winter.
Shreveport, La	N.	7	16	25	14	10	6	6	6	11	14	2	9	27	32	49	18
	N. W.	0	3	0	4	5	10	2	4	9	1	3	3	13	6	9	16
	W.	0	4	2	1	1	5	5	8	3	2	0	2	5	6	4	18
	S. W.	16	5	0	1	6	5	7	4	3	13	3	3	19	24	7	16
	S.	28	13	2	9	30	41	30	29	22	33	24	25	79	66	41	100
	S. E.	23	17	10	8	14	6	14	4	3	5	15	15	23	55	32	24
	E.	12	16	11	15	1	1	4	4	19	7	21	8	47	36	27	9
	N. E.	1	8	2	11	4	9	4	7	8	6	5	8	19	17	17	20
	Calm.	6	11	38	30	19	10	20	21	15	9	20	17	44	34	87	51
	Blank.	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Smithville, N. C	N.	10	19	32	26	29	31	37	21	23	10	9	13	42	42	87	89
	N. W.	2	1	6	9	5	7	9	14	6	3	2	0	11	3	20	30
	W.	10	8	2	3	7	11	6	3	10	8	5	1	23	19	12	20
	S. W.	16	13	5	5	11	19	11	12	11	34	24	43	69	72	21	42
	S.	26	32	11	10	7	9	5	19	12	16	26	9	54	67	28	33
	S. E.	8	3	9	8	4	3	1	5	7	3	14	4	24	15	21	9
	E.	9	11	4	16	12	3	10	4	8	4	7	5	19	25	32	17
	N. E.	11	5	21	15	13	6	13	9	12	11	5	10	28	26	49	28
	Calm.	1	1	0	1	2	4	1	0	4	1	1	5	6	7	3	5
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Springfield, Ill	N.	8	16	15	5	4	8	9	6	13	9	11	8	33	32	24	23
	N. W.	7	9	19	16	15	22	9	19	17	16	6	2	39	18	50	50
	W.	10	5	6	7	11	12	12	13	8	10	3	17	21	32	24	37
	S. W.	22	8	8	13	9	6	10	14	7	8	8	17	23	47	30	30
	S.	16	27	21	27	28	20	28	21	12	30	36	24	78	67	76	69
	S. E.	5	9	10	15	9	9	16	9	16	8	10	8	34	22	34	34
	E.	11	5	5	2	8	6	3	3	8	5	14	5	27	21	15	12
	N. E.	10	9	5	8	1	5	6	2	10	2	4	6	16	25	14	13
	Calm.	4	5	1	0	5	5	0	0	2	2	1	3	5	12	6	5
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Springfield, Mass	N.	14	24	17	12	19	22	29	10	27	6	7	13	40	51	48	61
	N. W.	4	10	6	9	14	15	14	21	22	12	11	7	45	21	29	50
	W.	6	7	8	11	15	7	8	15	12	17	7	13	36	26	34	30
	S. W.	7	5	3	7	6	5	4	1	3	7	6	7	16	19	16	10
	S.	35	22	33	25	20	24	21	28	11	30	41	20	82	77	78	73
	S. E.	4	1	3	3	4	1	0	1	1	2	3	2	6	7	10	2
	E.	5	0	0	3	0	1	1	1	3	0	0	1	3	6	3	3
	N. E.	4	7	5	6	2	9	6	2	7	6	5	7	18	18	13	17
	Calm.	14	17	15	17	10	9	10	8	7	10	13	20	30	51	42	27
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Saint Louis, Mo	N.	9	20	15	16	13	11	11	9	21	16	10	7	47	36	44	31
	N. W.	5	4	12	8	10	18	9	17	16	9	2	7	27	16	30	44
	W.	8	2	7	9	9	11	10	9	5	15	5	7	25	17	25	30
	S. W.	15	11	4	6	5	5	5	8	5	2	2	11	9	37	15	18
	S.	25	35	30	28	35	21	40	30	17	31	42	36	90	96	93	91
	S. E.	13	11	9	15	9	13	9	5	15	11	13	9	39	33	33	27
	E.	8	8	3	4	4	8	3	3	9	2	15	3	26	19	11	14
	N. E.	10	2	10	7	5	6	3	6	5	4	4	8	13	20	22	15
	Calm.	0	0	0	0	0	0	3	0	0	0	0	2	0	2	0	3
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Saint Mark's, Fla*	N.	3	6	7	10	....	....	....	....	....	....	....	....	....	....	23	....
	N. W.	9	13	5	2	....	....	....	....	....	....	....	....	....	....	20	....
	W.	11	4	1	0	....	....	....	....	....	....	....	....	....	....	5	....
	S. W.	30	14	3	1	....	....	....	....	....	....	....	....	....	....	18	....
	S.	15	9	6	4	....	....	....	....	....	....	....	....	....	....	19	....
	S. E.	11	12	4	14	....	....	....	....	....	....	....	....	....	....	30	....
	E.	5	7	7	14	....	....	....	....	....	....	....	....	....	....	28	....
	N. E.	6	20	51	43	....	....	....	....	....	....	....	....	....	....	114	....
	Calm.	3	8	6	1	....	....	....	....	....	....	....	....	....	....	15	....
	Blank.	0	0	0	4	....	....	....	....	....	....	....	....	....	....	4	....
Saint Paul, Minn	N.	10	5	6	2	2	10	6	5	6	10	2	6	18	21	10	21
	N. W.	9	17	26	16	25	21	22	17	17	20	9	13	46	39	67	60
	W.	12	11	12	5	14	14	9	17	12	13	16	8	41	31	31	40
	S. W.	19	9	11	11	12	9	10	8	11	10	11	5	32	33	34	27
	S.	16	12	10	23	8	5	8	10	9	6	16	19	31	47	41	23
	S. E.	17	22	11	28	19	13	27	20	21	11	27	19	59	58	58	60
	E.	9	10	10	4	6	11	6	4	6	12	7	5	25	24	20	21
	N. E.	1	6	0	0	3	4	0	0	8	5	3	7	16	14	3	4
	Calm.	0	1	4	4	1	6	5	6	3	3	2	8	8	9	9	17
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

*Station closed October 30, 1879.

Statement showing how many times the wind was observed blowing, &c.—Continued.

Station.	Wind.	July, 1879.	August.	September.	October.	November.	December.	January, '80.	February.	March.	April.	May.	June.	Spring.	Summer.	Autumn.	Winter.
Thatcher's Island, Mass.	N.	4	4	2	2	5	6	8	2	8	5	3	8	16	16	9	16
	N. W.	13	15	12	25	22	21	16	19	20	5	11	12	36	40	59	46
	W.	8	7	5	15	12	22	21	23	14	20	9	9	43	24	32	66
	S. W.	29	28	33	26	15	14	16	11	5	20	17	15	42	72	74	41
	S.	14	8	8	2	15	3	3	13	8	16	24	12	48	34	25	19
	S. E.	11	9	12	11	5	12	14	8	12	9	13	13	34	33	28	34
	E.	5	4	8	1	2	7	3	3	5	3	7	6	15	15	11	13
	N. E.	9	18	7	10	13	8	11	5	21	11	8	12	40	39	30	21
	Calm.	0	0	3	1	1	0	1	3	0	1	1	3	2	3	5	4
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Toledo, Ohio	N.	1	2	11	14	0	6	3	2	7	5	3	0	15	3	25	11
	N. W.	4	11	11	3	15	3	7	16	12	14	7	6	33	21	29	26
	W.	29	37	17	15	12	20	12	10	14	15	10	13	39	79	44	42
	S. W.	21	11	10	21	30	22	26	27	15	25	44	40	84	71	61	75
	S.	6	3	23	28	17	12	11	11	6	11	7	8	24	17	68	34
	S. E.	13	5	6	1	7	6	10	12	11	3	6	4	20	22	14	28
	E.	11	8	10	1	3	14	7	4	10	3	4	4	17	23	14	25
	N. E.	8	12	0	7	4	9	16	5	16	10	8	15	34	35	11	30
	Calm.	0	4	2	3	2	1	1	0	2	4	4	0	10	4	7	2
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Umatilla, Oreg	N.	5	2	4	3	7	1	0	2	4	2	0	3	6	10	14	3
	N. W.	11	7	4	4	5	2	1	5	5	8	9	4	22	22	13	8
	W.	24	23	16	26	19	13	21	22	25	18	38	27	81	74	61	56
	S. W.	19	16	15	13	10	16	25	6	21	19	24	31	64	66	38	47
	S.	0	1	1	4	3	4	8	2	7	3	3	3	13	4	8	14
	S. E.	1	11	20	28	25	21	16	32	15	9	6	1	30	13	73	69
	E.	13	18	13	8	8	18	4	9	8	20	8	17	36	48	29	31
	N. E.	12	5	11	6	6	11	2	9	8	10	5	4	23	21	23	22
	Calm.	8	10	6	1	7	7	9	0	0	1	0	0	1	18	14	16
	Blank.	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	7
Unalashka, Alaska*.	N.	....	....	....	18	4	1	14	5	7	9	....	....	....	....	....	20
	N. W.	....	....	....	18	5	47	7	10	1	7	....	....	....	....	....	64
	W.	....	....	....	22	24	3	10	22	28	17	....	....	....	....	....	35
	S. W.	....	....	....	11	24	8	15	15	2	4	....	....	....	....	....	38
	S.	....	....	....	0	1	3	8	7	4	4	....	....	....	....	....	18
	S. E.	....	....	....	9	18	18	18	18	25	30	....	....	....	....	....	54
	E.	....	....	....	1	0	0	15	2	1	3	....	....	....	....	....	17
	N. E.	....	....	....	10	5	6	2	4	8	3	....	....	....	....	....	12
	Calm.	....	....	....	4	9	7	4	4	17	13	....	....	....	....	....	15
	Blank.	....	....	....	0	0	0	0	0	0	0	....	....	....	....	....	0
Vicksburg, Miss	N.	3	12	16	17	10	10	8	13	11	8	3	2	22	17	43	31
	N. W.	6	0	7	0	1	3	2	7	8	4	2	3	14	9	8	12
	W.	21	6	0	2	4	2	1	4	6	2	4	6	12	33	6	7
	S. W.	21	12	0	7	9	22	19	11	10	13	4	15	27	48	16	52
	S.	5	7	6	0	24	34	28	12	16	32	8	16	56	28	30	74
	S. E.	21	13	16	22	22	9	21	19	7	9	31	18	47	52	60	49
	E.	7	15	9	17	5	4	6	7	15	7	30	12	52	34	31	17
	N. E.	4	21	19	22	13	8	6	9	16	8	8	12	32	37	54	23
	Calm.	5	7	17	6	2	1	2	5	2	7	3	6	12	18	25	8
	Blank.	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	0
Virginia City, M. T.	N.	0	0	1	1	0	4	0	0	0	1	0	2	1	2	2	4
	N. W.	15	21	15	5	6	1	0	6	1	2	9	8	12	44	26	7
	W.	9	3	5	11	6	7	12	12	11	10	19	19	40	31	22	31
	S. W.	5	5	10	17	11	16	45	16	29	14	14	10	57	20	38	77
	S.	5	7	3	5	2	0	5	0	0	1	6	3	7	15	10	5
	S. E.	20	17	19	10	3	4	2	7	9	6	6	11	21	48	32	13
	E.	3	2	6	5	1	2	0	6	2	9	2	2	13	7	12	8
	N. E.	9	9	3	3	2	1	0	1	4	6	9	7	19	25	8	2
	Calm.	27	29	28	36	59	58	29	39	37	41	28	28	106	84	123	126
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Visalia, Cal	N.	6	3	6	7	5	11	4	4	13	15	15	9	43	18	18	19
	N. W.	43	41	24	19	20	23	13	21	22	28	48	43	98	127	63	57
	W.	10	12	12	10	3	11	9	13	7	3	8	7	18	29	25	33
	S. W.	9	3	6	7	11	7	10	9	5	3	4	10	12	22	24	26
	S.	8	7	7	12	6	10	12	6	17	6	5	5	28	20	25	28
	S. E.	5	15	14	20	18	13	28	16	15	16	7	6	38	26	52	57
	E.	2	1	1	5	7	5	6	9	6	8	2	3	16	6	13	20
	N. E.	1	1	4	1	5	1	2	3	3	8	2	3	13	5	10	6
	Calm.	9	10	16	12	15	12	9	6	5	3	2	2	10	21	43	27
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

*No reports received prior to October, 1879, or subsequent to April 30, 1880.

Statement showing how many times the wind was observed blowing, &c.—Continued.

Station.	Wind.	July, 1879.	August.	September.	October.	November.	December.	January, '80.	February.	March.	April.	May.	June.	Spring.	Summer.	Autumn.	Winter.
Washington, D. C.	N.	12	19	15	8	9	14	15	8	22	7	7	12	36	43	32	37
	N. W.	13	13	19	16	25	11	21	25	22	25	17	17	64	43	60	57
	W.	8	9	5	8	6	1	3	5	10	6	10	14	26	31	19	9
	S. W.	16	11	4	13	8	12	3	9	8	9	7	10	24	37	25	24
	S.	21	26	20	31	26	24	18	27	6	27	33	17	66	64	77	69
	S. E.	10	1	7	0	7	4	3	6	6	6	6	2	18	13	14	13
	E.	8	0	7	5	4	8	7	1	7	6	6	10	19	18	16	16
	N. E.	1	7	5	7	5	17	16	5	10	3	5	6	18	14	17	38
	Calm.	4	7	8	5	0	2	7	1	2	1	2	2	5	13	13	10
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wilmington, N. C.	N.	1	7	11	7	11	9	19	10	14	10	3	4	27	12	29	38
	N. W.	4	6	5	3	8	4	6	6	16	5	3	4	24	14	16	16
	W.	6	8	6	5	6	8	8	6	8	9	7	11	24	25	17	22
	S. W.	25	21	1	5	13	30	8	20	20	32	17	27	69	73	19	58
	S.	14	13	10	7	12	6	5	7	4	14	27	12	45	39	29	18
	S. E.	10	3	6	7	4	5	6	3	2	4	16	3	22	16	17	14
	E.	9	12	13	17	10	10	13	11	11	7	6	11	24	32	40	34
	N. E.	19	14	32	31	17	16	18	9	15	6	9	12	30	45	80	43
	Calm.	5	9	6	11	9	5	10	15	3	3	5	6	11	20	26	30
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Winnemucca, Nev	N.	5	10	10	10	10	1	0	5	6	5	10	13	21	28	30	6
	N. W.	5	3	2	3	2	2	1	1	1	0	3	6	4	15	7	4
	W.	22	17	14	10	1	8	2	4	7	4	7	9	18	48	25	14
	S. W.	36	38	28	31	35	52	71	42	50	40	40	31	130	105	94	165
	S.	1	3	0	3	4	3	1	6	1	3	3	1	7	5	7	10
	S. E.	3	0	1	1	2	2	3	1	0	2	0	0	2	3	4	6
	E.	6	5	14	8	12	9	6	3	4	4	4	1	12	12	34	18
	N. E.	13	16	20	26	20	15	8	25	24	18	14	29	56	58	66	48
	Calm.	2	1	1	1	4	1	1	0	0	14	12	0	26	3	6	2
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood's Holl, Mass	N.	5	6	4	6	9	11	9	8	12	7	6	5	25	16	19	28
	N. W.	6	13	8	21	33	27	24	26	24	16	6	10	46	29	62	77
	W.	7	12	9	27	10	18	10	20	9	11	7	8	27	27	46	48
	S. W.	36	33	22	7	17	11	13	9	10	34	50	38	94	96	46	33
	S.	12	4	17	9	6	2	5	9	2	5	8	9	15	25	32	16
	S. E.	16	9	14	11	7	12	17	8	10	4	6	8	20	33	32	37
	E.	8	4	10	6	4	6	5	6	8	6	1	3	15	15	20	17
	N. E.	3	12	6	5	4	6	8	1	18	5	9	6	32	21	15	15
	Calm.	0	0	0	1	0	0	2	0	0	2	0	3	2	3	1	2
	Blank.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yankton, Dak	N.	3	8	9	4	13	9	11	5	21	19	10	8	50	19	26	25
	N. W.	12	9	23	20	26	24	25	25	18	14	23	10	55	31	69	74
	W.	3	2	5	19	15	5	11	10	11	15	11	8	37	13	39	26
	S. W.	9	18	13	9	10	4	16	11	15	13	14	10	42	37	32	31
	S.	30	9	10	28	5	2	9	5	11	10	16	20	37	59	43	16
	S. E.	18	17	9	10	13	4	10	6	9	2	14	9	25	44	32	20
	E.	5	19	3	1	2	4	4	1	3	7	2	7	12	33	6	9
	N. E.	6	7	14	0	2	2	4	4	4	7	2	14	13	27	16	10
	Calm.	7	4	4	2	4	2	3	5	1	3	1	4	5	15	10	10
	Blank.	0	0	0	0	0	37	0	15	0	0	0	0	0	0	0	52

Paper 20.

Showing stations inspected, by whom, and when inspected, during the fiscal year ending June 30, 1880.

Station.	Name of inspector.	Date.
Albany, N. Y	First Lieut. J. A. Buchanan, acting signal-officer	August 23–25, 1879.
	First Lieut. John McClellan, acting signal-officer	June 24–25, 1880.
Albuquerque, N. Mex	First Lieut. J. A. Buchanan, acting signal-officer	May 17–18, 1880.
Alpena, Mich	Second Lieut. W. A. Glassford, Signal Corps, U. S. A	June 30, July 1, 1880.
Apache, Ariz	First Lieut. J. P. Story, acting signal-officer	Dec. 30, 1879, Jan. 1, 1880.
Apache Pass, Ariz	First Lieut. C. A. Booth, acting signal-officer	October 15, 1879.
	First Lieut. J. P. Story, acting signal-officer	January 8–9, 1880.
Atlanta, Ga	First Lieut. John McClellan, acting signal-officer	Dec. 16–17, 1879.
Atlantic City, N. J	First Lieut. S. C. Vedder, acting signal-officer	March 12, 1880.
Augusta, Ga	First Lieut. J. A. Buchanan, acting signal-officer	Nov. 13–15, 1879.
Bangor, Me	do	August 9, 1879.
Barnegat, N. J	First Lieut. S. C. Vedder, acting signal-officer	March 6, 1880.
Belen, N. Mex	First Lieut. J. A. Buchanan, acting signal-officer	May 17, 1880.
Boerne, Tex	Second Lieut. L. E. Sebree, Signal Corps, U. S. A	May 27–29, 1880.
Boise City, Idaho	First Lieut. John McClellan, acting signal-officer	August 27–29, 1880.
Boston, Mass	First Lieut. J. A. Buchanan, acting signal-officer	July 27, Aug. 1, 1879.
	First Lieut. John McClellan, acting signal-officer	June 18–21, 1880.
Brackettville, Tex	Second Lieut. L. E. Sebree, Signal Corps, U. S. A	May 14–17, 1880.
Brownsville, Tex	do	April 12–14, 1880.
Bridgetown, W. I	First Lieut. John McClellan, acting signal-officer	April 19–24, 1880.
Burkes, Ariz	First Lieut. J. P. Story, acting signal-officer	December 3–4, 1879.
Burlington, Vt	First Lieut. J. A. Buchanan, acting signal-officer	August 15–17, 1879.
	First Lieut. John McClellan, acting signal-officer	June 22–23, 1880.
Burlington, Iowa	First Lieut. B. H. Gilman, acting signal-officer	August 19, 1879.
Campo, Cal	First Lieut. C. A. Booth, acting signal-officer	August 7–8, 1879.
	First Lieut. J. P. Story, acting signal-officer	November 26, 1879.
Cantonment, Ind. T	Second Lieut. C. A. Tingle, acting signal-officer	December 29, 1879.
Cape Hatteras, N. C	First Lieut. S. C. Vedder, acting signal-officer	February 18, 1880.
Cape Henry, Va	do	February 24, 1880.
Cape Lookout, N. C	do	February 11, 1880.
Cape May, N. J	do	March 17, 1880.
Castroville, Tex	Second Lieut. L. E. Sebree, Signal Corps, U. S. A	May 20–22, 1880.
Cedar Keys, Fla	First Lieut. John McClellan, acting signal-officer	February 21–22, 1880.
Central City, N. Mex	First Lieut. J. A. Buchanan, acting signal-officer	May 8–11, 1880.
Charleston, S. C	do	Nov. 11–12, 1879.
Charlotte, N. C	First Lieut. John McClellan, acting signal-officer	February 5–6, 1880.
Chattanooga, Tenn	First Lieut. J. A. Buchanan, acting signal-officer	Oct. 31, Nov. 1, 1879.
Cheyenne, Wyo	First Lieut. John McClellan, acting signal-officer	Nov. 19–20, 1879.
Chincoteague, Va	First Lieut. S. C. Vedder, acting signal-officer	March 25, 1880.
Cleveland, Ohio	First Lieut. J. A. Buchanan, acting signal-officer	Sept. 12–14, 1879.
	Second Lieut. W. A. Glassford, Signal Corps, U. S. A	June 3–5, 1880.
Coleman City, Tex	First Lieut. J. A. Buchanan, acting signal-officer	March 24–26, 1880.
Colorado Springs, Col	First Lieut. John McClellan, acting signal-officer	Nov. 24–27, 1879
Concho, Tex	First Lieut. J. A. Buchanan, acting signal officer	Mar. 28, April 5, 1880.
Corsicana, Tex	Second Lieut. L. E. Sebree, Signal Corps, U. S. A	March 17–19, 1880.
Corrillia Station, Ariz	First Lieut. C. A. Booth, acting signal-officer	October 11, 1879.
	First Lieut. J. P. Story, acting signal-officer	Dec. 22–23, 1879.
Craig (Fort), N. Mex	First Lieut. J. A. Buchanan, acting signal-officer	May 15–16, 1880.
Cummings, N. Mex	do	May 8–11, 1880.
Davis, Tex	do	April 16–19, 1880.
Decatur, Tex	do	March 12–13, 1880.
Delaware Breakwater, Del.	First Lieut. S. C. Vedder, acting signal-officer	March 22, 1880.
Denison, Tex	First Lieut. J. A. Buchanan, acting signal-officer	March 2–6, 1880.
Denver, Col	First Lieut. John McClellan, acting signal-officer	November 23, 1879.
Des Moines, Iowa	First Lieut. B. H. Gilman, acting signal-officer	August 22, 1879.
Detroit, Mich	Second Lieut. W. A. Glassford, Signal Corps, U. S. A	June 12–15, 1880.
Dodge City, Kans	First Lieut. John McClellan, acting signal-officer	November 30, 1879.
	First Lieut. J. A. Buchanan, acting signal-officer	June 27–28, 1880.
Eagle Pass, Tex	Second Lieut. L. E. Sebree, Signal Corps, U. S. A	May 10–12, 1880.
Eastport, Me	First Lieut. J. A. Buchanan, acting signal-officer	August 12–13, 1879.
Edinburg, Tex	Second Lieut. L. E. Sebree, Signal Corps, U. S. A	April 16–17, 1880.
El Paso, Tex	First Lieut. J. A. Buchanan, acting signal-officer	April 25–30, 1880.
Erie, Pa	Second Lieut. W. A. Glassford, Signal Corps, U. S. A	May 31, June 2, 1880.
False Cape, N. C	First Lieut. S. C. Vedder, acting signal-officer	February 25, 1880.
Florence, Ariz	First Lieut. C. A. Booth, acting signal-officer	October 3–6, 1879.
	First Lieut. J. P. Story, acting signal-officer	Dec. 19–20, 1879.
Fredericksburg, Tex	Second Lieut. L. E. Sebree, Signal Corps, U. S. A	May 30, June 2, 1880.
Galveston, Tex	do	March 20–23, 1880.
Goodwin, Ariz	First Lieut. C. A. Booth, acting signal-officer	October 21, 1879.
	First Lieut. J. P. Story, acting signal-officer	Dec. 25–27, 1879.
Graham, Tex	Second Lieut. C. A. Tingle, acting signal-officer	January 15–16, 1880.
	First Lieut. J. A. Buchanan, acting signal-officer	March 17–18, 1880.
Green Bay, Wis	First Lieut. B. H. Gilman, acting signal-officer	July 11, 1879.
Griffin (Fort), Tex	Second Lieut. C. A. Tingle, acting signal-officer	January 18, 1880.
	First Lieut. J. A. Buchanan, acting signal-officer	March 20–22, 1880.

Showing stations inspected, by whom, and when inspected, &c.—Continued.

Station.	Name of inspector.	Date.
Havana, Cuba	First Lieut. John McClellan, acting signal-officer	March 25–27, 1880.
Horn's Pier, Wis	First Lieut. B. H. Gilman, acting signal-officer	July 10, 1879.
Indianola, Tex	Second Lieut. L. E. Sebree, Signal Corps, U. S. A	March 26–28, 1880.
Jacksboro, Tex	First Lieut. J. A. Buchanan, acting signal-officer	March 15–16, 1880.
Jacksonville, Fla	First Lieut. John McClellan, acting signal-officer	February 11–14, 1880.
Kenosha, Wis	First Lieut. B. H. Gilman, acting signal-officer	July 5, 1879.
Kewaunee, Wis	do	July 9, 1879.
Key West, Fla	First Lieut. John McClellan, acting signal-officer	February 18–19, 1880.
Kingston, W. I	do	May 5–6, 12–14, 1880.
Kittyhawk, N. C	First Lieut. S. C. Vedder, acting signal-officer	January 23, 1880.
Knoxville, Tenn	First Lieut. John McClellan, acting signal-officer	December 23–24, 1879.
La Mesilla, N. Mex	First Lieut. J. A. Buchanan, acting signal-officer	May 2–5, 1880.
Laredo, Tex	Second Lieut. L. E. Sebree, Signal Corps, U. S. A	April 26–29, 1880.
Leavenworth, Kans	First Lieut. John McClellan, acting signal-officer	December 3–5, 1879.
	First Lieut. J. A. Buchanan, acting signal-officer	June 29–July 1, 1880.
Little Rock, Ark	do	February 26–27, 1880.
Logansport, Ind	First Lieut. B. H. Gilman, acting signal-officer	August 15, 1879.
Los Angeles, Cal	First Lieut. John McClellan, acting signal-officer	October 25–27, 1879.
Los Lunas, N. Mex	First Lieut. J. A. Buchanan, acting signal-officer	May 17, 1880.
Louisville, Ky	do	October 27–29, 1879.
Lynchburg, Va	First Lieut. John McClellan, acting signal-officer	December 25–26, 1879
Macon (Fort), N. C	First Lieut. S. C. Vedder, acting signal-officer	February 9, 1880.
Manitowoc, Wis	First Lieut. B. H. Gilman, acting signal-officer	July 9, 1879.
Maricopa, Ariz	First Lieut. C. A. Booth, acting signal-officer	September 12, 1879.
	First Lieut. J. P. Story, acting signal-officer	December 4–5, 1879.
Mason, Tex	Second Lieut. L. E. Sebree, Signal Corps, U. S. A	June 4–5, 1880.
McKavett, Tex	do	June 12–14, 1880.
Melvin Station, Ariz	First Lieut. C. A. Booth, acting signal-officer	September 26, 1879.
	First Lieut. J. P. Story, acting signal-officer	December 13–14, 1879.
Memphis, Tenn	First Lieut. J. A. Buchanan, acting signal-officer	February 20–25, 1880.
Menomonee, Mich	First Lieut. B. H. Gilman, acting signal-officer	July 12, 1879.
Mobile, Ala	First Lieut. John McClellan, acting signal-officer	March 8–10, 1880.
Montgomery, Ala	do	March 4–5, 1880.
Mt. Washington, N. H	First Lieut. J. A. Buchanan, acting signal-officer	August 5–6, 1879.
Nashville, Tenn	First Lieut. John McClellan, acting signal-officer	December 12–13, 1879.
New Haven, Conn	First Lieut. J. A. Buchanan, acting signal-officer	July 12–17, 1879.
New London, Conn	do	July 17–19, 1879.
New Orleans, La	First Lieut. John McClellan, acting signal-officer	March 11–15, 1880.
Newport, R. I	First Lieut. J. A. Buchanan, acting signal-officer	July 22–24, 1879.
New River, N. C	First Lieut. S. C. Vedder, acting signal-officer	February 6, 1880.
New York, N. Y	First Lieut. J. A. Buchanan, acting signal-officer	July 5–12, 1879.
	First Lieut. John McClellan, acting signal-officer	June 16–17, 1880.
Norfolk, Va	do	February 1–3, 1880.
North Platte, Nebr	First Lieut. B. H. Gilman, acting signal officer	October 4, 1879.
Ocean City, Md	First Lieut. S. C. Vedder, acting signal-officer	March 23, 1880.
Olympia, Wash	First Lieut. John McClellan, acting signal-officer	September 15–16, 1879.
Omaha, Nebr	First Lieut. B. H. Gilman, acting signal-officer	August 26, 1879.
Oswego, N. Y	First Lieut. J. A. Buchanan, acting signal-officer	Aug. 27–Sept. 2, 1879.
Pensacola, Fla	First Lieut. John McClellan, acting signal-officer	March 6–7, 1880.
Phœnix, Ariz	First Lieut. C. A. Booth, acting signal-officer	September 13, 1879.
	First Lieut. J. P. Story, acting signal-officer	December 17, 1879.
Pike's Peak, Col	First Lieut. John McClellan, acting signal-officer	November 25–26, 1879.
Pilot Point, Tex	First Lieut. J. A. Buchanan, acting signal-officer	March 9–10, 1880.
Pioche, Nevada	First Lieut. John McClellan, acting signal-officer	August 16–19, 1879.
Pittsburgh, Pa	Second Lieut. W. A. Glassford, Signal Corps, U. S. A	May 28–30, 1880.
Port Huron, Mich	do	June 16–28, 1880.
Portland, Me	First Lieut. J. A. Buchanan, acting signal-officer	August 7–8, 1879.
Portland, Oreg	First Lieut. John McClellan, acting signal-officer	September 8–10, 1879.
Portsmouth, N. C	First Lieut. S. C. Vedder, acting signal-officer	February 14, 1880.
Prescott, Ariz	First Lieut. C. A. Booth, acting signal-officer	September 19–23, 1879.
	First Lieut. J. P. Story, acting signal-officer	December 8–12, 1879.
Racine, Wis	First Lieut. B. H. Gilman, acting signal-officer	July 7, 1879.
Red Bluff, Cal	First Lieut. John McClellan, acting signal-officer	November 11–12, 1879.
Reno (Fort), Idaho	Second Lieut. C. A. Tingle, acting signal-officer	November 26–27, 1879.
Rio Grande City, Tex	Second Lieut. L. E. Sebree, Signal Corps, U. S. A	April 19–22, 1880.
Rochester, N. Y	First Lieut. J. A. Buchanan, acting signal-officer	September 3–9, 1879.
Roseburg, Oreg	First Lieut. John McClellan, acting signal-officer	September 10–11, 1879.
Sacramento, Cal	do	November 8–10, 1879.
Salt Lake City, Utah	do	November 17–18, 1879.
San Antonio, Tex	Second Lieut. L. E. Sebree, Signal Corps, U. S. A	May 23–27, 1880.
San Diego, Cal	First Lieut. John McClellan, acting signal-officer	October 6–11, 1879.
	First Lieut. J. P. Story, acting signal-officer	Nov. 23, 24, 28, 1879.
Sandusky, Ohio	Second Lieut. W. A. Glassford, Signal Corps, U. S. A	June 7–8, 1880.
Sandy Hook, N. J	First Lieut. J. A. Buchanan, acting signal-officer	July 1–3, 1879.
	First Lieut. S. C. Vedder, acting signal-officer	March 5, 1880.
San Francisco, Cal	First Lieut. John McClellan, acting signal-officer	September 24–30, 1879.
Santa Fé, N. Mex	First Lieut. J. A. Buchanan, acting signal-officer	May 27, June 25, 1880.
Santiago de Cuba, W. I	First Lieut. John McClellan, acting signal-officer	April 2–4, 1880.
Savannah, Ga	do	February 7–10, 1880.
Sheboygan, Wis	First Lieut. B. H. Gilman, acting signal-officer	July 8, 1879.
Shreveport, La	Second Lieut. L. E. Sebree, Signal Corps, U. S. A	March 13–15, 1880.
Silver City, N. Mex	First Lieut. J. A. Buchanan, acting signal-officer	May 8–11, 1880.

Showing stations inspected, by whom, and when inspected, &c.—Continued.

Station.	Name of inspector.	Date.
Sloop Point, N. C	First Lieut. S. C. Vedder, acting signal-officer	February 4, 1880.
Smithville, N. C	do	February 2, 1880.
Socorro N. Mex	First Lieut. J. A. Buchanan, acting signal-officer	May 15-16, 1880.
Springfield, Ill	First Lieut. John McClellan, acting signal-officer	December 9-10, 1879.
Springfield, Mass	First Lieut. J. A. Buchanan, acting signal-officer	August 3-4, 1879.
Stewart's Ranch, Ariz	First Lieut. C. A. Booth, acting signal-officer	October 17-19, 1879.
	First Lieut. J. P. Story, acting signal-officer	January 6-7, 1880.
Stockton, Tex	First Lieut. J. A. Buchanan, acting signal-officer	April 11-14, 1880.
Sturgeon Bay, Wis	First Lieut. B. H. Gilman, acting signal-officer	July 10, 1879.
Saint Louis, Mo	First Lieut. John McClellan, acting signal-officer	December 6-8, 1879.
St. Thomas, W. I	do	April 11-14, 1880.
Supply (Fort), Ind. T	Second Lieut. C. A. Tingle, acting signal-officer	December 2-5, 1879.
Thatcher's Island, Mass.	First Lieut. J. A. Buchanan, acting signal-officer	August 1-2, 1879.
Toledo, Ohio	Second Lieut. W. A. Glassford, Signal Corps, U. S. A	June 9-11, 1880.
Tres Alamos, Ariz	First Lieut. C. A. Booth, acting signal-officer	October 13, 1879.
	First Lieut. J. P. Story, acting signal-officer	December 23, 1879.
Tucson, Ariz	First Lieut. C. A. Booth, acting signal-officer	October 8-10, 1879.
	First Lieut. J. P. Story, acting signal-officer	December 21-23, 1879.
Umatilla, Oreg	First Lieut. John McClellan, acting signal-officer	September 1-3, 1879.
Uvalde, Tex	Second Lieut. L. E. Sebree, Signal Corps, U. S. A	May 18-19, 1880.
Visalia, Cal	First Lieut. John McClellan, acting signal-officer	October 29-30, 1879.
Wickenburg, Ariz	First Lieut. C. A. Booth, acting signal-officer	September 17, 1879.
	First Lieut. J. P. Story, acting signal-officer	December 6-7, 1879.
Wilmington, N. C	First Lieut. S. C. Vedder, acting signal-officer	January 30, 1880.
Winnemucca, Nev	First Lieut. John McClellan, acting signal-officer	November 13-15, 1879.
Wood's Holl, Mass	First Lieut. J. A. Buchanan, acting signal-officer	July 25-26, 1879.
Yuma, Ariz	First Lieut. C. A. Booth, acting signal-officer	September 6-9, 1879.
	First Lieut. J. P. Story, acting signal-officer	Nov. 30, Dec. 2, 1879.

PAPER 21.

(On the cover of the Book of Forms and Rules.)

(Form 14.)

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL-OFFICER,

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

Inspection report of ———, *made on station at* ———, *on* ———.

Comparative readings of barometer and thermometers at ———. *Corrected for an elevation of* ——— *feet.*

Date.	Inspector's barometer No. ———. Instrumental error, ———.			Station barometer No. ———. Instrumental error, ———.			Extra barometer No. ———. Instrumental error, ———.			Aneroid barometer No. ———.	Aneroid barometer No. ———, corrected.	Station thermometer No. ———.	Extra thermometer.	Dry bulb.
	Attached thermometer.	Observed reading.	Corrected reading.	Attached thermometer.	Observed reading.	Corrected reading.	Attached. thermometer.	Observed reading.	Corrected reading.					

Station barometer No. —— reads —— than inspector's barometer No. ——.
Extra barometer No. —— reads —— than inspector's barometer No. ——.

——— ———, *Inspector.*

RULES FOR THE GUIDANCE OF INSPECTING OFFICERS OF THE SIGNAL SERVICE, UNITED STATES ARMY.

1. The outfit of an inspecting officer will consist of the following-named instruments, in addition to the necessary blanks, stationery, &c.:

One standard mercurial barometer.
One standard aneroid barometer.
One standard thermometer.
One standard compass.

2. Upon arriving at a station he will carefully compare all station instruments with his standards, making not less than thirty readings of each instrument, and keeping an accurate record of the observations of both his own and the station instruments, and forwarding the same to the Chief Signal-Officer with his inspection report.

3. He will determine by the aid of his compass the accuracy with which the station wind-vane is placed in position upon the true meridian, and, if an error is found, will have it corrected before he leaves the station.

4. He will ascertain by actual measurement whether any change has been made in the elevation of the barometer, thermometer, or rain-gauge since the station was last inspected, and if such change has been made, will report the amount and date of the same.

5. In the event of any change having been made in the location of the office since the date of the last report, he will ascertain the exact elevation of the new office and of the several instruments above the bench-mark of the station, as given in circular No. 2, issued from the office of the Chief Signal-Officer under date of January 11, 1873, and is authorized to employ for this purpose, whenever necessary, the city engineer, or, in his absence, any other responsible person.

6. He will note carefully the condition of the office room or rooms, and when they are found improperly kept or arranged will see that the proper changes are made before he leaves the station.

7. He will examine in detail the office books from the date of the last previous inspection, and if errors are found, will point them out and instruct the observer in charge how to correct them. In case of omission on the part of the observer in charge to keep all or part of any record, he will report the fact to the Chief Signal Officer, with such recommendations as he thinks proper, accompanying the report with a written statement from the observer of the cause of said omission.

8. The condition of the several instruments will be thoroughly examined, and when any fault of location or want of cleanliness is discovered, will attend in person to its correction. The observer will be examined as to his knowledge of the instruments and their management in detail, and when found ignorant of any part will be properly instructed.

9. All map and bulletin frames will be personally inspected and their condition noted from actual observation, and not from the observer's statement. The date of the several maps and bulletins posted in the frames at the time of inspection will be observed, and if the latest issue is not found therein the observer will be called to account for neglect of duty.

10. A full list will be forwarded with each report of all maps and bulletins issued at the station inspected, showing the names and local address of each person, firm, or institution receiving them.

11. The chairman of the meteorological committee, or committees where more than one exist at a station, will be visited, and inquiry made as to the conduct of the observer and other men on duty at the station, and the manner in which they perform their special duties. Suggestions will be invited that tend to increase the usefulness of the service by a wider diffusion of the reports.

12. The amount and condition of the property for which the observer is responsible will be noted in the report, and suitable disposition of unserviceable property recommended.

13. The observer in charge will be examined as to his knowledge of the various circulars from the central office, and when he does not appear to understand any one or part of one, proper instructions will be given him.

14. The inspector will explain to each observer the proper manner of furnishing items of special interest in the reports to the local newspapers, impressing upon them at all times, however, the fact that these items will not be furnished when the papers can be induced to print full reports.

15. The inspection report of each station must be made out and mailed before the inspecting officer leaves the station.

16. The inspector will be present in person at all the observations made at the station he is inspecting during some one day of his inspection, and will correct on the spot any errors into which the observer may have fallen.

17. He will examine the assistants on duty at the station as to their knowledge of their practical duties, and also as to the progress made by them in the theoretical

knowledge of meteorology, and will report the result of such examination to the Chief Signal Officer.

18. When any instrument or other item of public property is found unserviceable at a station, the inspector will state whether or not it is necessary that it should be replaced.

19. When the removal of an office is recommended by an inspector, the location and rental of the proposed office will be given, and also a careful estimate of the cost of removal.

20. The official numbers of all instruments will be given in each inspection report.

21. If the inspector finds it necessary to change instruments on any station, the fact, as well as the numbers of the instruments exchanged, will be reported.

WAR DEPARTMENT,

OFFICE OF THE CHIEF SIGNAL OFFICER,

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INSPECTION REPORT.

Diagram of office, giving dimensions, number and location of doors and windows. Positions of instruments to be marked.	Name and number of street on which office is situated.	Price paid for rent of office. (Per month.)	Name and address of person or persons from whom office is rented.	Name.	Miscellaneous instruments, &c.														Kind of shelter, size and location with position of instruments.
					Anemometers.	Anemometer rods, telescopic.	Anemoscopes.	Barometers, mercurial.	Barometers, aneroid.	Compass.	Eye-glasses, colored, and case, pairs.	Greasers for instruments.	Hygrometers (complete).	Hygrometer tubes.	Keys, telegraph.	Lightning arresters.	Measuring stick.	Marine glasses, cases and straps.	
		Elevation of surface of mercury in cistern of barometer above mean tide level.	Authority.	Number........ Elevation above the ground... Condition															

REMARKS UPON THE LOCATION OF OFFICE, ETC.

INSPECTION REPORT—Continued.

Name.	Miscellaneous instruments, &c.																						Office furniture and supplies.												
	Mercury, pounds.	Rain-gauges.	Relays.	Relays, pocket.	Repeaters.	Self-registers for anemometers.	Self-registers for anemometers and anemoscopes combined.	Sounders.	Sounders, box.	Switch-board, wires.	Switches, cut-out.	Styli.	Telescopes, telegraph.	Telescopes and straps.	Telescope holders.	Thermometers, standard.	Thermometers, maximum.	Thermometers, minimum.	Thermometers, water, and case.	Thermometers, tester, tin.	Tool-box (complete).	Wind-vanes, large.	Arrows and discs, combined, for weather maps.	Arrows for weather maps.	Baskets, waste paper.	Boxes, coal and wood.	Boxes, cash.	Boxes, stamp.	Brooms.	Brushes, dust.	Brushes, scrubbing.	Brushes, hygrometer.	Bulletin-boards.	Buckets, water.	Calendars.
Number																																			
Elevation above the ground																																			
Condition																																			

REMARKS. *Note.*—State how fuel and lights are obtained and paid for.

Name.	Office furniture and supplies.																																		
	Candles, pounds.	Carpet, yards.	Cases, office.	Chairs.	Clocks, regulator.	Coal, tons of.	Coal-hods.	Cord for W. thermometer, feet of.	Counters and partitions, feet of.	Cupboards and closets.	Cushions.	Desks.	Dippers.	Discs for weather maps.	Dusters, feather.	Dust-pans.	Flags, United States recruiting.	Flags, international code signal, sets of.	Flags, 6-foot, white.	Flags, 8-foot, white.	Flags, 6-foot, red.	Flags, 8-foot, red.	Flags, 15-foot, red.	Frames, bulletin.	Frames, map.	Frames, monthly mean.	Gas-fixtures.	Indicator, cautionary signal.	Ladders.	Lamps.	Lamp-chimneys.	Lamp-wick.	Lanterns.	Lanterns, dark.	Lanterns, signal, white.
Number																																			
Condition																																			

REMARKS.

INSPECTION REPORT—Continued.

Name.	Office furniture and supplies.																																		
	Lanterns, signal, red.	Letter presses.	Letter scales.	Lounges, bed.	Mallets.	Matches, boxes of.	Maps.	Maps, large weather.	Mats, foot.	Matting, yards.	Oil, clock, bottles of.	Oil, kerosene, gallons of.	Oil, lard, gallons of.	Oil, sperm, gallons of.	Oil-cans.	Oil-cloth, yards.	Pitchers.	Pokers, fire.	Railing, wooden, feet of.	Screws, clamp, for W. map.	Shears, pairs.	Shades, for gas or lamps.	Shelving, feet.	Shovels, coal.	Shovels, fire.	Signs, office.	Sprinklers.	Spittoons.	Staffs, flag.	Stamps or dies, boxes of.	Stoves.	Stove-pipe, joints.	Tables.	Tables, operating.	Tin, sheets, for manifold forms.
Number																																			
Condition																																			

REMARKS.

Name.	Office furniture and supplies.										Text and record books.																								
	Towels.	Towel racks.	Tumblers.	Twine, balls of.	Wash-basin.	Wash-stand.	Water-cooler.	Wicking for hygrometer.	Window curtains.	Wood, cords of.	Annual Reports of C. S. O., copies.	Bibles.	Buchan's Meteorology, copies.	Cipher Hand-books, copies.	Daily Bulletins, &c., &c., bound copies.	Daily Journals.	Daily Records of Observation.	Dictionaries.	Expense books.	Flags of Maritime Nations' books.	Guyôt's Meteorological Tables, copies.	Instructions to Observer Sergeants.	Index-books.	International Code Signal books.	Loomis' Meteorology, copies.	Manual of Signals, copies.	Manual of Military Telegraphy.	Marine Register (American Lloyds'.	Messengers' receipt books.	Original Records of Observation.	Piddington's Horn Book, copies.	Pope's Telegraphy, copies.	Postage Memo. books.	Records of American and foreign shipping.	Records of Bulletins.
Number																																			
Condition																																			

REMARKS.

INSPECTION REPORT—Continued.

	Name.	Number	Condition
Text and record books.	Record of letters sent.		
	Record of letters received.		
	Record of signals.		
	Register books.		
	River record books.		
	Rule books.		
	Smithsonian directions, met. for obs.		
	Suggestions, copies.		
	Tariff books, W. U.		
Forms, stationery, &c.	Binders, Conant.		
	Cards, barometer.		
	Cards, cipher, sets.		
	Cards, error.		
	Cards, notifying.		
	Circuit blanks.		
	Envelopes, official.		
	Envelopes, message.		
	Envelopes, small.		
	Envelopes, printed "C. S. O."		
	Envelopes, printed "Supt. U. S. Tel."		
	Erasers.		
	Files, Shipman's.		
	Form No. 1, tel.		
	Form No. 2, tel.		
	Form No. 3, tel.		
	Form No. 4, tel.		
	Form No. 5, tel.		
	Form No. 6, tel.		
	Form No. 7, tel.		
	Form No. 8, tel.		
	Form No. 9, tel.		
	Form No. 10, tel.		
	Form No. 11, tel.		
	Form No. 12, tel.		
	Form No. 1, met'l.		

	Name.	Number	Condition
Forms, stationery, &c.	Form No. 2, met'l.		
	Form No. 3, met'l.		
	Form No. 4, met'l.		
	Form No. 5, met'l.		
	Form No. 6, met'l.		
	Form No. 7, met'l.		
	Form No. 8, met'l.		
	Form No. 15, met'l.		
	Form No. 16, met'l.		
	Form No. 19, met'l.		
	Form No. 20, met'l.		
	Form No. 21, met'l.		
	Form No. 22, met'l.		
	Form No. 23, met'l.		
	Form No. 24, met'l.		
	Form No. 25, met'l.		
	Form No. 26, met'l.		
	Form No. 27, met'l.		
	Form No. 28, met'l.		
	Form No. 29, met'l.		
	Form No. 30, met'l.		
	Form No. 31, met'l.		
	Form No. 32, met'l.		
	Form No. 33, met'l.		
	Form No. 34, met'l.		
	Form A, met'l.		
	Form B, met'l.		
	Form, acknowledgment of orders, &c.		
	Form, estimate of stationery, forms, &c.		
	Form, report of signal-service property.		
	Form, stamp return.		
	Form, record sheets.		
	Form, purchases or expenditures.		
	Form, medical vouchers.		
	Form, pay vouchers, commissary, sets.		

INSPECTION REPORT—Continued.

Name.	Forms, stationery, &c.																																		
	Form, pay vouchers, quartermaster, sets.	Form, pay vouchers, paymaster, sets.	Ink, copying, quarts.	Ink, copying, pints.	Ink (writing fluid), quarts.	Ink (writing fluid), pints.	Ink, red, bottles.	Inkstands.	Letter clips.	Mucilage, bottles of.	Memorandum books.	Paper, blotting, sheets.	Paper, carbon, sheets.	Paper, cap, quires of.	Paper, clip, packages of.	Paper, envelope, quires of.	Paper, legal cap, quires of.	Paper, letter, quires of.	Paper, note, quires of.	Paper, printing, quires of.	Paper, manifold, books of.	Paper, flat letter, reams of.	Paper fasteners.	Paper folders, ivory.	Paper cutters, tin.	Paper weights.	Pencils, lead.	Pencil leads, boxes of.	Pen-holders.	Pen-racks.	Pens.	Ruber bands, gross.	Rubber erasers.	Rulers.	Ruling pens.
Number..........																																			
Condition.........																																			

Name.	Forms, stationery, &c.				Telegraph materials, tools, implements, &c.																														
	Sponge-cups.	Sponge, pieces.	Sealing-wax.	Tape, spools.	Axes.	Brackets, insulator, screw.	Block and tackle, sets.	Battery brushes.	Battery cups, Daniell.	Battery cups, Eagle's, round.	Battery cups, Eagle's, square.	Battery pitchers.	Battery porous cups.	Battery syringes.	Battery zincs.	Binding screws.	Connectors, double.	Climbers and straps.	Crowbars.	Digging bars.	Files.	Hammers.	Hatchets.	Insulators, screw.	Nails, pounds.	Planes.	Pliers, cutting.	Poles, new, feet.	Poles, new, feet.	Poles, old, feet.	Shovels, long-handle.	Saws.	Solder, pounds or bars.	Soldering irons.	Soldering fluid, pounds.
Number..........																																			
Condition.........																																			

INSPECTION REPORT—Continued.

Name.	Telegraph materials, tools, implements, &c.												Printing material.																						
	Soldering pots, with pans.	Staples, pounds.	Sulphate of copper, pounds.	Sulphate of zinc, pounds.	Vises, hand.	Vises, strapped.	Wire, compound, pounds.	Wire, galvanized, No. —, pounds.	Wire, galvanized, No. 9, coils.	Wire, insulated, feet.	Wire, office, feet.	Wrenches, splicing.	Benzine, gallons of.	Blankets, press.	Bodkins.	Boxes, miter.	Brushes, lye.	Cans, benzine.	Cases, job.	Cases, type, single.	Cases, type, pairs.	Chases.	Cotton waste, pounds.	Electrotypes, autograph of A. J. Myer.	Electrotypes, "Farmers' Bulletin."	Electrotypes, letter heads.	Electrotypes, "Indications."	Electrotypes, "Published by co-operation."	Electrotypes, "Synopsis."	Furniture, feet.	Furniture, pounds.	Galleys.	Ink, black, pounds.	Ink, lake, pounds.	Leads, pounds.
Number..........																																			
Condition..........																																			

Name.	Printing material.																										Miscellaneous.								
	Lye, boxes.	Lye-pots.	Mallets.	Oiling cans.	Planers.	Presses, printing.	Quoins.	Quadrats.	Rollers, ink.	Rules, brass, feet of.	Rules, composing.	Saws.	Spatula.	Springs, type.	Stands, type.	Sticks, composing.	Sticks, side.	Sticks, shooting.	Stones, imposing.	Symbols, type.	Turpentine.	Tweezers, pairs.	Type, fonts of.	Type, pounds of.	Type, figures, pounds of.	Wrenches.	Bedsteads, camp, and slats.	Canteens and straps.	Canvas cases and straps.	Cans, copper, 5-gallon.	Carbines.	Carbine slings.	Carbine swivels.	Cartridge boxes.	Cartridges, cal.
Number..........																																			
Condition..........																																			

INSPECTION REPORT—Continued.

Name.	Miscellaneous.																																		
	Cartridges, cal.	Extinguishers, foot.	Extinguishers, flying.	Flags, 4-foot, white.	Flags, 4-foot, red.	Flame shades, foot.	Flame shades, flying.	Funnels.	Haversacks.	Matches, wind, boxes of.	Pliers, pairs.	Revolvers.	Revolver holsters.	Screw-driver for revolver.	Scissors, pairs.	Staffs, jointed, sets.	Straps, small.	Torches, foot.	Torches, flying.	Turpentine, gallons.	Waist-belts.	Waist-belt plates.	Wicking, balls of.	Wormers.											
Number..........																																			
Condition..........																																			

BULLETINS.

No. issued of a. m. reports.	Where posted.	No. issued of p. m. reports.	Where posted.	No. issued of night reports.	Where posted.

REMARKS. *Note.*—The style, size, and general appropriateness of the bulletin boards should be stated.

PRESS REPORTS.

No. of papers supplied with 7.00 a. m. reports.	Names of papers.	No. supplied with 3.00 p. m. reports.	Names of papers.	No. supplied with 11.00 p. m. reports.	Names of papers.

REMARKS.

MANIFOLD MAPS.

Number issued.	Where posted.	Condition.

REMARKS.

TELEGRAPH AND WAND PRACTICE.

Name.	Rank.	Telegraph practice (Morse code).		Wand practice.	
		Number of words sent per minute.	Number of words received per minute.	Number of words sent per minute.	Number of words received per minute.

REMARKS.

GENERAL REMARKS AND SUGGESTIONS.

———— ————, *A. S. O. and Inspector.*

Date, ———

Station, ———.

PAPER 22.

Extracts from the instructions to observer sergeants.

* * * * * * *

6. The regular observations from ——— will commence with the morning observation of ———, and on and after that date eight observations will be made daily, three of which will form the *telegraphic*, three the *local*, and one the *midday*, and one the *sunset* series. These observations will be recorded in the "Original Record of Observations" and the "Daily Record of Observations," a separate sheet being used in the Daily Record of Observations for each series.

7. The observations forming the telegraphic series will be taken daily at — a. m., — p. m., and — p. m., local time (corresponding with 7 a. m., 3 p. m., and 11 p. m. Washington mean time), and, after the proper corrections have been made, will be written on Form 5, if the station is a telegraphic one, and also in the Record of Bulletins (where this is authorized). The midday series of observations will be taken at — m., local time (corresponding with 11 a. m. Washington mean time), and those of the local series at 7 a. m., 2 p. m., and 9 p. m., respectively. The midday series will be entered in the Daily Record as a separate series. When this report is called for by telegraph from the central Office a full report will be sent, consisting of the corrected and actual barometric readings, temperature, humidity, direction of wind, and state of weather; velocity of wind, in miles, per hour; maximum velocity of wind, in miles, per hour since last telegraphic observation; upper clouds; lower clouds; and the reading of the maximum thermometer at the time of observation; the whole being sent in the order in which they are here named, and in the regular cypher words, the word to express the maximum velocity since last telegraphic report being taken from the column of words beginning with the letter I. Rainfall will not be sent at this report. In sending the maximum temperature at time of observation, the cypher words on page 32 of the cypher book will be used. At stations that do not report by telegraph, Form 5 will not be used. A reading of the barometer, *i. e.*, corrected for temperature and instrumental error only (actual barometer), will be taken and recorded daily at each station at the hour of sunset. Spaces will be ruled on the last leaf of the Original Record of Observations, and an additional column in the weekly Meteorological Record book, and on Form 4, local sheet, in the blank space headed "Remarks for recording these observations."

8. The instruments will be read in the following order:

1. Barometer.	3. Hygrometer.	5. Anemoscope.
2. Thermometer.	4. Anemometer.	6. Rain-gauge.

The minimum thermometer at the a. m. telegraphic observation and the maximum and minimum thermometers at the midnight telegraphic observation will be read after the exposed thermometer. After the instruments have been read the character of the clouds and state of weather will be noted.

9. The readings of the different instruments and character of clouds and state of weather must be entered in the Original Record of Observations as soon as made, and *not* copied in afterward from a slip of paper. Observers will habitually carry this book when making observations and enter the readings in *pencil*, as noted at the time. They will also enter the proper corrections, as indicated by the marginal references. Pen and ink must *not* be used for entering any observation or corection. In filling up that portion of the Original Record of Observations which comes under the head of "Weather," *local* time will be used.

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27. At all stations ordered to make river reports, the depth of water will be observed at 1 o'clock (local time) each afternoon, and embodied in the next succeeding regular telegraphic report.

28. Whenever any sudden or unusual change occurs in the condition of the river, a special series of observations will be made, which will be reported in the usual manner at the next succeeding telegraphic reports. These special reports will be continued tri-daily (one at each telegraphic report) until the river resumes its normal condition, when they will be discontinued.

* * * * * * *

30. The observations for the morning and midnight special river reports will be made, if practicable, within an hour of the time of report.

Observers must exercise the utmost care in making and recording the river observations, in order that they may be relied upon as accurate by interested parties.

31. The amount of precipitation (rain and melted snow) will be measured and reported at each of the three telegraphic reports only. Should more than four (4) inches of rainfall be recorded, two (2) cipher words will be used in reporting it.

The observer at each station will note, each day, at the exact time of sunset, and for a time not to exceed thirty minutes after sunset, the character of the western sky and of the sunset, and will state this character at the time, in writing, as "Fair Weather Sunset," "Doubtful Sunset," or "Foul Weather Sunset." The term "Fair Weather Sunset" will express such condition of the sky, particularly the western, and such character of the sunset as is considered to indicate a clear day for the day ensuing. The term "Doubtful Sunset" will indicate that the conditions are such as to leave the mind of the observer in doubt as to what the sunset presages for the following day. The term "Foul Weather Sunset" indicates that the sun is wholly obscured by clouds, and the appearances indicate a rainy or stormy day for the day following. It will be frequently noticed at the time of sunset that the western sky, while exhibiting generally the characteristics of a fair-weather sunset, is tinged more or less and in different places with the colors yellow or green. It is important that these colors should be carefully noted. In some instances the sunset will be found a decidedly yellow sunset, that being the predominant color of the western sky. The color green is rarely the predominant color, but portions of the western sky will sometimes markedly exexhibit it. For purposes of observation and report, the sunsets so differently described are known as yellow sunsets or green sunsets. Care must be taken in reference to reporting yellow, and particularly in reporting green, sunsets. The observer is to be quite sure that he clearly sees "green," and enough of it to be worthy of report. Whenever green is reported, the retained copy of such report will have written upon it the extent of western sky-surface seen apparently so colored, as $\frac{1}{6}$, $\frac{1}{4}$, and so on. Yellow and green sunsets will be considered as fair-weather sunsets.

The observer will endeavor to note either "Fair Weather," or "Foul Weather," noting as few "Doubtful" as possible. It is considered that practice will be found to make this comparatively easy. The note made for each evening will, at sunset of *next* day, be noted in writing as "verified" or "not verified."

The sunset prediction will be the last entry in the Journal and Abstract for the day, and its verification, as determined by the weather from the hour of prediction up to sunset of the ensuing day, be entered on the same line with it. In making sunset predictions, only local observations will be used.

An additional word will be added to the "midnight" telegraphic report from the station when the character of the sunset is "Doubtful" or indicates "Foul Weather." If, however, after the cipher word for thermometer, and before humidity, no word is added, it will be understood at this Office that the station reports a "Fair Weather Sunset." If the station reports a "Doubtful Sunset," it will do so by adding after the cipher word for thermometer, and before that for humidity, the word "Doubt." If the report is "Foul Weather Sunset," it will add, in the same space, the word "Foul." If a yellow sunset, the word "Yellow" will be added in the same space. If a green sunset, the word "Vert" will be added in the same space.

1. A sunset prediction of one day is verified, or not verified, as the case may be, by the weather until sunset of the ensuing day.

2. The prediction "FOUL" or "FAIR" refers especially to rain, and does not refer, in any way, to amount or kind of clouds or fog.

3. The prediction "FOUL" means that the appearance of the sky indicates *rain*. If *any* rain equalling or exceeding one one-hundredth of an inch falls before sunset on the ensuing day, the prediction is verified; and if not, it is *not* verified.

4. FAIR means that the appearance of the sky does not indicate rain, and if no rain equalling or exceeding one one-hundredth of an inch falls, the prediction is verified; if *any rain* in excess of this amount does fall the prediction is *not verified.*

5. DOUBTFUL sunsets cannot be verfied.

In using the following table for determining the proper times for taking the sunset observation, the times opposite the dates will be used as follows, viz: The time opposite the first of each month will be used on all dates from the first until the tenth; the time opposite the eleventh will be used on all dates from the eleventh until the twentieth; the time opposite the twenty-first will be used on all dates from the twenty-first until the last of the month.

* * * * * * *

BAROMETER.

34. The barometers used on signal-stations of observations will in all cases be carefully compared with the standard at this Office before issue, and the correction to be applied for instrumental error sent with each when issued.

The two barometers at each station will be carefully compared on the last two days of each month, by the observer in charge making a series of comparative readings of not less than twenty in number, ten being made each day at hourly intervals, the result of which will be recorded, as soon as made, in the daily journal. These comparative readings must not be corrected for elevation, but for temperature and instrumental error only.

In this connection it must be borne in mind that the *correction* for instrumental error is the reverse of the instrumental error; that is, if the error of a barometer is plus (+), the instrument reads too high and an amount equal to the error must be subtracted in order to correct for the error; and vice versa when the error is minus (—).

No change of instrumental error will be made without direct authority from this Office.

35. The barometer will be suspended so that the top of the mercurial column will be about the height of the eye, near a window, in such a manner as to be lighted perfectly, without exposure either to the direct rays of the sun or to the currents of air which are always found at the window-casings and doors. To protect the instrument from external injuries from dust, and from the direct radiation of warm bodies or currents of air from the window, observers will fasten the wooden case in which it is carried firmly againt the wall in a vertical position. An opening large enough to admit the tube of the barometer will be cut in the upper end of the box, and directly above this, at the distance of one inch, a strong hook will be driven into the wall. This hook must be small enough to allow the barometer to swing freely upon it and to hang in a perfectly vertical position, and should extend two or three inches beyond the box, and upon it the instrument will be suspended. When not in use, the cover will be closed; but when an observation is to be taken, it will be opened, and the instrument drawn out on the hook, clear of the box, and in the full light of the window. After the observation is made the barometer will be slipped back into the box.

36. A reading of the barometer taken for telegraphic transmission will be corrected by the observer making the observation for *temperature*, for *instrumental* error, and for *elevation*, before they are sent from his station. In correcting for temperature, the reading of the *attached* thermometer will be used, while, in correcting for elevation, the temperature used will be that of the *exposed* or open-air thermometer.

In addition to the barometrical reading, reduced to sea-level, as above specified, the actual barometer reading (corrected for temperature and instrumental error only) will be reported from all stations equipped with mercurial barometers, and will be enciphered in the third space on Form 5.

In correcting for elevation, the height of the surface of the mercury in the cistern of the barometer above the ground must be added, in all cases, to the height of the station above sea-level, as in the following example, viz: Suppose height of station above sea-level to be 670 feet; height of mercury (surface) in cistern to be 27 feet above the ground; then the elevation to be corrected for would be 697 feet.

In correcting for temperature, Table I will be used; and for elevation, Table II, when special tables are not prepared under the direction of this Office.

37. The elevation to be corrected for at station No. —— is —— feet, as follows: Height of ——— above mean tide-level, —— feet. Height of ground (which should be a mark upon a door-sill, coping-stone, or other permanent object and noted in records) at office above or below datum-point, —— feet. Height of mercury in cistern of barometer above ground, —— feet. Total height to be corrected for, —— feet.

38. Observers will obtain from reliable sources the proper figures to fill up the blank spaces in the preceding paragraph, and will report them promptly to this Office on the form "Report of Instruments and their Positions," provided for this purpose.

In reporting the datum-point or bench-mark observers must be particular to give its *exact* location and the authority therefor; they will also, in every instance, give the authority for all measurements above or below such datum-points to the surface of the mercury in the cistern of the barometer, be assured that the measurements made by themselves are accurate, and must state it in such clear and concise manner as to leave no room for doubt in reference thereto at this Office. The data, step by step, from which the elevation of the datum-point above mean sea-level has been determined will be kept on file at the station. They will also briefly and clearly state on the form any other information in relation to the position of the instruments not provided for by the printed headings.

39. In moving a barometer even across a room, it should be screwed up and carried with the cistern uppermost. For traveling, it is provided with a wooden case. On steamboats or railroads, it should be hung up in a state-room or car, and the lower end firmly strapped to the side of the room or car to prevent jarring. In wheeled vehicles, it should be carried by hand, supported by a strap over the shoulder, or held upright between the legs; but it must *not* be allowed to rest on the floor of the carriage, as a sudden jolt might break the tube. If carried on horseback, it should be strapped over the shoulders of the rider, where it is not likely to be injured, unless the animal is subject to a sudden change of gait. When required for use, it should be taken from its case, gently inverted, hung up, and unscrewed. While it has the cistern uppermost the tube is full—is one solid mass of metal and glass—and not easily injured; but when hung up, a sudden jolt might send a bubble of air into the vacuum at the upper end of the tube, and the instrument become useless until repaired. Observers must never *swing* the barometer or endeavor to force the mercury against the top of the tube without first screwing up the large adjusting screw at the base of the cistern.

40. If the cistern should become dirty, it can be cleaned with safety and without changing the zero of the instrument. Everything used in the operation must be clean and dry. Blowing upon any of the parts must be avoided, as the moisture from the breath is injurious.

The instrument being placed vertically, the cistern uppermost, unscrew and take off the brass casing which incloses the wooden and leathern part of the cistern. This wooden part (which has the grain crosswise, and therefore is not air-tight) is made in two pieces, fastened together by four screws and four brass pieces. It will be necessary to take out two of these screws and loosen the other two, when the brass pieces can be taken off. The upper wooden piece, to which the bag is attached, can then be lifted off, and the mercury will be exposed. By then inclining the instrument a little, a portion of the mercury in the cistern may be poured out into a clean vessel at hand to receive it, when the end of the tube will be uncovered. This is to be closed by the *gloved hand;* when the instrument can be inverted, the cistern emptied, and the tube brought again to its vertical position. Care must be taken to prevent any mercury from passing out of the tube. The long screws which fasten the glass portion of the cistern to the other parts can then be taken off, the various parts wiped with a clean cloth or handkerchief, and restored to their former positions. The mercury which has been taken out of the cistern must now be cleaned, or replaced by other that is clean and pure. If the old mercury is merely dusty, or dimmed by a film of oxide, the cleaning may be effected by straining it through chamois leather, or through a funnel with a capillary hole at the end, of a size to admit of the passage of but a small thread of the metal. Such a funnel is conveniently made of letter-paper. The dust will adhere to the skin or paper, and the filtered mercury will present a clean and bright appearance. At stations where muriatic acid can be procured the mercury may be easily and quickly cleaned by mixing with it about two ounces of the acid in a small vessel or cup, and then pouring into the vessel clear water until it overflows and carries off all the impurities. When sufficiently pure, the water will be poured off, and the mercury heated over a gas or lamp light until all remaining moisture is expelled. If chemically impure, it should be rejected, and fresh, clean mercury used. With such clean mercury, the cistern should be filled as nearly full as possible, the wooden portions put together and securely fastened by the screws and clamps, the casing screwed on, and the screws at its end screwed up. The instrument can then be hung up and readjusted. If a little mercury has been lost during the operation, and there is none at hand to replace it, no serious harm has been done; but if much is lost, a little fresh mercury must be added to prevent the open end of the tube from becoming exposed while inverting the instrument. Should any air have entered the tube during the process of cleaning, efforts will be made to expel it by screwing the mercury into the tube, then inverting the instrument, loosening the screw, and tapping the top against the shoe. If this fails to expel the air, the fact that the barometer is unserviceable will be promptly reported to this Office.

41. Station barometers will not be cleaned or repaired unless ordered from this Office, or by an inspecting officer, or when such action appears to be absolutely necessary. In any case the fact will be promptly reported to this Office, stating the number of the instrument cleaned or repaired, with date and result of the operation, and the record of a full series of comparative readings taken immediately before and after cleaning be forwarded.

42. To take a reading of the barometer: 1st. Read the attached thermometer to the nearest half degree. 2d. Adjust the surface of the mercury in the cistern carefully to the ivory point, or zero of the scale. When the mercury is perfectly pure, the proper adjustment can be easily made by causing the actual point of the zero-pin to coincide exactly with its reflected image in the mercury below; but when the mercury is covered with a slight film of oxide, it is necessary to determine the contact by immersing the point in the mercury first, and then slowly lowering the screw until the depression caused by this immersion disappears. 3d. Tap the barrel of the barometer firmly, to free the mercury from the sides of the tube. 4th. Bring the lower edges of the vernier to the column of mercury, so that they exactly coincide with the top of the meniscus or curvature of the column, without cutting off any of the light at the angles. At night the light from the lamp must be thrown upon the paper. The barometer must never be viewed toward a distant white wall, nor a window, nor an artificial light, but always toward a piece of white paper in adjusting the vernier. 5th. A piece of white paper will be placed in the barometer box behind the tube to reflect the light and aid in setting the vernier accurately. 6th. The inches and tenths will then be read from the scale, and the hundredths and thousandths from the vernier.

43. Each observer, upon establishing a new station, will, as soon as he obtains the correct elevation of his barometer above sea-level, prepare a special table for reducing to sea-level the barometric observations made at his station.

44. This table will be made to cover the range of barometer (as reduced to sea-level) from 26.00 to 31.00 inches, and will give the reduction to sea-level to three decimal places, or to the nearest thousandths of an inch for every one-hundredth of an inch

of the barometric pressure, and for every five degrees of observed temperature of the air. For stations north of latitude 40° the table will cover a range of temperature from −40° to +100°; south of latitude 40°, the range will be from −10° to +110°, except in specially cold localities. Printed blank forms for the proper arrangement of this table will be furnished from this Office. The correction given in this special table will be obtained by simple interpolation from the general table No. II, page ——, of these instructions, and a full copy of such special table must be forwarded to this Office for revision and approval.

45. Until the special table for the station is approved, the individual readings of the barometer will be corrected from the general table.

46. Stations having an elevation over 2,000 feet will be furnished with a constant correction from this Office or with special instructions.

47. All extra barometers when not in use must be kept screwed up sufficiently to keep the cisterns filled to prevent oxidation of the mercury.

THERMOMETER.

48. The thermometer should be hung in the instrument-shelter in such a position that it will always be at least one foot from the window-panes or the wall of the building to which the shelter is attached. The instrument must be hung vertically, with the middle of the scale at a height that will bring it on a level with the eye of the observer. The readings should be made at all times, but especially in the winter, *through the panes* of glass, without raising the sash, when the shelter is built out from a window. When the shelter is built upon the roof, great care must be exercised in making the readings, in order to prevent the instrument from being affected by the heat of the body or the lantern at night. The observation must be made as rapidly as is consistent with accuracy.

49. The accuracy of all thermometers at each station will be tested on March 31, June 30, September 30, and December 31 of each year in the following manner:

Place the thermometers to be tested in the vessel provided for this purpose, keep them in a vertical position, pack finely-pounded ice around them to a height a little above the freezing point, and let them remain for one hour, at the expiration of which time read off the height of the mercury, without removing the thermometers from the ice, and note the result of the test of each thermometer in the daily journal, and report it to this Office in the journal abstract. If corrections have been authorized for any thermometer, the fact, with amount of such correction, will be stated. In testing the maximum thermometer it will be necessary to tap the bottom of it on the bottom of the vessel in which it is tested, to bring the mercury down to the temperature of melting ice, care being taken not to break the instrument during the operation.

Corrections will not be made for instrumental errors without authority from this Office.

MAXIMUM THERMOMETER.

50. The board which accompanies the maximum and minimum thermometers will be securely fastened with screws, in a horizontal position, upon the transverse bars which support the hygrometer and standard thermometer in the instrument-shelter.

51. For the support of the maximum thermometer, the long brass pin with a nut will be screwed into the board, in the hole to the extreme right. The nut will be taken off, and the pin slipped through the hole in the upper end of the instrument, which will be securely fastened by replacing the nut and screwing it tightly. The plain brass pin is then inserted in the hole at the left of the board, and the thermometer placed upon it so as to incline slightly in that direction.

The end of the pin to which the maximum is attached must be occasionally oiled to prevent friction.

The maximum temperature is obtained by noting the number of degrees upon the scale at the top of the column of mercury.

After making an observation the observer will remove the pin to the left, and, taking hold of the thermometer about three inches from the top, will spin it around several times, or until the top of the column is brought down to the temperature of the air at the time of observation. Care must be taken not to touch the bulb, and also that the nut is screwed up sufficiently tight to prevent the instrument from striking against the side of the board to which it is fastened. After adjustment, gradually raise the instrument to a horizontal position, and insert the pin as before.

Care should be taken in elevating the thermometer not to raise the bulb too high, as the column of mercury would then run to the upper end of the tube.

This instrument will be read daily at the time of making the 11 p. m. (Washington mean time) or last observation, and will then be set for the next day's observation, but, should a reading thereof be taken at any other time, care must be taken not to change the reading of the instrument.

MINIMUM THERMOMETER.

52. The brass support for the minimum thermometer will be screwed into the upper part of the board, and the holes so arranged as to slighty incline the left end of the support.

The top of the thermometer will be fastened by the small brass screw upon the support, while the lower end will be dropped into the notch to the left.

Upon receipt of a minimum thermometer at any station, it will be carefully compared with the standard, and if any portion of the spirit is detached from the column, the bulb will be immersed in warm water until the column reunites, *care being taken not to break the bulb by heating it too suddenly.*

After fastening the top of the instrument upon the support, the lower end will be raised until the top of the small index touches the top of the column of spirit.

The instrument is read by observing the number of degrees upon the scale where the top of the index rests. After taking a reading, the bulb or lower end of the thermometer should be elevated until the index touches the top of column, when the instrument will be dropped into the notch at the left of the support, as before.

The minimum thermometer will be read at the 7 a. m. and 11 p. m. (Washington mean time) observations. At the 7 a. m. observation care must be taken not to disturb the index, which will be set at the time of taking the night observation only. The minimum temperature at the time of making the 7 a. m. observation will form a part of the regular telegraphic report from all stations.

WATER-THERMOMETER.

53. The apparatus for noting the temperature of the water consists of a small thermometer, inclosed in a cylindrical metallic case. A portion of the case is hinged so as to be swung open when it is desired to read the thermometer. A valve at the bottom of the case admits the water as it sinks to the bottom of the river or lake, and, falling into place when the case is drawn up, prevents the water from escaping.

54. At stations provided with this thermometer one observation will be made at 3 o'clock p. m. (local time) daily, of the temperature of the water at the surface and bottom of the lake, bay, or river upon which the station is located.

The observer will select some convenient point on the shore (a wharf or pier, when practicable) where a sufficient depth of water exists to give a positive difference between the surface and bottom temperatures, and will provide himself with enough strong cord to reach the bottom at the place selected. One end of this cord will be securely fastened to the wire handle at the upper end of the cylinder inclosing the thermometer.

In making the observations, the observer will first note the temperature of the air at the surface of the water, then that of the surface-water by immersing the thermometer in the upper stratum of water, allowing it to remain long enough therein for the mercury to acquire the temperature of the water; and then, lowering the cylinder slowly to the bottom, will allow it to rest there long enough to fill; after which it will be drawn quickly to the surface, and the temperature shown by the thermometer carefully noted. The water will be poured out of the cylinder after each observation, and the thermometer thoroughly dried.

These observations will be recorded on Form 32.

HYGROMETER.

55. The hygrometer will be placed in the same shelter as the standard thermometer, and at a distance of one foot from it. The cistern will be kept supplied with pure rain-water at all times when the temperature of the air is above the freezing-point, and the cover of the wet bulb will be changed every month and the bulb carefully cleaned. The cover may be washed as often as necessary, without removal, by means of a jet of clean water from a small syringe.

When the temperature of the air is below the freezing point, the water will be emptied from the cistern, and in making an observation the wet bulb will be moistened with cold water, and the instant the mercury has reached its minimum its height will be noted. *Alcohol must not be used.*

The relative humidity of the air will be obtained from Table —, the manner of using which can best be given by an example.

Given dry-bulb thermometer (t) 97°, wet-bulb thermometer (t′) 76°, required corresponding relative humidity, vapor tension, dew point, and actual humidity. The difference of temperature is 21°. Place a ruler horizontally under the temperature of the wet bulb (t′) 76°. Where this meets the vertical column 21, take from the column marked at top R. H. the relative humidity 35, and from the column marked V. T. the vapor tension 0.61, and then from the table in lower right-hand corner, opposite the vapor tension 0.61, the corresponding dew point, D. P., and actual humidity, A. H., can be taken by inspection.

Thus, for $t=97^\circ$, $t'=76^\circ$, R. H.=35. V. T.=0.61, D. P.=64°.5, A. H.=6.58.
$t=68^\circ$, $t'=56^\circ$, R. H.=42. V. T.=0.29, D. P.=44°. , A. H.=3.31.

The values of the dew point and actual humidity are obtained by interpolation. The second sheet is to be pasted to the right of upper part of first sheet, and is for temperatures of the wet bulb from 50° to 104°, and for differences from 27° to 45°.

Especial care must be taken to keep the tubes of the hygrometer clean and the wet bulb properly moistened, and to make the observations and deductions accurately, as the humidity of the air forms an important element in all calculations of atmospheric changes.

To prevent the dry bulb of the hygrometer from showing a higher temperature than the exposed thermometer under similar exposure, the observer will cut a circular opening, about three inches in diameter, in the board to which the dry and wet bulbs are attached, and directly behind the bulbs.

ANEMOMETER.

56. The anemometer will be fixed in a vertical position upon the telescopic rod, the upper joint of which must be run up to its full extent, or, when this has not been furnished, upon a post of sufficient height to expose it to the full force of the wind. When possible, this post should be framed into the roof to steady it and prevent the instrument from vibrating; but when this cannot be done, it should be framed at the bottom into two pieces of scantling, not less than three feet in length, crossing each other at right angles, which can be nailed fast to the roof or platform upon which the instrument is placed. Short braces must be added, when necessary, to insure steadiness. The outer dial of the instrument is graduated in miles and tenths of miles, the figures 1, 2, 3, &c., indicating miles, and the subdivisions tenths. One complete revolution of this dial is equivalent to ten miles of wind. This anemometer registers up to nine hundred and ninety miles.

Observers will assure themselves by making a daily comparative reading that the record of the dials and that of the self-register agree at the time of changing the record sheets on the self-registering attachment at midday. When a discrepancy is found to exist between the two records, the anemometer will be carefully examined as to the condition of the dial-pegs or contact-pins (which should always be perfectly straight) and the contact-springs. The latter are liable to become corroded by the action of the electric spark or moisture, and must be kept clean and dry. When found, the defect should be remedied, and the cause of such discrepancy briefly explained by a marginal note on the sheet for the date, or dates, on which the discrepancy occurred. Should an anemometer be found to admit moisture, melted bees-wax will be applied to the joints.

Anemometers must be kept carefully and thoroughly oiled, to prevent friction and injury to the several bearings. Suitable oil for this purpose will be supplied from this Office upon application, and none other must be used after its receipt.

In making requisition for broken or defective portions of the anemometer, they will be designated by their appropriate letters, as shown in Plate No. ——, and the official number of the anemometer for which they are intended must always be given.

The screw posts must be kept bright, where they form connection with the conducting wires, to prevent resistance to the passage of the current.

Especial attention will be given to the large dial-screw, and when found loosened it will at once be tightened, but care must be taken not to screw it up tight enough to interfere with the free motion of dials.

57. The outer dial has one hundred and the inner dial ninety-nine divisions. As the dials are moved by the same wheel, they will move forward one hundred divisions in the same time. The outer dial having one hundred divisions, the inner dial will complete one revolution and its zero be one division beyond or to the left of the zero of the outer dial when the outer dial has completed one revolution, the zeros of the scales coinciding at the time the instrument was set in motion. Thus the revolutions made by the outer dial are recorded on the inner one, the number of revolutions being shown by the number of divisions of the scale on the inner dial between the zero of that scale and the zero of the outer one. In taking the reading of the anemometer at any time the hundreds and tens of miles are read from the inner scale, and the miles and tenths of miles are read from the outer one. Take from the inner scale the hundreds and tens of miles contained between the zero of that scale and the zero of the outer one, and the miles and tenths of miles on the outer scale contained between the zero of that scale and the index of the instrument, and the sum of these readings will be the reading of the instrument at the time of making the observation.

When the anemometer is not furnished with an index point, the center of the small wheel which gives motion to the dials will be taken as the reference point.

58. To obtain the velocity of the wind for the regular observations when the self-registering attachment is out of order, two readings of the outer dial must be taken with an interval of five minutes between them, and the *difference* between these readings will be the distance in tenths of miles traveled by the wind in that interval. This multiplied by twelve will give the proximate velocity in miles per hour. Example: Suppose the index of the anemometer to be at 3 on the outer dial when the first reading is taken, and at 3.6 five minutes after, the difference, .6, is the distance traveled in that time; and this multiplied by twelve gives a velocity of seven and two-tenths miles per hour. Whole numbers only will be used in expressing the velocity. When the decimal is *greater* than five-tenths, the unit's figure will be increased by one; when *five or less*, it will be thrown out.

The maximum hourly velocity of the wind when the self-registering attachment is used will be determined by multiplying the number of miles recorded in the fifteen minutes in which the maximum occurred by four, and, when the dial-readings are used, by multiplying the highest velocity in a period of five minutes by twelve.

The total movement by the wind in the preceding twenty-four hours, as shown by the anemometer, will be noted by the observer daily at 12 noon, local time (the time of changing the anemometer sheets), and recorded in the original record, on Forms 4, and on the anemometer sheets. The last will also give the velocity shown by the self-register, and will be recorded thereon in the following manner:

Total number of miles, self-register, 243.
Total number of miles, anemometer dials, 243.

In reckoning the number of miles recorded by the self-registering attachment, observers will count and record the number of spaces between the marks, and not the marks themselves.

The total movement for the twenty-four hours will be obtained in the following manner: Subtract the reading of the anemometer at 12 noon of the preceding day from the reading taken at 12 noon of the current day, and the difference will be the total movement of the wind. When the reading of the anemometer is less than the reading of the preceding day, nine hundred and ninety miles will be added to it, and the remainder, after subtracting the reading of the preceding day, will be the total movement.

Example: The dial reading of to-day is 91, and that of yesterday was 950; hence, we have $91 + 990 = 1081$; $1081 - 950 = 131$, the total movement of the wind in miles during the past twenty-four hours.

In case of the loss of record from the anemometer sheets for one or more days, blank sheets for the period during which the record is missing will be filled up with the name of station, proper dates, and on each a remark explanatory of the cause of the loss of the record, and be forwarded with the regular weekly package to this Office.

All entries on the record sheets, except the record marks made by the self-register, will be made in ink instead of lead pencil.

Whenever a station is not supplied with an anemometer, or the anemometer becomes unserviceable, and fails to record the movement of the wind, the force of the wind will be estimated and reported as light, gentle, fresh, &c., designation being taken from the column in the telegraph cipher headed "designation of wind force."

The instrument must not be taken apart unnecessarily, and those having the new style of contacts will be handled with especial care.

Observers must familiarize themselve with the construction of the several parts of the anemometer, in order that they may be able to locate faults whenever the instrument is out of order.

WIND-VANE.

66. Two wind-vanes will be furnished to each station; a small one to be sent with the observer for immediate use upon his arrival, and a larger one, or standard, to be sent as soon after the station is opened as practicable. When the latter has been received and placed in position, the small one will be removed, and carefully stored by the observer for use in cases of emergency.

67. The vane used for determining the direction of the wind must be set where the wind may act freely upon it, and must never be sheltered by surrounding buildings or other objects. Where the vane-rod does not pass through the roof to the office, the observer will mark upon a wooden dial, at the base of the upright which supports the vane, the true meridian and cardinal points of the compass.

68. At stations where the rod connected with the standard wind-vane passes through the roof and indicates the direction of the wind by an arrow in the office-room, the arrow will be adjusted to correspond exactly in direction with the vane itself, and, when such an adjustment has been made, the arrow will be securely fastened by means of the set-screw forwarded from this Office for that purpose.

A competent mechanic will be employed to perform such part of this work as cannot be done by the observer, and his bill forwarded for settlement in the usual manner.

69. When the large vane is received at any station, it will be immediately erected upon the building in which the office is located, provided the consent of the owner can be obtained, and the roof is strong enough to support its weight.

The general appearance of the vane and the location of the several parts are shown in Fig. 13. The iron straps which unite the two parts of the foot-block will be taken off and the block separated before raising the vane, in order to put the iron socket holding it in proper position. After the vane is up, the pieces will be fastened firmly together again by these straps. The central rod can be lengthened whenever necessary by adding a piece of the same diameter, and cutting a screw-thread on both ends.

When the office is on the upper floor, the central rod will be brought into the room and allowed to project about two inches below the ceiling. The gilded arrow will then be screwed on, and two circles drawn around it on the ceiling a little greater in diameter than the length of the arrow. On this circle will be painted the eight points of the compass used in the weather reports, care being taken to get the true meridian as a starting-point.

70. To fix the north and south line of the vane-circle in the "true meridian," place a table directly under the end of the vane-rod. Suspend a plummet from the center of the end of the rod. Place the compass upon the table with its center directly under the end of the plummet. If the variation of the magnet needle is given as *east* a certain number of degrees, turn the compass until the north end of the needle reads that many degrees *east* of the N point on the face of the compass. If the variation is *west*, turn the compass until the needle reads the given number of degrees *west* of the N point. Then lay a straight-edge across the face of the compass so that it will pass through the N and S points of the face, which are in the "true meridian," mark two points upon the table under the straight-edge; draw a straight line through these points; hold the plummet-string against the vane-circle and move it along until the plummet-point crosses the straight line on the table upon both the north and south sides; mark these crossings upon the circle, which are the "true" N and S points.

These instructions are based upon the supposition that the compass used is marked so that when placed upon a table and the observer sights from S to N the E point is on his right hand and the W to his left. Should the E point, as marked on the compass, be to the left and the W point to the right when the variation is given as *east*, turn the compass until the north end of needle reads the given number of degrees toward the west point; if *west*, turn it until the needle reads the proper number of degrees toward the east point.

71. At all stations supplied with the standard wind-vane, with the indicator extending through the roof to the office-ceiling, the words "*adjusted to the true meridian*" will be painted inside the vane-circle, upon the ceiling.

72. When permission cannot be obtained to put up the vane, the fact will be reported at once to this Office.

73. The observation of the vane requires more care than is usually given. In winds of considerable strength the vane is never at rest or fixed in the same direction; it oscillates incessantly, and its oscillations increase in extent with certain winds and with the violence of the wind. In such cases observers must *note the mean direction* between the extremes. When the wind is too light to move the vane, and when it is calm, no direction will be recorded. The attention of observers is called to this matter in order to prevent them from recording a direction of the wind when it is calm The direction of the wind will be designated by the eight principal points of the compass, N., N. E., E., S. E., S., S. W., W., N. W.

In reporting changes in the *direction* of the wind, the terms *veering* and *backing* will be used. The term *veering* indicates the changing of the wind from N. to E. to S., and so on, or in the direction corresponding with the movements of the hands of a watch; while *backing*, being the reverse term, indicates that it changes from N. to W. to S., and so on.

The bearings of the vane must be kept well and carefully oiled to prevent friction.

RAIN-GAUGE.

75. The rain-gauge will be placed, whenever practicable, with the top of the funnel-shaped collector twelve inches above the surface of the ground, firmly fixed in a vertical position, and protected from the interference of unauthorized persons. It will be examined at the time of making each of the three telegraphic observations, the amount of water it contains carefully measured by means of the graduated rod sent with each gauge, and then emptied and returned to its proper position. When a position at the level of the ground cannot be found with a sufficiently clear exposure, the gauge will be placed on the top of the instrument-room, or roof of the building occupied by the observer, who will measure the height above the ground, and report it to

this Office. The measuring-rod is graduated in inches and tenths of inches, and the proportion between the cylinder and funnel is as ten to one, so that ten inches upon the rod correspond with one inch of actual rainfall, one inch on the rod to one-tenth of rain, and one-tenth on the rod to one-hundredth of rain. Snow will be melted, and then measured and reported in the same manner as rain, *but the fact of its being melted snow must be noted under the head of remarks in the weekly reports*, and in the Original Record and the Daily Record of Observations. Whenever from any cause the snow cannot be melted, the depth will be measured and ten inches of snow reported as one inch of rainfall.

76. Stations in localities subject to heavy rainfall will be supplied with an attachment to the gauge of sufficient capacity to guard against overflow, but at stations where such rains are exceptional care must be taken by the observer to prevent overflow, by constant watchfulness during heavy rain.

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79. Immediately after placing his instruments in position, each observer will make out and forward to the Chief Signal Officer, at Washington, a full report in writing, stating the kind, size, and position of room selected; the street and number of the building in which the room is situated; the position of each instrument, and its height above the ground, and also above the bench-mark furnished by this Office. In giving the height of the barometer, the measurement will be made to the surface of the mercury in the cistern. Whenever the position of any instrument is changed (which must not be done without good and sufficient cause) a record will be made of such change, with date and amount of difference in elevation; and the facts reported at once to this Office.

In addition to this information, such other facts will be stated as will enable the Chief Signal Officer to judge of the manner in which this part of the observer's duty has been performed.

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FORMS.

117. The following-named meteorological forms are furnished by this Office for station use:

Form 1—Telegraphic river-report.
Form 2—Receiving-sheet.
Form 3—Daily manifold bulletin.
Form 4—Weekly report.
Form 5—Telegraphic report.
Form 8—Weather-map.
Form 15—Synopsis and indications.
Form 16—Monthly chart.
Form 22—Monthly mean.
Form 23—Cautionary-signal blank.
Form 24—Record of bulletins.
Form 25—Telegraphic-message form.
Form 26—River bulletin.
Form 27—Special river-report.
Form 28—Regular weeekly river-report.
Form 30—Monthly instruction-report.
Form 32—Monthly report—temperature of water.
Form 33—Comparative barometric readings.
Form 34—Annual mean or meteorological summary.
Form A—Record of telegrams refused by telegraph company.
Form B—Record of telegrams sent and received.
Form X—Weekly meteorological report from sunset stations.
Form Y—Monthly sunset report.

118. Form 1 is used by the special river-observers for their reports, and should be made in duplicate; one copy for file in the telegraph office at the schedule times, and the other to be forwarded to this Office at the end of each week.

119. Form 2 is for the use of the telegraph-operators in receiving the reports from other stations, and will be furnished by the observers in such quantities as may be required, care being taken to guard against wasteful and unnecessary use of them. The spaces will be filled up in regular order, commencing at the upper left-hand space, and filling each space to the right in succession on the first line and then commencing at the left-hand space on the second line, and so on. Observers will require the receiving operators to sign and date each sheet, and also to note the time the reports upon it were received, before taking it from the telegraph office. The time of receipt from the operator will be noted by the observer or assistant. When the reports are received in duplicate by the operator, observers will retain the original sheets furnished them by this Office.

After the reports have been translated and entered in the Bulletin, the receiving-sheets for each full report will be placed together, and folded neatly in three folds, parallel with the writing.

Each morning the three reports of the preceding day will be secured together, so as to form a single package. At the end of each week the seven daily packages for the week will be put in one neat package, and forwarded by mail to this Office, with the name of station plainly written upon the outer fold of the outside sheet.

120. Form 3 is the daily manifold bulletin issued for public information. The several columns will be filled up from the receiving-sheet, the words and figures being written plainly and distinctly.

Before making any entries upon the manifold form, the sheets will be carefully smoothed down, so that the registered lines of the several stations will fall directly over each other. If more than 15 bulletins are to be written, it is better to make out the number in two equal parts than to try and write them all at once, in order that all the copies may be legible.

The headings of the different columns indicate with sufficient clearness the matter to be filled in.

When any part of a report is not received, or, if received, is evidently incorrect, the word "Blank" will be written in the spaces to be filled by such part.

Absence of wind, clouds, rainfall, or change in barometer, thermometer, and river, will be indicated by the figure zero.

New stations, whose names are not in the printed list, will be written in the blank lines at the bottom of the form, or over the names of stations from which reports are not received.

Each copy of Form 3 posted must show the name of place where posted, date, and time of posting, and be signed by the observer or assistant making it out.

A file copy of Form 3 for each report will be preserved for office-reference, and suitable covers, for protecting these retained copies from defacement and other injury, will be furnished from this Office on application. One copy of the morning issue of the Saturday bulletin, on which the name of station from which sent must be plainly written, will be inclosed in Form 24 and mailed to this Office from each station.

121. Form 4 is the weekly meteorological report, three copies of which will be forwarded to this Office at the end of each week; one copy containing the full record of the telegraphic series of observations, one the record of the local series, and the third that of the midday observations.

In filling up this form, the *daily* means of the *local* (7, 2, and 9 o'clock), and the *weekly* means of the *telegraphic*, barometric and thermometric observations will be entered in their proper columns, and the words "Daily" and "Weekly," respectively, added to the heading.

In the telegraphic series will be given, first, the mean of the morning; second, that of the afternoon; third, that of the midnight observation.

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125. Form 5 will be used for all of the telegraphic reports, and will be made out each time in duplicate, one copy for file in the telegraph office, for transmission by telegraph, and the other for transmission by mail to this Office.

In making the duplicates of this form, carbon paper and a lead pencil will be used, and *both* copies written at the same time.

The time of filing in the telegraph-office and the transmission of the reports must be filled in by the telegraph-operator who receives and transmits them, and verified by his signature.

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133. Form 15 is for the Synopses and Indications, a copy of which, properly filled up, will be posted with each bulletin at all stations where they are received, and at which the Farmers' Bulletins are not printed. The midnight Indications will be used with the morning bulletin, and morning Indications with the afternoon bulletin, whenever practicable. At stations where the afternoon, and not the midnight, Indications are received, they will be used with the bulletin of the next morning.

In all cases the time and date of issue from Washington must be plainly written upon the form.

134. Observers will call the especial attention of the publishers of such papers as print the reports without proper official heading, time, and date, to the omission, and have it corrected when possible, as a matter of justice to this Office and to their readers.

135. Form 16 is the meteorological chart, to be made out monthly at each station, and forwarded by mail to this Office not later than the 10th of the month succeeding that for which it forms the record. In filling up this form the following instructions will be observed:

The time of beginning and ending of all auroral displays will be recorded in the spaces between the two upper lines, and under the proper dates, neatly written in black ink; when no auroras have been observed, the words "No Auroras observed" will be written opposite to the heading for these data.

For the thermometer, take the daily observations, and, with a sharp pencil, make a dot on the chart at the height at which the dry-bulb thermometer stood at the first observation of the first day of the month at its proper relative distance from the 12 m. (midday) line, as shown in Plate ——. Dot in a similar manner each of the seven observations. Join these dots with the pencil, and afterwards trace them with ink.

Continue the same process with the wet-bulb thermometer, reduced barometer, actual barometer, velocity of the wind, and the relative humidity, marking the direction of the wind in small letters at the point corresponding to the exact local time at which each observation was taken.

The average amount of clouds for each day will be given in the space immediately above the 29.00 inch line on the chart, dividing the squares into 1, 2, 3, and 4-4ths respectively.

The character of the sunset prediction, made each day at sunset, will be noted in the squares immediately above those used for the record of the clouds, and in the following manner: When the prediction is *fair*, by a red, yellow, or a green square, as the case may be; when *foul*, by a blue square, and when *doubtful*, by a half-red and half-blue square; the colored squares being of the same size as those used to indicate the amount of cloudiness.

The line representing the actual barometer (the barometer corrected for temperature and instrumental error only) will be drawn with *red* ink, and the line for the reduced barometer with *black* ink, so that the two may be easily distinguished from each other; and, on the left margin, opposite to the line representing the actual barometer readings, the words "Barometer Actual" will be written.

In case the scale on the chart does not extend low enough to comprehend the actual barometer readings, opposite to the reference line for 30.00 inches will be entered with *red ink* the number of the inch nearest to the normal barometer (corrected for temperature and instrumental error) and the scale graduated above and below it of sufficient compass for the range of the actual barometer; and on the left-hand margin the following note will be written:

"For (give name of station) the reference line marked 30.00 inches on the chart for reduced (sea level) readings is to be read ——— inches for actual barometer, which figures see in red ink opposite said line."

This note and the scale must invariably be written with red ink.

The rain and dry winds for the month will be entered on the bottom margin immediately to the left of the "Total Rainfall," thus:

Number of rain and snow storms preceded by winds from the

N.	NW.	W.	SW.	S.	SE.	E.	NE.	Calm.
0	0	1	2	3	2	1	2	0

In deciding whether a day is clear, fair, or cloudy, its character will be determined by taking the sum of the entire number of fourths of clouds observed at 7 a. m., 2 p. m., and 9 p. m. A clear day will be one in which the sum of the observed fourths is three or less than three; a fair day, one in which the sum is from four to eight, inclusive; and a cloudy day, one for which the sum is from nine to twelve, inclusive.

In filling up Form 16, the average cloudiness (in fourths) for the day will be entered. Average cloudiness will be found by dividing by three the sums above taken, and will be indicated as follows:

0 when the sum of the three observations is 0 or 1.
1 when the sum of the three observations is 2, 3, or 4.
2 when the sum of the three observations is 5, 6, or 7.
3 when the sum of the three observations is 8, 9, or 10.
4 when the sum of the three observations is 11 or 12.

The commencement of rain or snow will be indicated by a fine line one-sixteenth of an inch or less in length; the rate of fall by a broken curved line indicating the greater or less rapidity of the same; and the amount of water by a heavy straight line, conformably to any adopted scale, and with its right edge resting at the point representing the time it ceased. Should rain or snow continue falling after midnight of any day, the heavy straight line showing the amount which has fallen up to that time will be drawn, while a second broken curved line will be started to show the continuance of the same. When the time of commencement and ending of rain is known the lines will be drawn in black; but when the time is not known (this ought only to happen at night) the lines to express the data, whether the commencement or ending, or both, as the case may be, will be drawn on the chart at the place representing the time at which the commencement or ending is believed to have occurred, and in red ink.

As no fixed scale can be given for recording the amount of precipitation, it will be necessary for observers to adopt one, which should be made to comprehend the greatest amount of rainfall to be recorded in any one storm on any one date, but in all cases the scale used must be divided into *equal fractional parts of inches.*

When separate storms occur on the same day, separate records of amount should be made.

Different colored inks must be used for the several lines when the readings of the different instruments run close together or cross each other frequently.

In forwarding the charts by mail they must never be folded, but be rolled neatly and compactly around the paper tubes furnished for that purpose. As they are intended for future reference, care must be taken to make the data given upon them an accurate summary of the station observations for each month, as compiled from the official records.

The mean relative humidity, mean barometer, actual and reduced, mean temperature, prevailing wind, total movement of the wind, and total rainfall for the month must be entered in their proper places on the margin of the chart.

The name of the station and month for which prepared must always be plainly written on the right margin of the form. The range of temperature will be shown for each day by a vertical line crossing the temperature curve, as shown in Plate —. Care must be taken not to use too much ink in recording the rainfall, average cloudiness, and sunset predictions, as it penetrates the paper and injures the chart.

136. Form 22 is used for the record of the daily and monthly averages of the barometer and thermometer, the prevailing direction of the wind, amount of rainfall, and other data for the month designated by the headings of the form.

In filling up this form the daily averages of the thermometer readings for the local series of observations will be obtained by dividing the sum of the 7 a. m., 2 p. m., and *double* the 9 p. m. observations by four.

The average daily humidity will be obtained by dividing the sum of the 7 a. m., 2 p. m., and 9 p. m. observations by three. The *monthly* averages will be obtained by dividing the sum of the daily averages by the number of days in the month.

The monthly average of each series of the *telegraphic* (actual and reduced) observations will be obtained by dividing the sum of the observations recorded in each column by the number of days.

The total movement of wind during the month will be the number of miles counted from midnight of the last day of one month to midnight of the last day of the succeeding month, and will be the actual number recorded in the month. The maximum velocity of wind for each day will be calculated from the record sheet from midnight to midnight, as explained for computing other velocities.

In filling up that portion of the form prepared for rain-wind data, the following rules will be observed: In the—

First column, record day of month and year.

Second column, record whether rain, snow, hail, or sleet.

Third column, record actual time of commencement (hour of day), and, in case it commences before the ending of the preceding month, the date also.

Fourth column, record actual time of ending (hour of day).

Fifth column, record direction from which wind was blowing at each observation during continuance of precipitation.

Sixth column, record direction from which wind was blowing at each of the three observations immediately *preceding* the commencement of precipitation.

Seventh column, record direction from which wind was blowing at each of the three observations immediately *following* the ending of precipitation.

The wind directions recorded in columns 5, 6, and 7 must follow each other in the order in which the observations are taken.

When precipitation begins and ends between observations the words "No observation" will be written in the column headed "Direction of wind during rain or snow."

When an interval of 5 hours occurs between the ending of precipitation and its recommencement separate storms should be recorded.

Storms in which the amount of precipitation is too small to measure should not be considered.

The following is an example of the proper method of recording these data:

Date.	Rain, snow, hail or sleet.	Time of commencement.	Time of ending.	Direction of wind during rain, snow, hail or sleet at each observation.	Direction of wind at three (3) observations preceding rain, snow, hail or sleet.	Direction of wind at three (3) observations following rain, snow, hail or sleet.
1874.						
Dec. 1	Rain	8 a. m.	9. 25 a. m.	No observation	0., 0., N	S., S., S.
Dec. 3	do	4. 50 p. m.		NW. and S.	SW., S., S	
Dec. 4	do		1. 30 a. m.			N., N., N.
Dec. 6	do	6 a. m.	11 a. m.	W. W	W., S., S	N., N., NW.
Dec. 13	do	8. 40 p. m.	11. 30 p. m.	S. and W	S., S., S	S., S., NW.
Dec. 16	do	9. 40 p. m.	11. 45 p. m.	S	S., S., S	SW., SW., NW
Dec. 20	do	6. 40 a. m.	8 p. m.	NE., NE., NE.	NE., NE., NE	NW., NW., N.
Dec. 22	do	2. 06 p. m.	4 p. m.	No observation	S., S., S	S., S., SW.
Dec. 26	do	11. 50 a. m.	11. 10 p. m.	S., S., S., SW	S., S., NE	N., N., W.
Dec. 28	do	7. 30 p. m.		W., SW., S. 0	S., SW., S	
Dec. 29	do		9. 30 a. m.			NW, NW., NW

Special attention will be given to Form 22, and the several columns will be added up *twice*, both by the observer and the assistant, in order to secure accurate results. Copies of this form, properly filled up, will, at the end of each month, be furnished by observers to as many of the newspapers and other periodicals published at their stations as may desire to make use of it. One copy will also be forwarded to this Office on the *first* day of the month succeeding that of which it forms the record. Manifold books of this form will be furnished to those stations at which a large monthly issue is found necessary.

137. Form 23 is for use at stations designated for the display of cautionary signals, and will be filled up and forwarded weekly to this Office.

Care must be taken by the observer to accurately record the time of commencing, time when at its height, and time of ending of each gale, with prevailing direction and highest velocity of wind during the storm, and the direction of the wind at the time of the highest velocity of every storm which passes over his station, whether cautionary signals were ordered for it or not.

A display of signals will not be reported as justified unless the wind attains a velocity of twenty-five miles per hour.

A signal must never be reported *partly* justified, but, should the wind in the vicinity of a station be sufficiently great to justify a display of the signal, while at the station it should not reach the storm velocity, the signal should be reported as not justified, and the facts in the case be noted in the column for remarks, giving the character of sea, nature and extent of disasters, and any other data which would enable this Office to arrive at a proper conclusion in the case.

The off-shore signal will be reported justified as to velocity when the velocity of wind during the display of that signal reaches twenty-five miles, but not justified as to direction when the direction of wind is not off-shore, and fully justified when the velocity reaches twenty-five miles per hour, and the direction of wind is off-shore.

If an order to hoist signal is received after a gale has already set in, it will be noted and justified, but a note must be made in connection therewith to the effect that the order was received late, and the cause of its late receipt given, where it is known to the observer. If, however, a storm should end before an order to hoist a signal has been received, it will be recorded as a storm for which no signal was ordered, and the display of signals as not justified.

In the column of "Remarks" will be noted such special cases of benefits to commercial or other interests as may come to the observer's knowledge. It will also be stated whether any storm passed over the station during the week for which cautionary signals were not ordered.

All casualities resulting from storms at any cautionary station will be reported so far as they come within the knowedge of the observer. In giving this information, newspaper clippings may be used and forwarded with Form 23, fastened upon a separate sheet of paper in such manner that they can be easily detached for pasting in the office scrap-books.

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140. Form 26 is the River Bulletin, and will be filled up as indicated by the several headings, and posted in such places as are found necessary to give suitable publicity to the reports and meet the wants of business men interested in them. The name and location of each place of display must be reported to this Office. A copy must be supplied regularly to each daily newspaper published at the station, and one copy will be forwarded to this Office on Saturday of each week.

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142. Form 28 is for use at *all* river-stations, whether *regular* or *special*, and will be forwarded weekly to this Office, properly filled up, as indicated by the several headings. Under the head of "Remarks" on this form will be noted all unusual occurrences connected with the stage of water in the river at and near the station, such as the presence of floating ice, timber, &c.; formation and breaking of ice-gorges and other obstructions; damages to levees; time of opening and closing of navigation; accidents to gauge, or change in location of same, &c.

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144. Form 32 is the monthly report of observations of the temperature of water, of which *two* copies will be forwarded to this Office on the first day of the month succeeding that of which it forms the record. The precise nature of the spot where the water-temperatures are taken must be noted under the head of "Remarks."

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146. Form 34 is for the annual mean, or meteorological summary, which must be posted up in a conspicuous place in the observer's office. On this form will be entered, on the first day of each month, the data for the preceding month, as indicated at the top of the several columns. A carefully-compared copy of this form must be forwarded to this Office within fifteen days after the close of the year of which it forms the record, the original being kept for station-reference. Frames for the display of this form will be supplied on requisition.

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153. In the Daily Journal will be entered all matters of interest not provided for in the various forms, such as meteoric and auroral displays, earthquakes, and unusual atmospheric appearances and disturbances, giving in each case, when possible, the time of beginning and duration of each. Whenever a meteor is seen by any observer, the "cloud" left by the meteor will be carefully noticed, both as to its appearance and the direction in which it *floats*, and a record and full description of the meteor and cloud will be entered. Especially will the observer enter a detailed account of the characteristic phenomena of every serious storm that passes over his station.

154. Observers will be particular to note in the journal every display of aurora, seeking by inquiry of others, if necessary, to make their record complete.

If the heavens are obscured by clouds so that the aurora, if present, cannot be observed, the word "obscured" will be entered in that part of the record devoted to auroral displays. If the sky is sufficiently clear for observation, the words "aurora" or "no aurora" will be entered, according as one is visible or not. When observed, a full account of the phenomenon will be entered in the journal, showing the exact minute of beginning and ending of the aurora and the principal phases of changes that it experiences. The following particulars should be especially noted: the azimuth and altitude of each extremity and of the crown of any arch of light, and the same data for any corona or glory that may be formed.

When the observer is familiar with the names of the principal fixed stars, he may locate the arch or crown by reference to them, but it is preferable that he should observe directly the altitude and azimuth.

155. Altitudes are expressed by degrees from the horizon to the zenith. If any circle be divided into three hundred and sixty parts, and the radial lines connect these parts with the center, each pair of lines subtend an angle of one degree; the fourth part of the circle will subtend an angle of ninety degrees, or one right angle, and the corresponding radii are perpendicular to each other; thus the zenith (that point in the heavens immediately above the observer) is ninety degrees from the horizon, or, in other words, its altitude is 90°. A point half-way up from the horizon to the zenith has an altitude of 45°.

Azimuths are also expressed in degrees, but are measured on the horizontal plane, and will be recorded as is done in astronomy, from the south point to the westward, passing successively the west, north, and east points of the compass until 360° have been passed over, and the south point is again reached.

156. Observers must be particular as to the date of the aurora; and when it begins in the evening of one day and continues into the early morning of the next day, it will be entered as occurring on the *first* day, but its details will be given in the record as occurring between the hours of its actual beginning and ending. Thus an aurora that began on the evening of the 12th of January and continued until the early morning of the 13th would be entered as the aurora of the 12th, but its details would be recorded as occurring, for instance, between the hours of 10 p. m. of January 12 and 2 a. m. of January 13.

157. All entries in the journal of occurrences and observations of any one day will be made under or opposite to that day, and not for a subsequent date. For example, an auroral display occurring May 23 should be entered opposite that date, and not referred to on the 24th as having occurred "last evening."

158. At stations west of the Mississippi River observers will note the date of appearance of Rocky Mountain locusts; the direction from which they come; the direction

and velocity of wind and character of weather at time of appearance; the length of time they remain in the neighborhood of the station, and amount of damage done by them; the direction and velocity of flight; direction of flight when they leave; whether they fly with or against the wind; whether or not they laid eggs in great quantities in the surrounding country; what means were taken to destroy the eggs or the locusts, and any other information that can be obtained on this subject. In addition to this a summary in regard to their appearance, numbers, damage done, &c., will be made as the concluding part of the abstract. Immediately after the 30th of June of each year a report on the Rocky Mountain locust, giving the following data covering the period from the first of July preceding, will be made:

(1.) Date and time of day of the arrival of swarms; 1*a*, direction and force of wind at the time; 1*b*, temperature and character of the weather at the time (clear or cloudy); 1*c*, direction of the flight, density, and extent of swarms.

(2.) Date and time of day of the departure of swarms; 2*a*, direction and force of the wind at the time; 2*b*, temperature and character of the weather at the time; 2*c*, direction of the flight, density, and extent of the swarms.

(3.) Date when the first eggs, if any, were deposited during the year.

(4.) Date when the eggs were most numerously hatching during the year.

(5.) Nature of the soil and situations in which the eggs were most largely deposited.

(6.) Nature of the soil and situations in which the young were most numerously hatched.

(7.) Date at which the first insect acquired full wings.

(8.) Date when the winged insects began to migrate.

(9.) Estimate the injury done in your county and State.

(10.) Crops which suffered most.

(11.) Crops most easily protected.

(12.) Crops which suffered least.

(13.) The prevailing direction in which the young insects traveled and any other facts in relation to the marching of the young.

(14.) The means employed in your section for the destruction of the unfledged insects or to protect crops from their ravages, and how far these have proved satisfactory.

(15.) The means employed in your section for the destruction of the winged insects or to protect crops from their ravages, and how far these have proved satisfactory.

(16.) Descriptions and, if possible, figures of such mechanical contrivances as have proved useful in your locality for the destruction of either the young or the winged insects.

(17.) To what extent have birds, domestic fowls, and other animals, domestic or wild, been useful in destroying these insects?

159. Observers must pay particular attention to accuracy in the use of the terms "*morning*" and "*evening*," and will be governed by the following instructions in reference to them:

Midnight is the moment, 12*h*. 00*m*. 00*s*., and is the beginning or first moment of the new day, and should receive the date of that day. Thus, whatever happened in the afternoon of June 10, at 11*h*. 59*m*. 59*s*., happened at 11*h*. 59*m*. 59*s*. p. m. June 10; whatever happened one second later was at midnight of June 10 and 11, and at one second later at 12*h*. 00*m*. 01*s*. a. m. of June 11. At midday of same date whatever happened at 11*h*. 59*m*. 59*s*. happened at 11*h*. 59*m*. 59*s*. a. m. June 11; at one second later it was noon June 11; at one second later it was 12*h*. 00*m*. 01*s*. p. m. June 11.

160. A monthly abstract of the entries in the journal will be mailed to this Office from stations east of the 100th meridian as soon as possible, and not later than the 5th day of each month. At stations west of that meridian they must be mailed as soon as possible, and not later than the second of the month. This abstract must contain all the important entries of the journal, especial care being taken to exclude all matters relating to the ordinary routine of observations that are given on the various forms. The abstract should show clearly and briefly all matters of interest not provided for in the regular forms, such as flight of birds, early vegetation, the movement of the Rocky Mountain locust (at stations west of the Mississippi River), meteoric and auroral displays, earthquakes, thunder-storms, distant lightning, high winds and gales, the occurrence of frost (particularly first frost and first killing frost), first ice, fog, polar bands, zodiacal light, and other unusual atmospheric phenomena, giving, whenever practicable, the time of beginning and duration of each. In each day's abstract the subject of auroras and the character of the sunset will be noted briefly in the authorized manner.

Whenever a tornado occurs in the vicinity of any station the observer will make diligent effort to obtain an accurate description of all meteorological elements accompanying the tornado; the hour and date of occurrence; direction of movement; appearance of the clouds; direction of the whirl; rain-fall; accompanying noise; length of track; average width at different points; amount of destruction to life and property, &c. So much of this information will be given as can be learned without leaving station for such time as to require special permission. The report required by these instructions will be entered in the journal, and also reported to this Office in the monthly abstract.

161. The following additional subjects will be noted: All changes in the working force of the station, with the date and nature of such change; all movements of office or instruments, with date of such movement, and authority for making the same. The condition of instruments and of other public property will form the closing part of each abstract—the instruments named separately, and the official number of each one given. When any instrument is reported unserviceable or out of order, the nature of the fault will be stated, and also whether a new one is required to replace it. When repairs can be made on station, this fact will be stated, with estimated cost.

162. At river-stations all special phenomena affecting navigation will be noted, such as the date of high and low water during the month, with monthly range at station; closing of the river by ice or from any other cause; formation of ice or other gorges, with effect upon navigation, &c.

163. At lake and sea-coast stations the opening and closing of navigation, with the name of the first vessel to arrive and the last one to depart, with the nature of the cargo in each case and the number of cautionary and off-shore signals displayed during the month will be reported, with results as far as known at each station; number of storms that passed over station for which cautionary or off-shore signals were not ordered, dates, with velocity of wind, being stated in each instance; and at all stations a summary of the sunset predictions, the number of each kind verified and the number not verified, will be made, and in case one or more predictions may have been missed, an explanation of their absence must be made in the summary.

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ORIGINAL RECORD OF OBSERVATIONS.

188. The "Original Record" is intended to furnish the Central Office with data for the correction of errors made at the several stations in reducing and copying the observations. To make it of any value for this purpose the readings of the different instruments must be entered as made, and *not* copied in from a slip of paper. Observers will habitually carry this book when making an observation, and enter the readings in *pencil* as noted at the time. They will also use this book for making the proper corrections, as indicated by the marginal references. Pen and ink must *not* be used for entering any observation or correction.

The velocity of the clouds will be indicated by a single letter, following the direction, as follows: C for "no perceptible movement," S for "slowly," and R for "rapidly."

The character of wind will be indicated by the letters S for "steady" and V for "variable," following *both* the direction and velocity.

The occurrence of *first* "Frost" at station will be noted in this book under its proper date and time, and reported to the Central Office by telegraph in the prescribed manner.

Precipitation which is too small to measure will be noted in the proper space by a dash (—), and the words "Too small to measure" written on the margin of the page; the person who takes the observation always being careful to connect the dash (—) and the note by an asterisk (*) or other proper reference-mark.

Haze, smoke, and fog must not be recorded in fourths, but as "light," "dense," &c.

The occurrence of frost (except first frost), halos, coronæ, &c., being more properly journal entries, will not be recorded in the original record of observations.

In recording the amount of clouds, the upper should be noted as "hidden" when wholly obscured by the lower or fog; when more than one kind of upper is observed all the kinds will be entered in the space for upper clouds, and the amount and velocity of each kind be given in the spaces prepared for these data; so also in case more than one kind of lower clouds be observed.

When precipitation begins and ends after the last observation for the day has been taken, the time of such beginning and ending should be entered under the head of the first observation of the next subsequent day.

The character of rain, snow, &c., must invariably be designated as "light" or "heavy," as the case may be.

Whenever, from any cause, an observation is not taken, or is taken late, the reason therefor must be plainly written in all records and on all forms affected thereby in the space which such observation would have occupied had it been taken.

If an observation is taken fifteen minutes or more late, it will be recorded, with the *exact* time at which it was taken, but it will not be used in the computation of any of the means of the station; which fact must be clearly set forth by a remark in connection with such observation whenever recorded.

In case an instrument becomes unserviceable, the word "blank" will be written in the spaces for its readings, and an explanatory note made in connection therewith.

The name of the person taking observations must be signed in the spaces for that purpose at the bottom of the page, and to each observation.

Changes of the barometer since preceding observations will not be noted in this book.

All times of the beginning and ending of precipitation must be recorded when the interval between showers equals or exceeds fifteen (15) minutes.

Under no circumstances are observers allowed to make erasures or alterations in any observation recorded in the original record of observations, nor is it allowable to write one figure over another after it has been recorded. If an error has been made, the correct reading will be noted on the margin of the page, in connection with an explanatory note in reference thereto.

The book will be forwarded to this Office not later than the 10th of the month succeeding that of which it is the record.

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249. Observers will give close attention to the observation and record of all local premonitory signs of storms or changes of weather, and report them promptly to this Office. The following points should be particularly noted before, during, and after a storm or change of weather: Direction and force of the wind; kind, direction, motion, and appearance of the clouds; action of the barometer and thermometer, and such other purely local causes as appear to influence the results.

250. The attention of sergeants or other enlisted men in charge of stations is directed to the fact that they are required to make their reports absolutely correct, and that any shortcoming in this respect renders them liable to punishment. Aside from this, it should be kept constantly in mind that a single incorrect report may cause the loss of life and property to an unknown amount, and all reports must be made with this responsibility clearly in view. Whenever an observer is unable from any cause to get in his report, properly corrected, at the regular hours of report, he will *not* send the uncorrected portion, but will write the word "Blank" in each of the spaces that would otherwise have been occupied by this portion of the report. Observers will *never* send any report or part of report which they have reason to believe is incorrect, and will bear in mind that it is safer and more in accordance with instructions to omit a report than to make a false one.

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PAPER 23.

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL-OFFICER,
Washington, D. C., July 2, 1877.

The following rules in regard to sunset observations and verifications of reports based upon them are furnished for your information and guidance:

1. The observer at each station will note, each day, at the exact time of sunset (which he will obtain from circular No. 3, herewith inclosed), and for a time not to exceed thirty minutes after sunset, the character of the western sky and sunset, and will note in writing on Form Y, in the column for that date, the character at the time as "Fair weather sunset," "Foul weather sunset," or "Doubtful weather sunset."

The term "Fair weather sunset" will express such condition of the sky, particularly the western, and such character of the sunset, as is considered to indicate a fair day for the day *ensuing*.

The term "Foul weather sunset" indicates that the appearances are such as to presage a rainy day for the day ensuing.

The term "Doubtful weather sunset" will indicate that the conditions are such as to leave the mind of the observer in doubt as to what the sunset presages for the following day.

The prediction is for the period of time from the sunset of the day on which the prediction is made until sunset of the following day; and at the expiration of the time for which the prediction is made the observer will note on Form Y, opposite the prediction and in the column headed "Report correct," the word *yes* or *no*, according as the prediction is or is not verified.

A sunset prediction of one day is verified or not verified, as the case may be, by the weather of the ensuing day.

The prediction "Foul" or "Fair" refers especially to rain, and does not refer in any way to amount or kind of clouds or fog.

The prediction "Foul" means that the appearance of the sky indicates *rain*; if any rain equaling or exceeding one one-hundredth of an inch falls before sunset on the ensuing day the prediction is verified, and if not, it is not verified.

"Fair" means that the appearance of the sky does not indicate rain, and if no rain equaling or exceeding one one-hundredth of an inch falls, the prediction is verified. If any rain in excess of this amount does fall, the prediction is not verified.

"Doubtful" sunsets cannot be verified.

As soon as the observation has been taken and entered on Form Y, the report will be enciphered (or written) on Form 5, in duplicate, and the form handed to the operator in the telegraph office as soon as possible after the observation is taken, for transmission to ———.

The signature of the operator must be obtained to both copies of each report, with the exact time of receipt by him. The operator will retain one copy of the report; the observer will retain the other copy until Monday of the following week, when he will forward the retained copies by mail to this Office in the same envelope as Form X.

In filling up Form 5, carbon paper and stylus will be used in the following manner: two sheets of the printed forms will be raised up and the piece of sheet tin placed beneath them; one of the sheets will be spread smoothly on the tin; on this sheet will be placed a piece of carbon paper, and the other form will be placed on this. When the cipher-words representing the readings of the instruments are written in the proper spaces of the Form 5, the report will appear in duplicate.

The observations will be written on the Forms 5 in the following manner:

The name of station (   ) will be written in the upper left-hand or first space; the cipher-word for the sunset prediction in the second space, and will be found in the table showing amount of clouds at the time, opposite the sunset prediction, and under the letters showing the direction from which the wind is blowing at time of observations.

In the third space will be written the cipher-word found opposite the observed reading of the barometer.

In the fourth space will be written the cipher-word found opposite the readings of the dry-bulb thermometer.

In the fifth space will be written the cipher-word found opposite the readings of the wet-bulb thermometer.

In the lower left-hand space will be written the cipher-word corresponding to the amount of rain-fall since the observation of preceding day.

The report will be signed with the surname only of the observer.

Examples are given of the proper manner of filling up Forms 5.

EXAMPLE.

Deadwood.	Abide.	Daunt.	Finny.	Finding.
Reduce.				

TRANSLATION.

Station	Deadwood.
Sunset	Fair.
Direction of wind	S. E.
Amount of clouds in fourths	0.
Barometer	29. 85.
Dry-bulb thermometer	69°.
Wet-bulb thermometer	64°.
Amount of rain-fall since last report	1.20 inches.

EXAMPLE.

Fetterman.	Dimly.	Calver.	Fiddle.	Festive.
Rebuke.				

TRANSLATION.

Station	Fetterman.
Sunset	Doubtful.
Direction of wind	S.
Amount of clouds in fourths	¾.
Barometer	24.45.
Dry-bulb thermometer	44°.
Wet-bulb thermometer	33°.
Amount of rain-fall since last report	.85 inches.

EXAMPLE.

Hamilton.	Elope.	Apron.	Few.	Fennel.

TRANSLATION.

Station	Hamilton.
Sunset	Foul.
Direction of wind	E.
Amount of clouds in fourths	$\frac{4}{4}$.
Barometer	18.75.
Dry-bulb thermometer	39°.
Wet-bulb thermometer	23°.
Amount of rain-fall since last report	None.

If no rain has been collected in the rain-gauge since the last report the cipher-word for rain-fall will be omitted from the report, and, until you have received a barometer, the word to express the reading of that instrument will also be omitted, and the words for the readings of dry-bulb and wet-bulb thermometers and amount of rain-fall be moved up one space.

The observation of the sunset, the direction of wind, and amount of clouds will be made at the times given in Circular No. 3. The observations of barometer, thermometers, and rain-fall, since observation of preceding day, will be taken at ——— each day.

In the form for the "Meteorological Record" for the week (Form X) should be entered as soon as possible after the observation is taken, and in the proper columns, the date of observation, hour of observation, reading of aneroid barometer, readings of dry and wet bulb thermometers, direction of wind, and velocity of wind in miles per hour (estimated from the Signal Service scale), amount of clouds in fourths, time (a. m. or p. m.) rain or snow began and ended, amount of rain or melted snow since last observation in inches and hundredths of an inch, state of the weather, and any remarks about the weather which, in the opinion of the observer, will be of interest, such as dates of auroras, thunder-storms, &c.

This form, properly filled up, should be forwarded by the mail on Monday, in an envelope addressed:

"THE CHIEF SIGNAL-OFFICER OF THE ARMY,
Washington, D. C."

Form Y will be forwarded to this Office on the *first* day of the month succeeding that of which it forms the record.

Instructions for reading the instruments.

ANEROID BAROMETER.

If the observer stands facing the barometer, the short arm will move to the right as the pressure of the atmosphere or weight of air increases, and to the left as the pressure diminishes. The long arm should be moved so as to coincide with or directly cover the short arm, and the reading of the barometer is obtained by reading from the lowest reading found on outer scale to the division of that scale to which the long arm points or which it covers. The inches and hundredths of inches are marked on the scale. The inches and hundredths are counted from left to right, or in the same direction as the hands of a watch move. The inches and hundredths are written in the same manner as dollars and cents, thus: One dollar and seventy-five cents would be written $1.75, or one and seventy-five hundredths, $29.35, twenty-nine dollars and thirty-five hundredths.

The barometer reading 29 inches and thirty-five hundredths of an inch would be written 29.35 inches, &c.

THERMOMETER.

In reading the thermometer the observer should be careful to place the eye at the same level as the top of the column of mercury, otherwise the reading will not be correct.

WET-BULB THERMOMETER.

A piece of wicking six or eight inches in length should be used with this thermometer, one end being drawn over the bulb until it is entirely covered, and the other end placed in the cistern which is on the wooden frame. The cistern should be kept filled with pure rain-water at all times when the temperature of the air is above freezing-point, and the cover should be changed once a month and the bulb carefully cleaned. The cover can be kept clean by washing it (without removal) by use of a jet of water thrown from a small syringe.

When the temperature of the air is below the freezing-point the water will be emptied from the cistern and the bulb moistened with water. By watching the mercury in the tube it will be seen to fall for a few minutes and then to rise again. The height of the mercury, or reading of thermometer, when at its lowest point, should be read.

WIND VANE.

The vane used for determining the direction of the wind must be set where the wind will act freely on it, and must never be sheltered by surrounding buildings or other objects.

The direction of wind is indicated by the point of the horizon from which it comes. Thus a north wind is one blowing from the North, an east wind is one blowing from the East, a south wind is one blowing from the South, &c. The direction of the wind will be designated by the eight principal points of the compass, N., E., S., W., N.E., S.E., S.W., N.W.

The wind vane and stand consist of the following parts:

1st. Upright staff about five feet in length, at the lower end of which should be cut a tenon about one inch in length; near upper end are two holes which cross each other at right angles, and through which are passed the iron arms (marked 3), at the ends of which are the letters N. and S. and E. and W. A hole is bored in the *upper* end of staff, in which the slender iron (marked 4) is screwed, and on which the wind vane (marked 5) is placed.

2d. Four iron braces.

3d. Two iron arms with letters N. and S. and E. and W. at the ends.

4th. Slender iron rod on which the vane is placed.

5th. Wind vane.

To place the vane and stand in position, a small platform, about two and a half feet square, should be placed on roof of observer's office and carefully leveled. A hole to receive the tenon at the foot of staff should be cut in center of platform. Draw upon the platform the true meridian line passing through the center, and mark the ends of the line N. and S. respectively.

To determine the true meridian line, place the compass with its center over the center of the hole in the platform; place the eye at south end of needle, and mark on platform a point toward which the north end of needle points; place the eye at north end of needle, and mark the point towards which the south end of needle points. Draw through the points thus determined and the center of platform a line, which will be the magnetic meridian.

The variation of the needle at your station is ° east; that is, the needle points ° east of the true north.

On "Plate I" will be seen two lines which cross each other at the point "O." One of these lines is marked simply "N." and "S."; the other line is marked "True N." and "True S." Place this plate with the point marked "O" at center of platform, and so that the line marked "N." and "S." immediately covers the line (or magnetic meridian) which has been marked on platform. Mark on the platform where the line marked "True N." and "True S." reaches edges of plate; a line drawn through these points and the center of platform will be the true "N." and "S." line, or true meridian. Paint on the platform a circle (whose center coincides with the center of the platform) having a diameter of about two feet, and on this circle mark the four cardinal points, N., E., S., and W., and the four intermediate points, N. E., S. E., S. W., and N. W. Unscrew the nuts at ends of iron arms (3), take off the movable letters, pass the rod through the holes drilled near upper end of staff, put on the letters and screw on the nuts. Screw the slender iron rod (4) into the hole in end of staff. Place a screw about six inches above the lower end of staff and immediately below the end of arm on which the letter "N." is placed. Place the tenon at foot of staff in the hole in center of platform, and turn the staff until the screw under letter "N." is immediately over the meridian line; the arm with letter "N." will be immediately over the end of meridian line (marked "N."), and therefore points to the true north. Place the staff in a vertical position, this being determined by the use of a plumb line; fasten one end of each of the iron braces (2) to the platform and the other end to the staff, so as to hold the latter firmly in position. Place the wind vane on the slender rod (4), passing the rod through the hole near the center of vane.

In determining the direction of the wind at the time of observation, the division of the circle which most nearly coincides with the direction in which the arrow-head of vane points will be taken as the direction of the wind.

In winds of considerable strength the vane is never at rest or fixed in the same direction; it oscillates incessantly, and its oscillations increase with the violence of the wind. In such cases observers must note the mean direction between the extremes. When the wind is too light to move the vane and when it is calm no direction will be recorded.

RAIN GAUGE.

The rain gauge will be placed, whenever practicable, with the top of the funnel-shaped collector twelve inches above the surface of the ground, firmly fixed in a vertical position and protected from the interference of unauthorized persons. It will be examined at time of making the daily observations, the amount of water it contains carefully measured by means of the graduated rod sent with each gauge, and then emptied and returned to its proper position. When a position at the level of the ground cannot be found with a sufficiently clear exposure, the gauge will be placed on the top of the instrument room or roof of the building occupied by the observer, who will measure the height above the ground and report it to this office.

The measuring rod is graduated in or divided into inches and tenths of inches, and the proportion between the cylinder and funnel is as ten to one, so that ten inches upon the rod corresponds with one inch of actual rain-fall, one inch on the rod to one-tenth of rain, and one-tenth on the rod to one-hundredth of rain. Snow will be melted and then measured and reported in the same manner as rain, but the fact of its being melted snow must be noted under the head of remarks in the weekly reports.

Whenever from any cause the snow cannot be melted the depth will be measured and ten inches of snow reported as one inch of rain. The rule for determining the amount of rain-fall from the amount of water collected in the tube is as follows, viz:

Measure the amount of water in the tube with the measuring stick, which is divided into inches and tenths. Divide the amount of water found by ten, the quotient will be the amount of rain-fall.

EXAMPLES.

Amount of water in tube	1.4 inches.
Amount of rain-fall	0.14 inch.
Amount of water in tube	15.6 inches.
Amount of rain-fall	1.56 inches.
Amount of water in tube	0.1 inch.
Amount of rain-fall	0.01 inch.

When reports cannot be forwarded on the day on which they are taken, they will not be transmitted by telegraph.

C. E. KILBOURNE,
First Lieutenant Second U. S. Artillery, Acting Signal Officer and Assistant.

PAPER 24.

S. S. ——— ———.

Bulletin for the —— half of the month of ———, 18—, of simultaneous international meteorological observations, taken each day at 7 a. m., Washington mean time (12.08 *p. m., Greenwich mean time*).

Day.	Station. (Harbor, or latitude and longitude at 7 a. m., Washington time.)	Barometer. ——feet above sea-level.	Attached thermometer.	Temperature. (Fahrenheit.)		Wind.		Clouds.		Rain-fall in 24 hours.	Sea-swell.		Weather.	Ship's course and distance sailed since last report.	Signature of observer.
				Dry bulb.	Wet bulb.	Direction from which coming.	Force.	Amount.	Direction from which coming.		Character.	Direction from which coming.			

☞ See notes on the back of sheet.

Barometer error ———.
Last comparisons at ———.

[On the back of the foregoing.]

NOTE.—A brief account of any remarkable storm may be indorsed hereon below.

S. S. —— ——.

Bulletin of simultaneous international meteorological observations for the —— half of ——, 18—.

Respectfully forwarded to the Chief Signal Officer of the Army.

—— ——,
Commanding.

NOTES.

1. These observations must be taken and recorded each day without fail, at the precise hour, 7 a. m., Washington mean time (12.08 p. m., Greenwich mean time).

2. The *mercurial barometer* is to be used when possible. When the *aneroid barometer* is used, as, for instance, on account of the ship's motion, a letter (*a*) is to be placed after the reading, and the aneroid is to be regulated at all times by the mercurial barometer.

3. When, from stress of weather or other causes, all the observations cannot be made, part of them must be invariably given. For instance, if it is not possible to say more than "violent gale," let that be said.

4. The *direction of the wind* is to be given by compass point (corrected for variation) as closely as possible. *Wind force* may be given by Beaufort scale of numbers 0 to 12, or in velocity of miles per hour or pressure per square foot, where there are anemometers.

5. One of these blanks, filled out for the first fifteen days of the month, to be mailed on the fifteenth day of each month, or as soon thereafter as practicable, and one filled for the remaining days of the month, to be mailed on the first day of the month, or as soon thereafter as practicable, addressed to the Chief Signal Officer of the Army, Washington, D. C.

6. Commanding officers of vessels will cause frequent comparisons of barometer readings to be made with those of the Signal Service whenever practicable, and as frequently as may be found necessary to obtain correct results—the comparisons, of course, to be made at precise common time, as, for instance, at 7 a. m., 2 p. m., and 9 p. m., for several days together, and at whatever of the signal stations may be convenient at the time.

7. Whenever in foreign waters, like comparisons will be made if practicable with the barometers of United States naval vessels wherever the commanding officer has reason to believe additional accuracy can be obtained. On every report forwarded the barometer error (+ or —) will be noted, and *not applied to the observations.* (See space at foot of blank.)

8. The reading of the attached thermometer must be given with all readings of the mercurial barometer. The blank for height of barometer above sea-level must be filled on shipboard by finding the height, in feet, of the cistern of the barometer, as hung in the ship, above the water-line, whenever the ship is in port. Give reading of barometer as *read off*, leaving all corrections and reductions to be made elsewhere.

9. Clouds, amount, must be reported as follows: Sky clear, 0; one-fourth covered, one-half covered, three-fourths covered, four-fourths covered.

10. Sea-swell may be reported as follows: Smooth, moderate, long, rough, cross, heavy, and very heavy.

11. Weather: Use words clear (when sky is less than one-fourth covered); fair (sky from one to three fourths covered); cloudy (sky more than three-fourths covered); sprinkling, drizzling, light (or heavy); rain, sleeting, hailing, thunder-storm, foggy, misty, hazy, threatening, clearing, &c. The above to express the state of weather, as the case may be, at the *moment of observation.*

12. If any observation is not taken, write in the space the word "blank."

It is requested the above directions be strictly complied with.

ALBERT J. MYER,
Brig. Gen. (Brevet Assigned), Chief Signal Officer, U. S. A.

PAPER 25.

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL OFFICER,
Washington, D. C., August 15, 1878.

Instructions for shipmasters comparing barometers with the Signal Service standard at the Maritime Association building in New York.

The upper surface of the mercury in the cistern of the large standard barometer is 11 feet and 6 inches above mean tide. The ship's barometer should be hung alongside and at the same elevation. A table for reducing the barometric readings to 32° Fahrenheit (freezing) will be found at the barometer desk. To all readings of the large standard barometer allow for the reduction to freezing to obtain the true reading. The difference between this corrected reading and the reading of the ship's barometer, similarly reduced to freezing, will be the correction to be always applied (that is, to be added to or subtracted from) to the readings of the ship's barometer, in order to make sure that these readings are correct. To illustrate by an example: the reading of the standard barometer reduced to feezing is, say, 29.985, and the reading of the ship's barometer to be compared, reduced to freezing, is, say, 29.970; in this case the standard is the higher, and the difference (.015) is to be added to all readings of the ship's barometer to obtain the standard reading. As another illustration: let the reading of the standard be, as above, 29.985, and the reduced reading of the compared ship's barometer 30.01; in this case the standard is the lower, and the difference (.025) is to be subtracted from all readings of the ship's barometer to obtain the standard reading. The comparisons are similarly made, though not so closely, and the correction determined, though the ship's barometer may not be scaled to very close readings, or of thousandths. The correction for the instrumental error of each ship's barometer, as thus determined, must be applied whenever corrected readings are desired.

For all reports made to this office, if such are made by any vessel, it will be sufficient to give, when a mercurial barometer is used, 1st, actual reading of barometer as read off; 2d, correction for instrumental error determined as stated above; 3d, reading of the attached thermometer; 4th, height (as nearly as possible) of barometer, as hung on shipboard, above the sea-level. These ought to appear on each separate form or report sent to this office.

Aneroid barometers are compared with standard mercurial barometer by first reading the mercurial barometer and correcting this reading for temperature only—that 32 reducing the reading to what it would be if the temperature of the barometer was is° Fahrenheit. Then read the aneroid and take the difference between the corrected e2ading of the mercurial and the actual (uncorrected) reading of the aneroid, which will be the correction to be applied to the aneroid; this correction to be added if the aneroid reads lower than the mercurial, and subtracted if it reads higher.

On all reports made for this office, when an aneroid barometer is used, the record should give, stated on the form, 1st, actual reading of the barometer as read off; 2d, correction for instrumental error, determined as above; 3d, reading of attached thermometer if there is one, or of a thermometer in the room; 4th, statement whether the barometer is "compensated" or not; 5th, height (as nearly as possible) of the barometer, as hung on shipboard, above sea-level.

A sergeant or assistant of the Signal Service will be in attendance at the Maritime Association building each day, from 12 to 1 p. m., to give any necessary information as to mode of making comparisons. The barometer case and the door of the screen will be opened at the hours named only, unless in instances of special need, and always in the presence of the sergeant or assistant.

Shipmasters of all nations are invited to make use of the Signal Service standard for the purpose of comparing their ships' barometers. The superintendent of the room of the Maritime Association will take charge of ships' barometers to be compared at any time they may be left with him for the purpose. They will be duly delivered by him to the sergeant or assistant in charge of the standard. Ships' barometers can be most conveniently returned to owners at the hour between 12 m. and 1 p. m.

ALBERT J. MYER,
Brigadier-General (Brevet Assigned), Chief Signal Officer, U. S. A.

PAPER 26.

List of merchant and naval vessels and naval stations from which simultaneous meteorological reports have been received at the office of the Chief Signal Officer during the year ending June 30, 1880.

MERCHANT VESSELS.

Name.	Months for which reports were received.	Line.
Steamship Circassian	January, 1880	Allan Line.
Steamship Hibernian	November and December, 1879, and January to May, 1880, inclusive.	Do.
Steamship Moravian	February and March, 1880	Do.
Steamship Peruvian	February, 1880	Do.
Steamship Sardinian	February, March, and April, 1880	Do.
Steamship Sarmatian	January, February, March, 1880	Do.
Steamship Illinois	1st half of January, 1880	American Steamship Company.
Steamship Indiana	June to December, 1879, and January to May, 1880, inclusive.	
Steamship Ohio	February to June, 1880, inclusive	
Steamship Newbern	February to May, 1880, inclusive	California and Mexican Steamship Line.
Steamship Samaria	April and May, 1879	Cunard Line.
Steamship Scythia	March and April, 1880	Do.
Steamship America	March, 1880	North German Lloyd of Bremen.
Steamship Braunschweig	June, August, September, October, 1879, and March to May, 1880.	
Steamship Ohio	May to December, 1879, inclusive, and January, 1880.	
Steamship Leipzig	June, July, August, September, November, and December, 1879, and January, February, and March, 1880.	
Steamship Strassburg	April, 1880	
Steamship Belgic	April, 1879, to April, 1880, inclusive	Occidental and Oriental Steamship Company.
Steamship Gaelic	May, 1879, to May, 1880, inclusive	
Steamship Oceanic	June, July, and August, 1879	
Steamship Geo. W. Elder	January to May, 1880, inclusive	Oregon Railway and Navigation Company
Steamship Ancon	February to June, 1880, inclusive	Pacific Coast Steamship Company.
Steamship State of California.	April, May, and June, 1880	
Steamship Idaho	May, 1880	
Steamship City of Chester	January to April, 1880, inclusive	
Steamship Alaska	February, 1880	Pacific Mail Steamship Company.
Steamship City of Panama	February to May, 1880, inclusive	Do.
Steamship City of Sydney	March to June, 1880, inclusive	Do.
Steamship City of Tokio	April to September, 1879, inclusive	Do.
Steamship China	March, April, and May, 1880	Do.
Steamship Colima	June to September, 1879, inclusive, and February to May, 1880, inclusive.	Do.
Steamship Dakota	May, June, July, 1879, and February to June, 1880, inclusive.	Do.
Steamship Granada	March to June, 1880	Do.
Steamship Zealandia	March to October, 1879, inclusive, and February to May, 1880, inclusive.	Do.
Steamship Belgenland	December, 1879, and January to May, 1880, inclusive.	Red Star Line.
Steamship Nederland	June, July, and September, to December, 1879, and January, 1880.	Do.
Steamship Adriatic	April and May, 1880	White Star Line.
Steamship Britannic	January, April, May, and June, 1880	Do.
Steamship Celtic	March, April, May, and June, 1880	Do.
Steamship Republic	April and May, 1880	Do.
Steamship Abana	August, September, and October, 1879	British vessel.
Schooner Abby K. Bentley	March to June, 1880, inclusive	
Schooner Addie Fuller	June to November, 1879, and March to June, 1880, inclusive.	
Brigantine Agnes Wilson	January and February, and April to July, 1879	British vessel.
Airlie	January, 1879	Do.
H. M. S. Alert	January, 1879, to January, 1880	Do.
Brig Alliance	January, February, March, May, June, July, August, October, November, December, 1879.	Do.
Steamship Amanda	January to April, 1879	Do.
Schooner Annie R. Lewis	April, May, and June, 1880	
Steamship Algeria	August, 1878, to March, 1879; May to August, 1879; and January, 1880.	British vessel.
Steamship Arno	February, 1879	Do.
Astarte	January and February, and April to July, 1879	Do.
Atmosphere	April, May, July, and August, 1879	Do.
Ship Bowfell	May to August, 1879	Do.
Ship British Commodore	February to May, 1879	Do.
Bark Belleisle	November, 1878, to April, 1879; July and August, 1879, and January, 1880.	Do.

List of merchant and naval vsssels and naval stations, &c.—Continued.

MERCHANT VESSELS—Continued.

Name.	Months for which reports were received.	Line.
British Peer	March to July, 1879	British vessel.
City of Agra	January to April, 1879	Do.
City of Cashmere	January and February, 1879, and April, 1879, to March, 1880.	Do.
Brigantine Carrie Hechle	December 5, 1879, to February, 1880	
Bark Commewyne	January to May, 1879, and July and August, 1879; October, 1879, to February, 1880.	British vessel.
Bark Decapolis	January, 1880	Do
Schooner Delia Hodgkins	July and August, 1879	
Ship Denbighshire	January to March, 1879	British vessel.
Bark Dochra	January, 1879	Do.
Bark Drumclog	May, 1879	Do.
Early Moon	March, 1879	Do.
Brig Endymion	October and November, 1879	Do.
Steamship Ethiopia	July to December, 1879, and January, 1880	Do.
Barkentine Fylde	March, April, July, August, and September, 1879	Do.
H. M. S. Fawn	January to August, 1879	Do.
Bark Fedalma	April, June, and August, to December, 1879; January to March, 1880.	Do.
Steamship Gorden Castle	January, February, July, August, and September, 1879.	Do.
Steamship German	September, 1879, to March, 1880	Do.
H. M. sloop Gannet	May to December, 1879	Do.
Brigantine George	June to September, 1879, and January to June, 1880.	
Schooner W. D. Hilton	June, 1879	
Steamship Haytien	October, 1879	British vessel.
Schooner Henry Whitney	May and June, 1879	
Schooner Harry and Fred	April, May, and June, 1879	
Ship Hippolyta	April to May, 1880	British vessel.
Bark Hope	February, 1879	Do.
Ship Iron Cross	June, August, September, and December, 1879; and January to March, 1880.	Do.
Ship Jumna	June, 1880	Do.
Ship Kingston	February to May, 1879	Do.
Ship Lochee	March, April, May, July, August, September, and October, 1879	Do.
H. M. S. Magpie	January to December, 1879	Do.
Bark Mertola	January to December, 1879	Do.
Steamship Nizam	February to June, 1879	Do.
Bark Nordenskiöld	May and June, 1879	Do.
Steamship Otranto	December, 1877; and January, February, and March, 1878.	Do.
Pendragon	January and February, 1879	Do.
Steamship Peruvian	August, 1878, to February, 1879, and April, 1879, to January, 1880.	Do.
Bark Queen of Cambria	March, April, May, June, September, October, and November, 1879.	Do.
Light-house tender Richmond.	July, August, and September, 1879, and November, 1879, to March, 1880.	Do.
Royal Alexandria	April and June, 1879	Do.
Schooner A. A. Rowe	June, 1879	
Bark Shun Lee	January, April, May, June, August, September, and October, 1879.	British vessel.
Bark Sophia Joakin	January, February, March, 1879	Do.
Steamship Sorrento	September, 1878, to January, 1879	Do.
Steamship Strathleven	January to June, 1879; September to December, 1879, and January, 1880.	Do.
Steamship Sunbeam	November and December, 1879, and January, 1880	Do.
Bark Syringa	April, 1880	
Theophane	May to August, 1879	British vessel.
Schooner Traveller	April to November, 1879	Do.
German brig W. V. Freeden.	April, May, and August, 1879	
Bark Victoria Cross	December, 1877	British vessel.
Bark Virginia	September and October, 1878, and February, 1879	Do.
Steamship Wyberton	February and March, 1879	Do.
Bark Australia	April 23 to May 19, 1880	Swedish vessel.

List of merchant and naval vessels and naval stations, &c.—Continued.

UNITED STATES NAVAL VESSELS.

Names.	Months for which reports were received.
Adams	April, 1879, to May, 1880, inclusive.
Alaska	May and June, 1879; August, 1879, to February 15, 1880, and March 16 to May 16, 1880.
Alert	April 13 to 30, 1880.
Alliance	June 1 to December 7, 1879, and May 10 to 15, 1880.
Ashuelot	May to October, 1879.
Colorado	June 1, 1879, to June 15, 1880.
Constitution	June 1, 1879, to June 15, 1880.
Constellation	June 1 to September 9, 1879.
Despatch	May and June, 1879.
Essex	April 11 to 26, and July 16 to October 15, 1879.
Enterprise	June 1, 1879, to May 8, 1880.
Franklin	June 16, 1879, to June 15, 1880.
Hartford	May 16 to November 30, 1879.
Independence	July 1, 1879, to June 15, 1880.
Jamestown	April 1 to May 31, 1880.
Kearsarge	June 16, 1879, to May 15, 1880.
Lackawanna	April 1, 1879, to April 15, 1880.
Monocacy	May, 1879, to April, 1880.
Monongahela	May 16 to October 31, 1879.
Michigan	June 16, 1879, to June 15, 1880.
Minnesota	February 24 to April 30, and June 1 to 15, 1880.
Marion	May 16 to June 30, 1879, and October 1, 1879, to April 30, 1880.
New Hampshire	June 1, 1879, to June 15, 1880.
Nipsic	December 1, 1879, to May 31, 1880.
Onward	June 1, 1879, to May 16, 1880.
Portsmouth	May 16 to November 15, 1879, and May 16 to 31, 1880.
Palos	May, 1879, to April, 1880.
Pensacola	May 16, 1879, to April 30, 1880.
Powhatan	June 16, 1879, to June 15, 1880.
Passaic	June 16, 1879, to June 15, 1880.
Quinnebaug	June, 1879, to May, 1880.
Rio Bravo	June 16, 1879, to June 15, 1880.
Ranger	May 1, 1879, to February 16, 1880.
Richmond	May 16, 1879, to March 31, 1880, and April 16 to 30, 1880.
Saint Louis	June 16, 1879, to June 16, 1880.
Santee	June 16, 1879, to March 16, 1880.
Saratoga	April 1 to October 31, 1879, and April 1 to May 31, 1880.
Swatara	January 16 to March 31, 1880.
Shenandoah	October 1, 1879, to April 16, 1880.
Tennessee	December 16, 1879, to June 15, 1880.
Trenton	June 1 to November 30, 1879, and January 1 to May 31, 1880.
Tuscarora	June 1, 1879, to May 16, 1880.
Vandalia	June 16, 1879, to January 15, 1880, and February 22 to June 15, 1880.
Wabash	June 16, 1879, to June 15, 1880.
Wachusett	June 16, 1879, to January 15, 1880, and February 1 to May 15, 1880.
Wyoming	June 1, 1879, to May 15, 1880.

UNITED STATES NAVAL LAND STATIONS.

Pensacola, Fla	June 16, 1879, to June 15, 1880.
Portsmouth, N. H	October 1, 1879, to June 15, 1880.
Yokohama, Japan	May 16, 1879, to May 15, 1880.

PORTUGUESE NAVAL VESSELS.

Bartholomew Dias	April 16 to May 31, 1879.
Duque da Terceira	January 28 to July 15, 1879.
Rio Lima	March 1, 1879, to March 15, 1880.
Sá da Bandeira	March 16 to April 15, 1879.
Sado	August 1 to 15, 1879, and September 1, 1879, to February 15, 1880.
Tejo	March 1 to August 31, 1879, and September 16, 1879, to February 15, 1880.
Quanza	April 1 to September 15, 1879.

SWEDISH NAVAL VESSELS.

Balder	November 20, 1878, to April 19, 1879, and October 30, 1879, to May 7, 1880.
Gefle	November 20 to December 20, 1878, and January 16 to April 30, 1879.
Saga	May 24 to August 5, 1879, and May 30 to August 9, 1880.

3

WINDS ACCOMPANYING THE ATLANTIC STORMS.

American Coast.					European Coast.			
No.	DATE.	Direction.	Miles per Hour.	Meters per Second.	DATE	Direction.	Miles per Hour.	Meters per Second.
III.	June 14th..	NW	20 to 25	8.9 to 11.2	June 22ud....	SW to NW	*40 to 70	17.9 to 31.3

* Estimated from a scale of 0 to 9.

CHART No. IV.

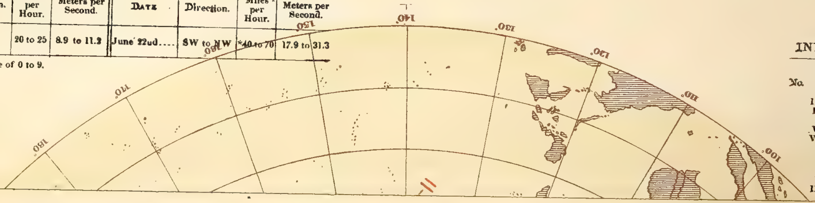
INDEX TO STORM-TRACKS

Atlantic Ocean.

No. I. from June 3rd to 8th. 1879.
II. from June 4th to 10th. 1879.
III. from June 9th to 28th. 1879.
IV. from June 10th to 18th. 1879.
V. from June 12th to 19th. 1879.
VI. from June 20th to 29th. 1879.
VII. from June 22nd to 25th. 1879.

Pacific Ocean.

I. from April 24th to 28th. 1879.
II. from May 7th to 8th. 1879.
III. from May 12th to 16th. 1879.



wind-direction.

The tracks charted in black have appeared in previous *Reviews.*

The tracks charted in red have been made from data collected since preceding *Review.*

List of merchant and naval vessels and naval stations, &c.—Continued.

UNITED STATES NAVAL VESSELS.

Names.	Months for which reports were received.
Adams	April, 1879, to May, 1880, inclusive.
Alaska	May and June, 1879; August, 1879, to February 15, 1880, and March 16 to May 16, 1880.
Alert	April 13 to 30, 1880.
Alliance	June 1 to December 7, 1879, and May 10 to 15, 1880.
Ashuelot	May to October, 1879.
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Minnesota	February 24 to April 30, and June 1 to 15, 1880.
Marion	May 16 to June 30, 1879, and October 1, 1879, to April 30, 1880.
New Hampshire	June 1, 1879, to June 15, 1880.
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Santee	June 16, 1879, to March 16, 1880.
Saratoga	April 1 to October 31, 1879, and April 1 to May 31, 1880.
Swatara	January 16 to March 31, 1880.
Shenandoah	October 1, 1879, to April 16, 1880.
Tennessee	December 16, 1879, to June 15, 1880.
Trenton	June 1 to November 30, 1879, and January 1 to May 31, 1880.
Tuscarora	June 1, 1879, to May 16, 1880.
Vandalia	June 16, 1879, to January 15, 1880, and February 22 to June 15, 1880.
Wabash	June 16, 1879, to June 15, 1880.
Wachusett	June 16, 1879, to January 15, 1880, and February 1 to May 15, 1880.
Wyoming	June 1, 1879, to May 15, 1880.

UNITED STATES NAVAL LAND STATIONS.

Pensacola, Fla	June 16, 1879, to June 15, 1880.
Portsmouth, N. H	October 1, 1879, to June 15, 1880.
Yokohama, Japan	May 16, 1879, to May 15, 1880.

PORTUGUESE NAVAL VESSELS.

Bartholomew Dias	April 16 to May 31, 1879.
Duque da Terceira	January 28 to July 15, 1879.
Rio Lima	March 1, 1879, to March 15, 1880.
Sá da Bandeira	March 16 to April 15, 1879.
Sado	August 1 to 15, 1879, and September 1, 1879, to February 15, 1880.
Tejo	March 1 to August 31, 1879, and September 16, 1879, to February 15, 1880.
Quanza	April 1 to September 15, 1879.

SWEDISH NAVAL VESSELS.

Balder	November 20, 1878, to April 19, 1879, and October 30, 1879, to May 7, 1880.
Gefle	November 20 to December 20, 1878, and January 16 to April 30, 1879.
Saga	May 24 to August 5, 1879, and May 30 to August 9, 1880.

WINDS ACCOMPANYING THE ATLANTIC STORMS.

	American Coast.				*European Coast.*			
No.	DATE.	Direction.	Miles per Hour.	Meters per Second.	DATE	Direction.	Miles per Hour.	Meters per Second.
III.	June 14th..	NW	20 to 25	8.9 to 11.2	June 22nd....	SW to NW	*40 to 70	17.9 to 31.3

* Estimated from a scale of 0 to 9.

CHART No. IV.

INDEX TO STORM-TRACKS

Atlantic Ocean.

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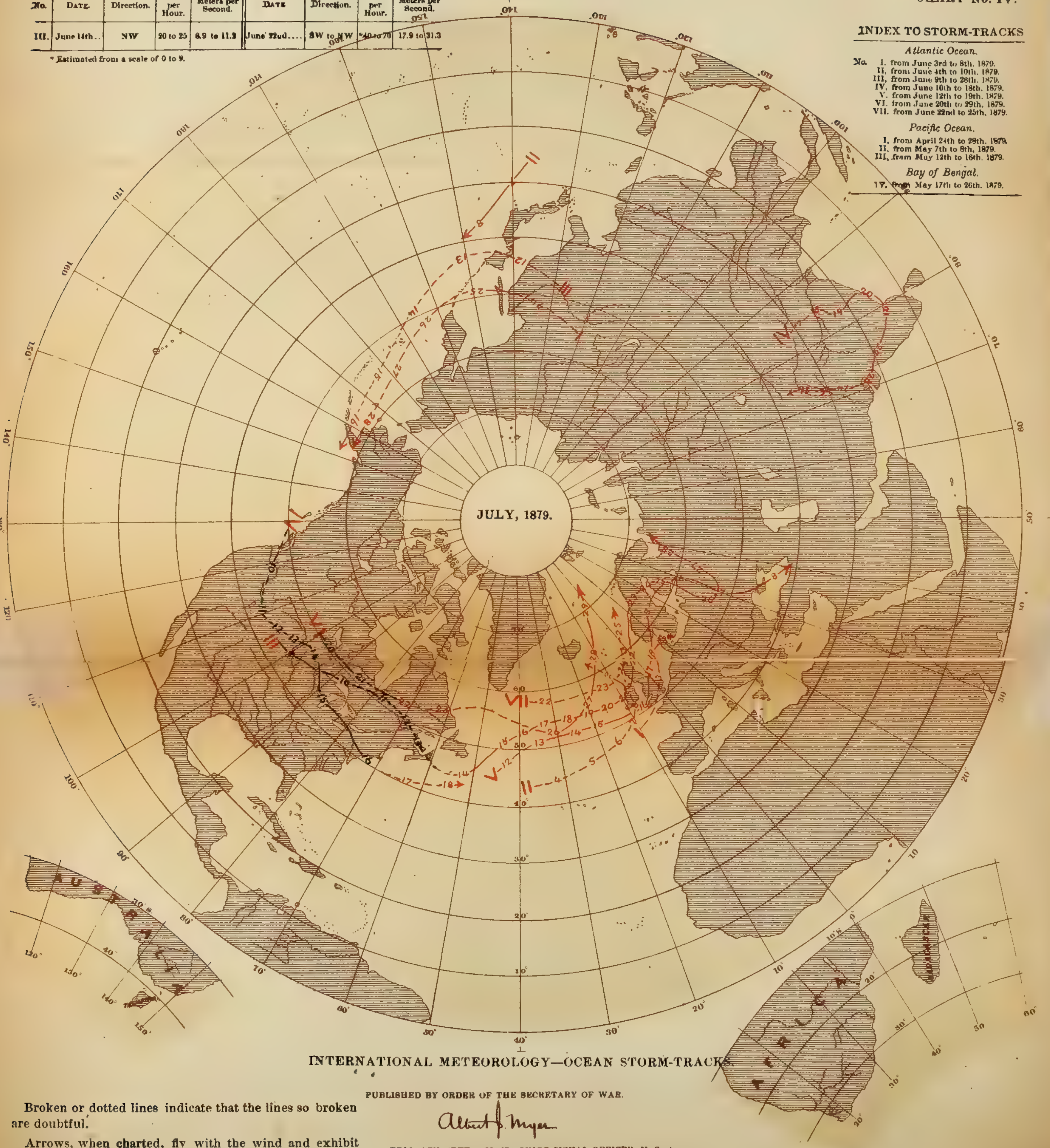
II, from June 4th to 10th, 1879.
III, from June 9th to 28th, 1879.
IV, from June 10th to 18th, 1879.
V, from June 12th to 19th, 1879.
VI, from June 20th to 29th, 1879.
VII, from June 22nd to 25th, 1879.

Pacific Ocean.

I, from April 24th to 28th, 1879.
II, from May 7th to 8th, 1879.
III, from May 12th to 16th, 1879.

Bay of Bengal.

IV, from May 17th to 26th, 1879.



INTERNATIONAL METEOROLOGY—OCEAN STORM-TRACKS.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER. U. S. A.

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Arrows, when charted, fly with the wind and exhibit wind-direction.

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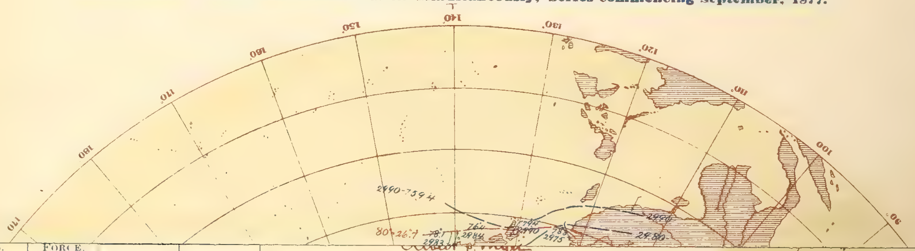

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER. U. S. A

SYMBOLS.	FORCE.	Miles per hour.	Metres per second.
→	1, 2	0 to 9	0 to 4.0
≻→	3, 4	9.1 to 22.5	4.1 to 10.1
≻→	5, 6	22.6 to 40.5	10.1 to 18.1
≫→	7, 8	40.6 to 67.5	18.1 to 30.2
⋙→	9, 10	67.6 up.	30.2 & over.

ISOBARS AND ISOTHERMS.

Isobars in *blue;* detached barometer means in English inches.

Isotherms in *red;* detached temperature means in degrees Fahrenheit.

INTERNATIONAL MONTHLY CHART.

Showing mean pressure, mean temperature, mean force and prevailing direction of winds at 7:35 A. M., Washington mean time, for the month of July, 1878, based on the daily charts of the International Bulletin.

4

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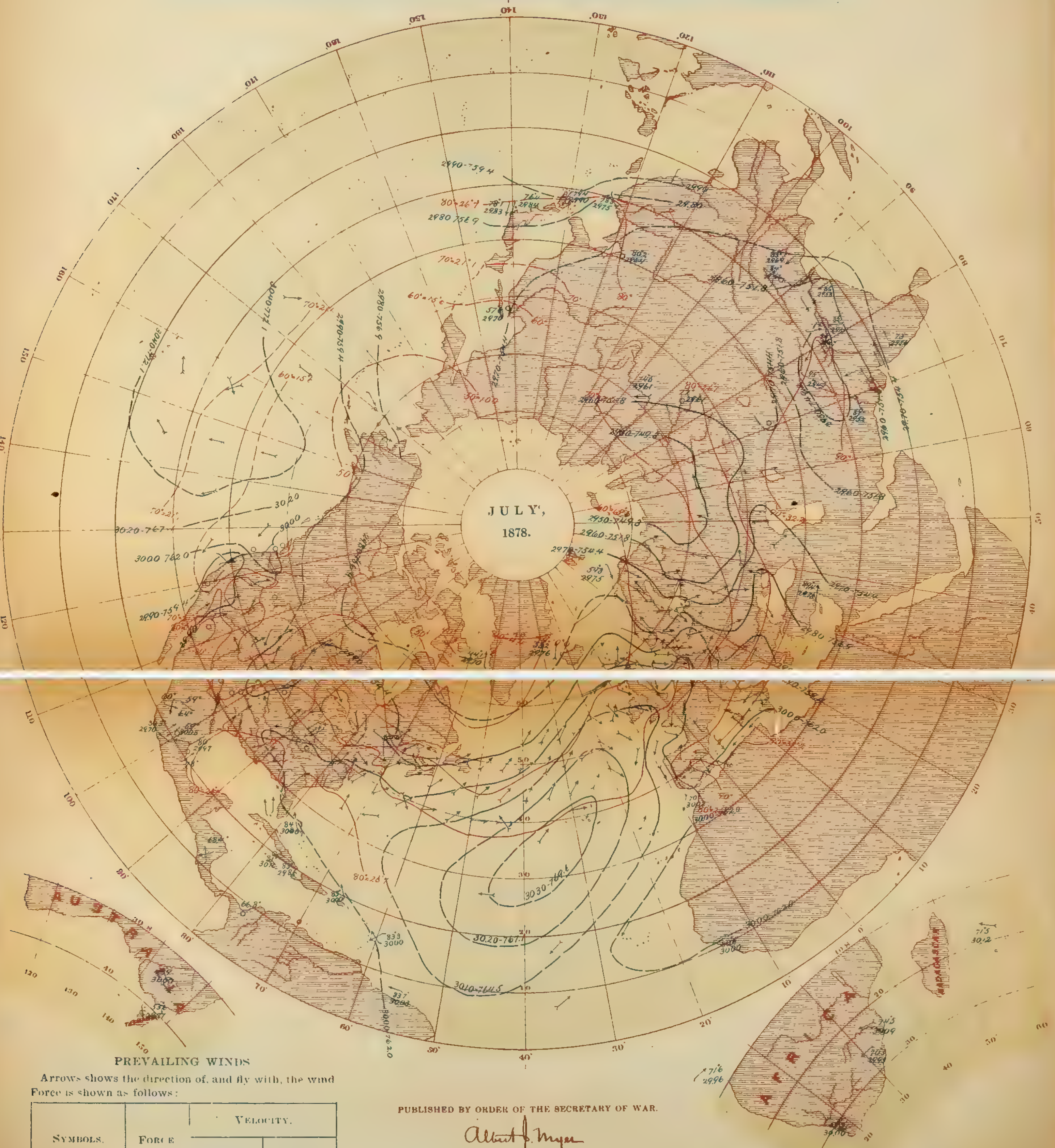

PREVAILING WINDS

Arrows shows the direction of, and fly with, the wind Force is shown as follows:

Symbols.	Force	Velocity.	
		Miles per hour.	Metres per second.
⟶	1, 2	0 to 9	0 to 4.0
>⟶	3, 4	9.1 to 22.5	4.1 to 10.1
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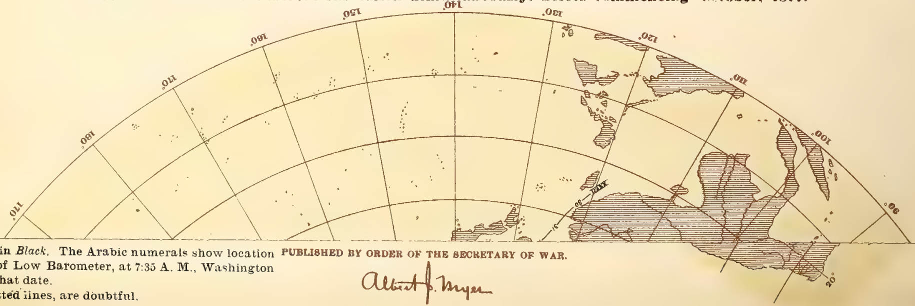
No. VI.



Storm-tracks in *Black*. The Arabic numerals show location of the centres of Low Barometer, at 7:35 A. M., Washington mean time, of that date.

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INTERNATIONAL CHART.

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July, 1878.

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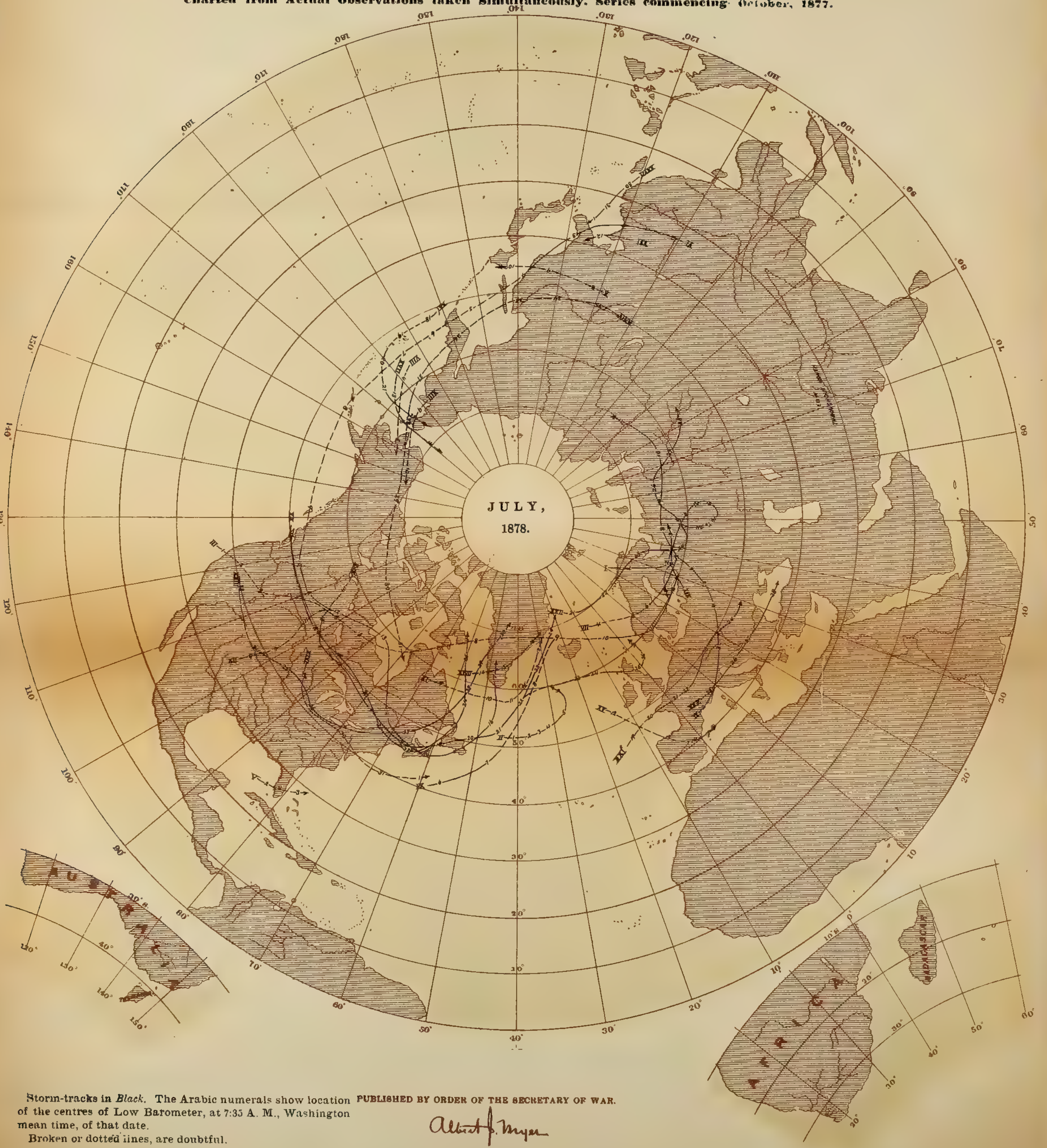

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INTERNATIONAL CHART.
Showing Tracks of Centres of Low Barometer for July, 1878.

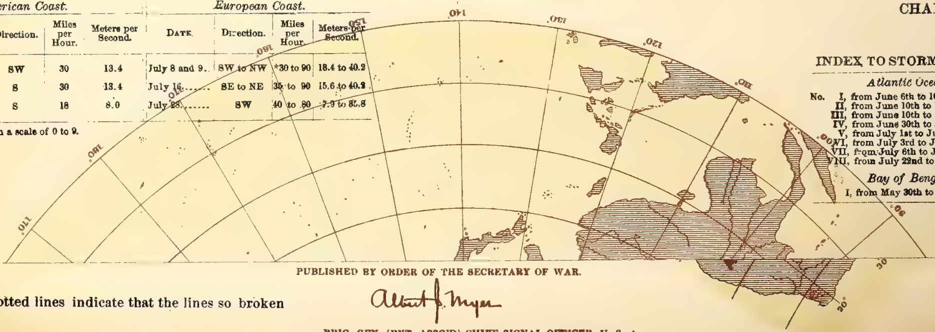
6

CHART No. IV.

WINDS ACCOMPANYING THE ATLANTIC STORMS.

	American Coast.				European Coast.			
No.	DATE.	Direction.	Miles per Hour.	Meters per Second.	DATE.	Direction.	Miles per Hour.	Meters per Second.
V.	July 4......	SW	30	13.4	July 8 and 9..	SW to NW	*30 to 90	13.4 to 40.2
VII.	July 9......	S	30	13.4	July 16......	SE to NE	35 to 90	15.6 to 40.2
VIII.	July 23......	S	18	8.0	July 28......	SW	40 to 80	17.9 to 35.8

* Estimated from a scale of 0 to 9.



INDEX TO STORM-TRACKS

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IV, from June 30th to July 9th, 1879.
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VI, from July 3rd to July 5th, 1879.
VII, from July 6th to July 17th, 1879.
VIII, from July 22nd to July 28th, 1879.

Bay of Bengal.

I, from May 30th to June 6th, 1879.

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WINDS ACCOMPANYING THE ATLANTIC STORMS.

	American Coast.				*European Coast.*			
No.	DATE.	Direction.	Miles per Hour.	Meters per Second.	DATE.	Direction.	Miles per Hour.	Meters per Second.
V.	July 4......	SW	30	13.4	July 8 and 9.	SW to NW	*30 to 90	18.4 to 40.2
VII.	July 9......	S	30	13.4	July 16......	SE to NE	35 to 90	15.6 to 40.2
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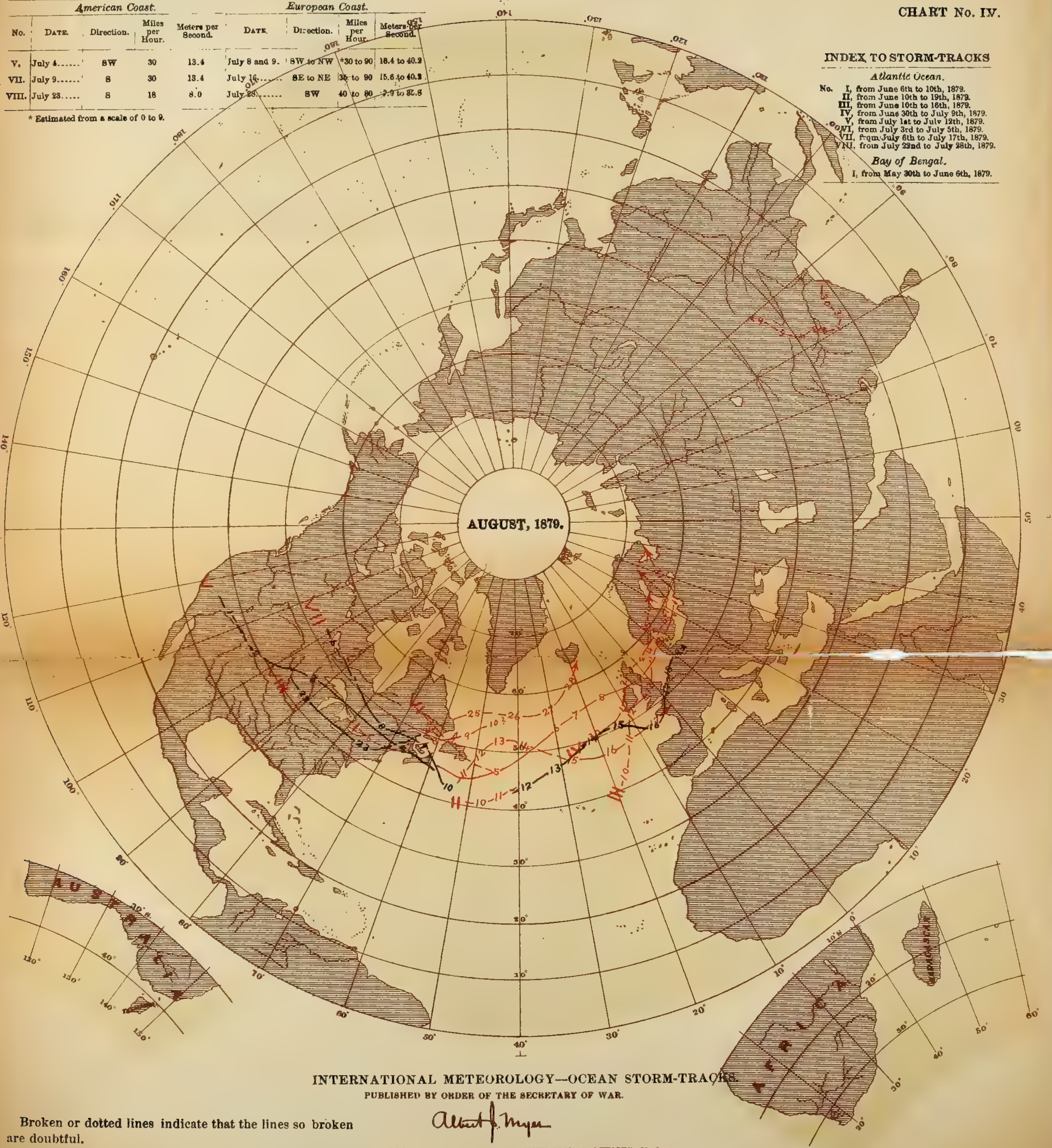

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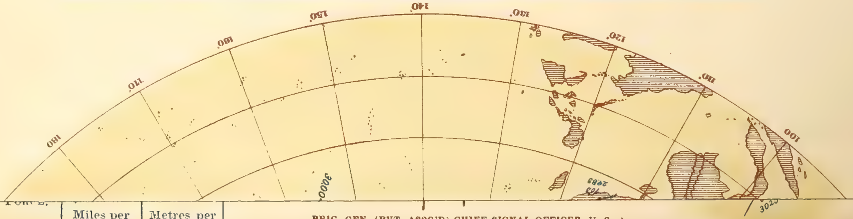

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

Symbols.	Force.	Miles per hour.	Metres per second.
⟶	1, 2	0 to 9	0 to 4.0
›⟶	3, 4	9.1 to 22.5	4.1 to 10.1
››⟶	5, 6	22.6 to 40.5	10.1 to 18.1
»⟶	7, 8	40.6 to 67.5	18.1 to 30.2
»›⟶	9, 10	67.6 up.	30.2 & over.

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Isobars in *blue*; detached barometer means in English inches.

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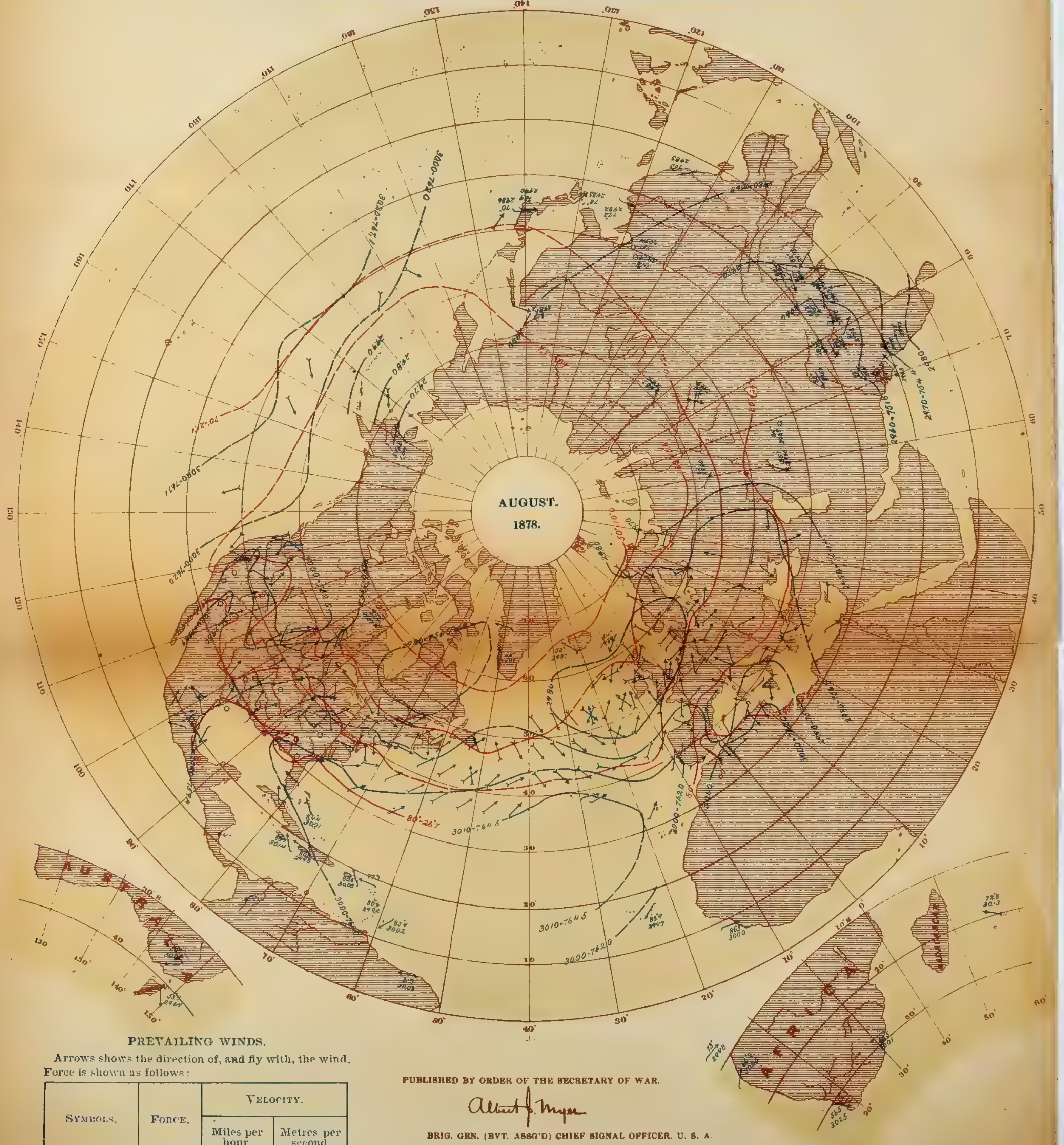

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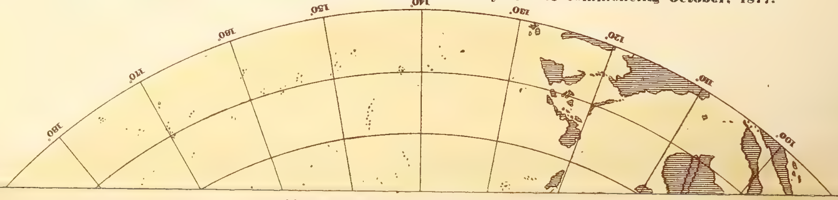

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A

INTERNATIONAL CHART.

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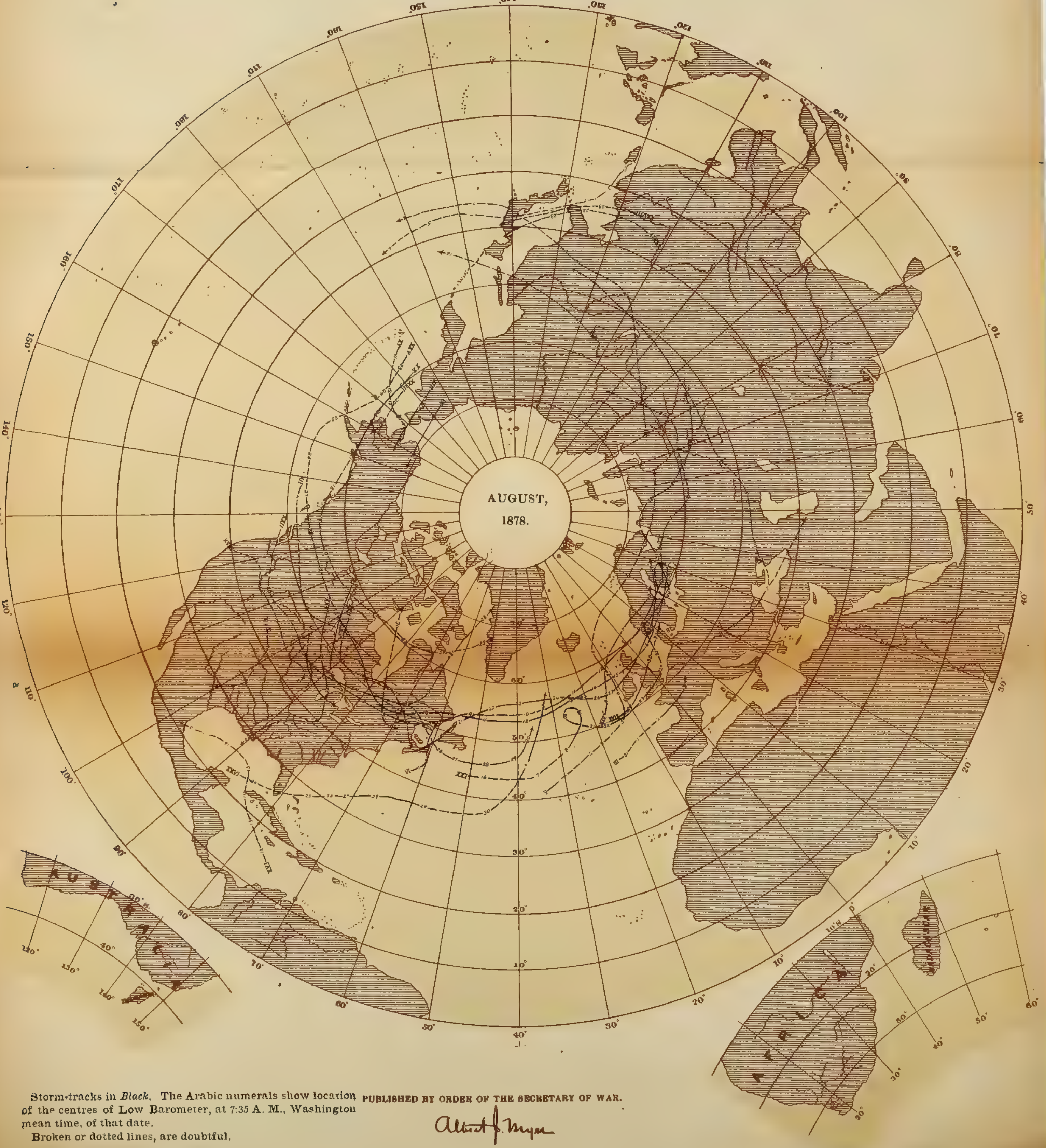

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WINDS ACCOMPANYING THE ATLANTIC STORMS.

	American Coast.				European Coast.			
No.	DATE.	Direction.	Miles per Hour.	Meters per Second	DATE	Direction.	Miles per Hour.	Meters per Second
I.	July 27....	NE	30	13.4	August 1	NW	40	17.9
IV.	August 6....	W	30	13.4	August 11	SE	40	17.9
XI.	August 23..	W	15	6.7	August 27	S	*80	35.8

* Estimated from a scale of 0 to 9.

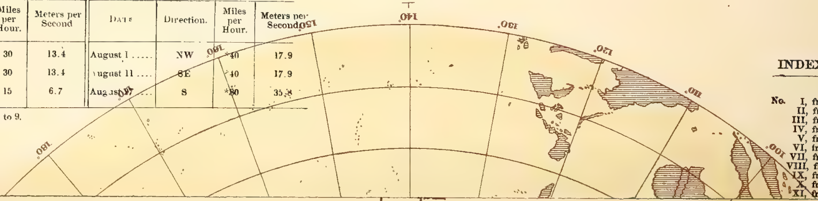

CHART No. IV.

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IV, from Aug. 5th to Aug. 14th, 1879.
V, from Aug. 9th to Aug. 11th, 1879.
VI, from Aug. 13th to Aug. 20th, 1879.
VII, from Aug. 15th to Aug. 16th, 1879.
VIII, from Aug. 15th to Aug. 17th, 1879.
IX, from Aug. 20th to Aug. 24th, 1879.
X, from Aug. 20th to Aug. 31st, 1879.
XI, from Aug. 21st to Aug. 31st, 1879.

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BRIG. GEN. (BVT. ASSO'D). CHIEF SIGNAL OFFICER. U. S. A

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	American Coast.				European Coast.			
No.	DATE.	Direction.	Miles per Hour.	Meters per Second	Date	Direction.	Miles per Hour.	Meters per Second
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XI, from Aug. 21st to Aug. 31st, 1879.
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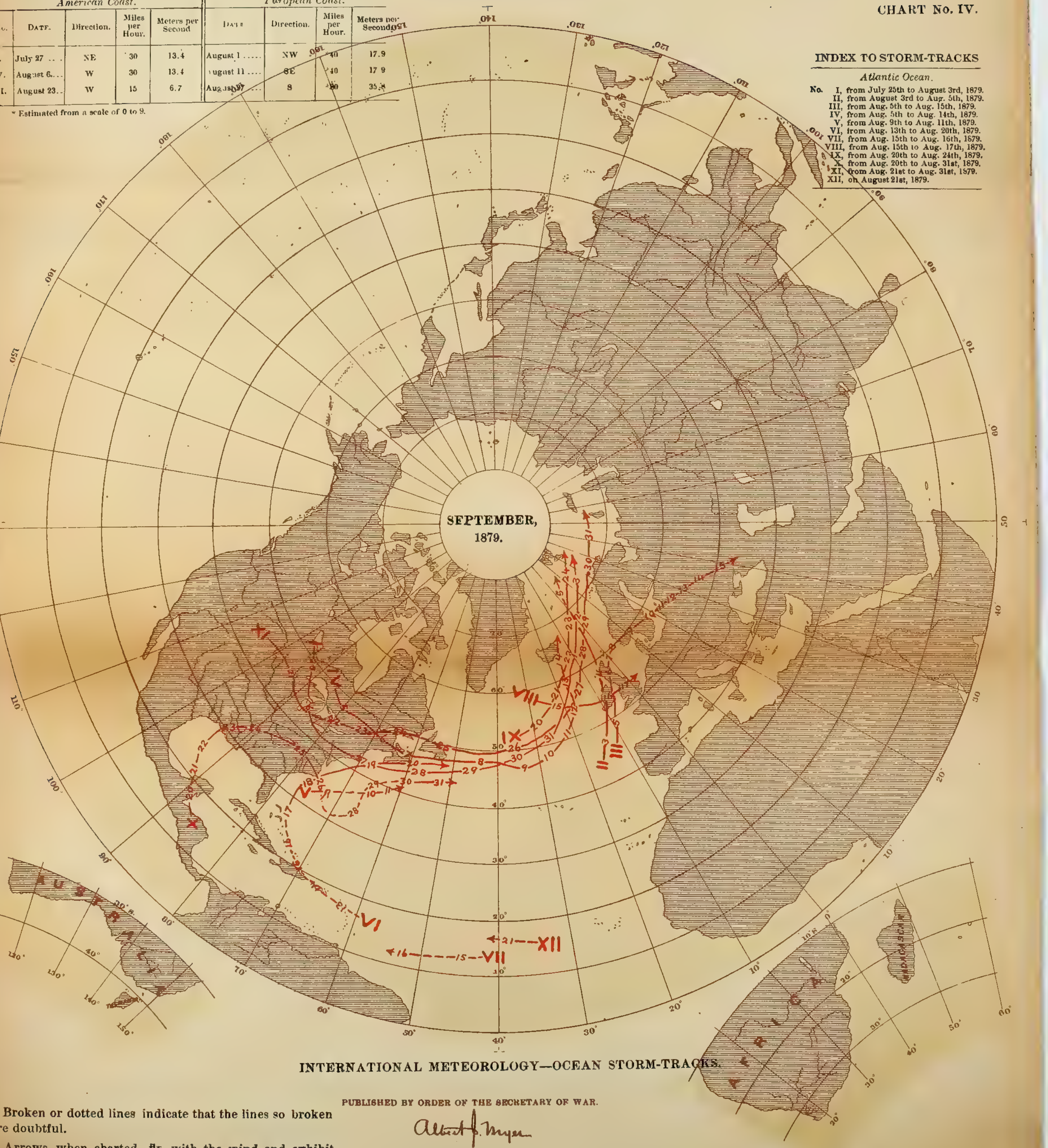

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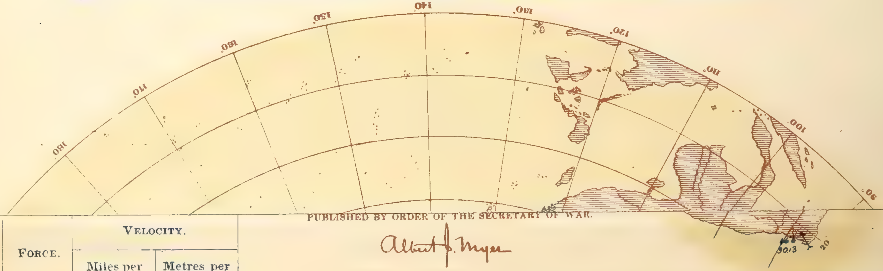

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SYMBOLS.	FORCE.	VELOCITY.	
		Miles per hour.	Metres per second.
→	1, 2	0 to 9	0 to 4.0
>→	3, 4	9.1 to 22.5	4.1 to 10.1
>>→	5, 6	22.6 to 40.5	10.1 to 18.1
>>>→	7, 8	40.6 to 67.5	18.1 to 30.2
>>>>→	9, 10	67.6 up	30.2 & over.

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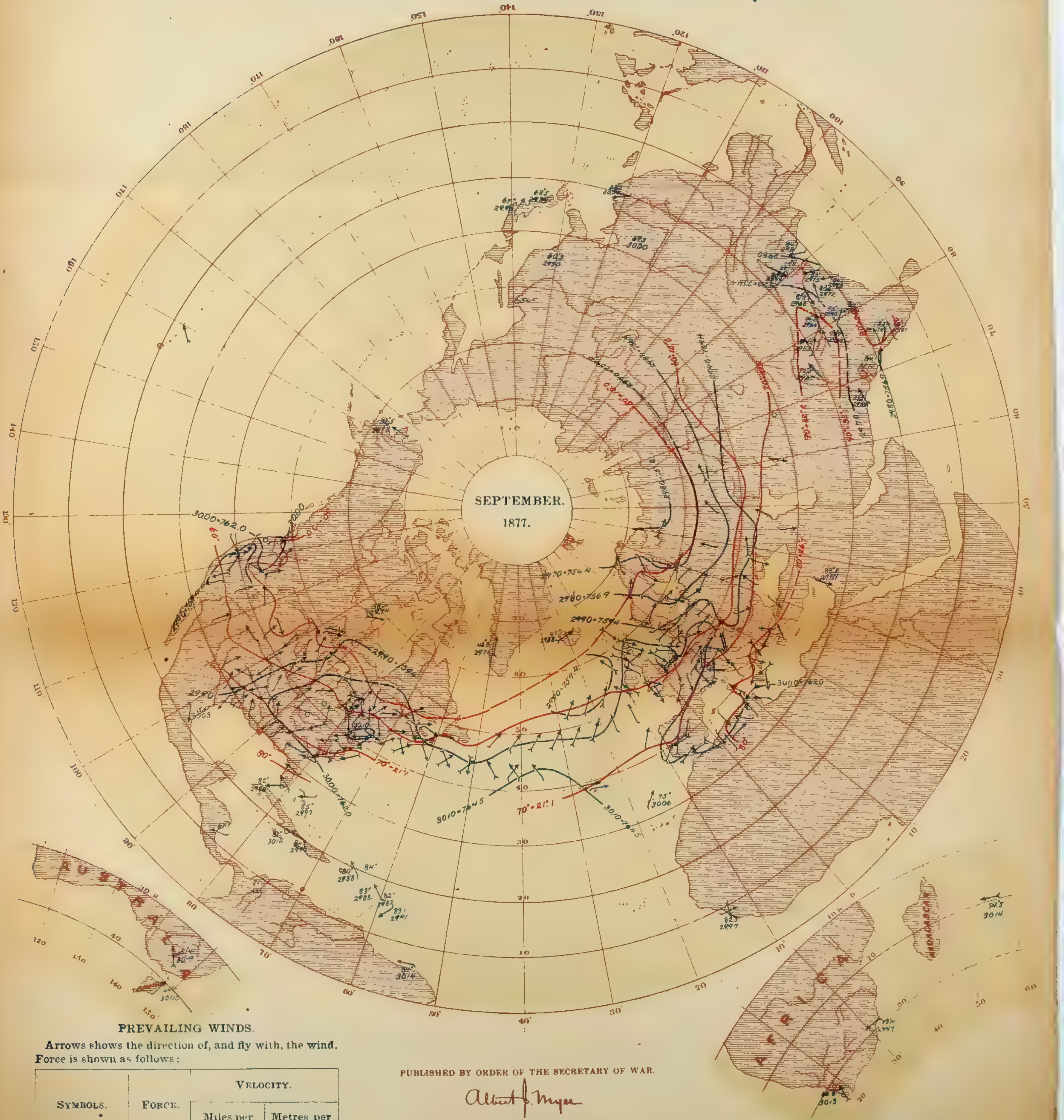

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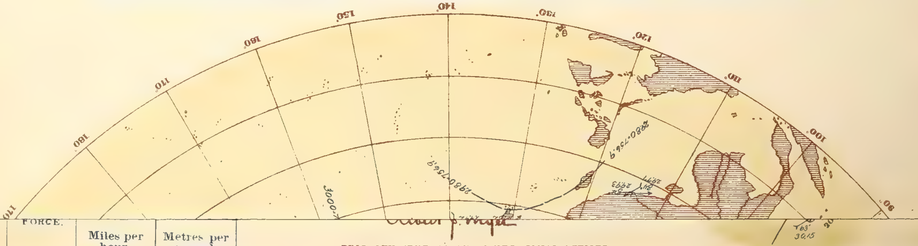

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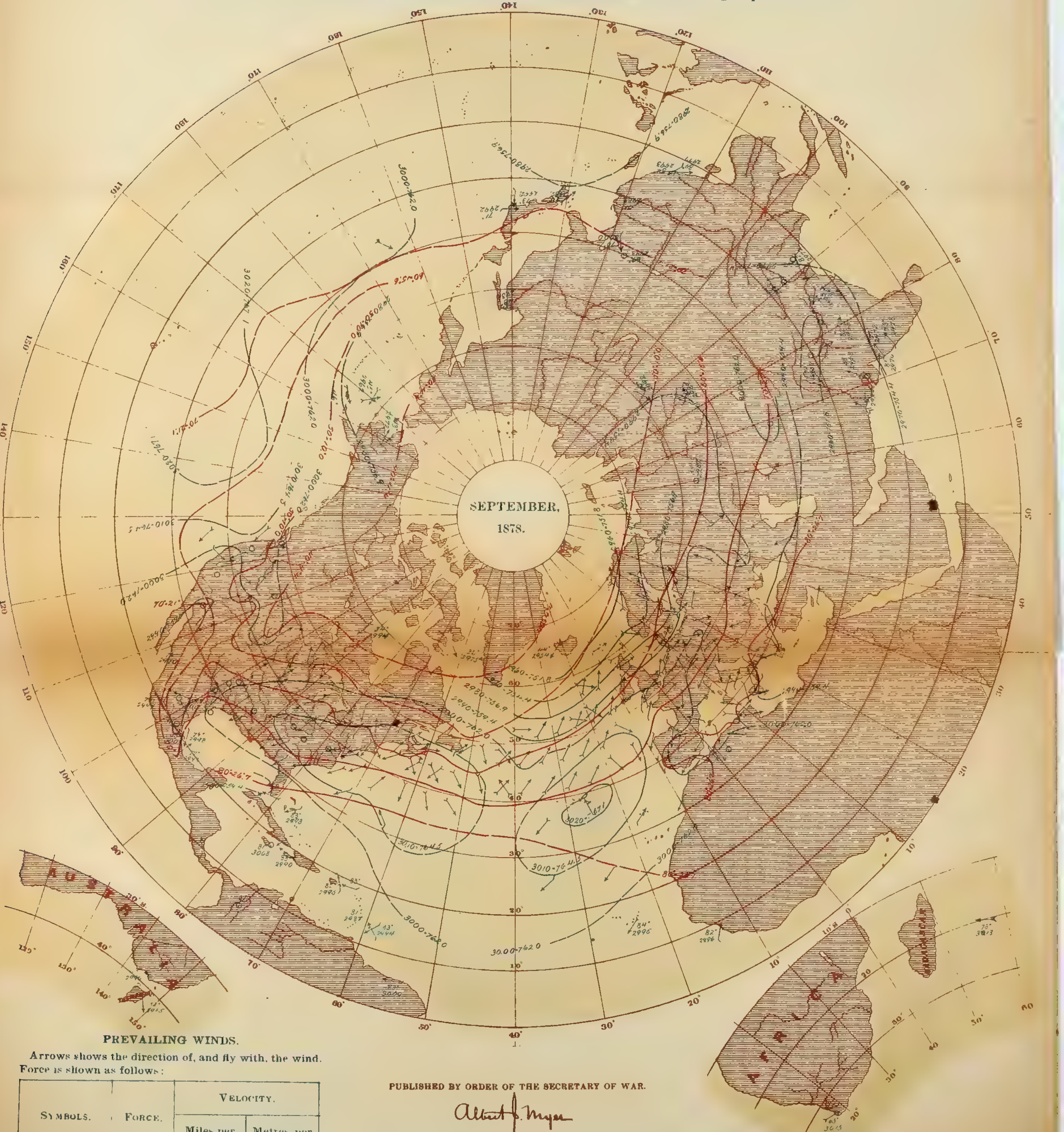

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BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

ISOBARS AND ISOTHERMS.

Isobars in *blue*; detached barometer means in English inches.

Isotherms in *red*; detached temperature means in degrees Fahrenheit.

Broken lines, are doubtful.

INTERNATIONAL MONTHLY CHART

Showing mean pressure, mean temperature, mean force and prevailing direction of winds at 7:35 A. M., Washington mean time, for the month of September, 1878, based on the daily charts of the International Bulletin

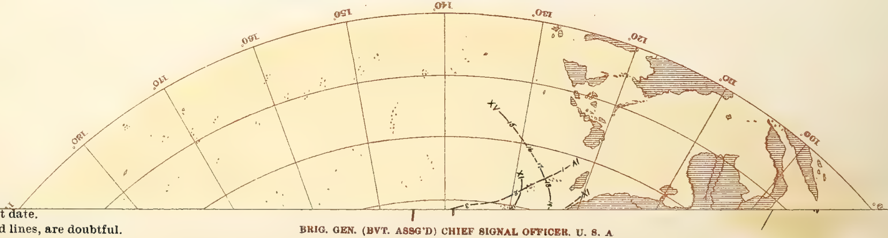
12

Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously, Series commencing October, 1877.

No. VI.



mean time, of that date.

Broken or dotted lines, are doubtful.

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER. U. S. A

INTERNATIONAL CHART.

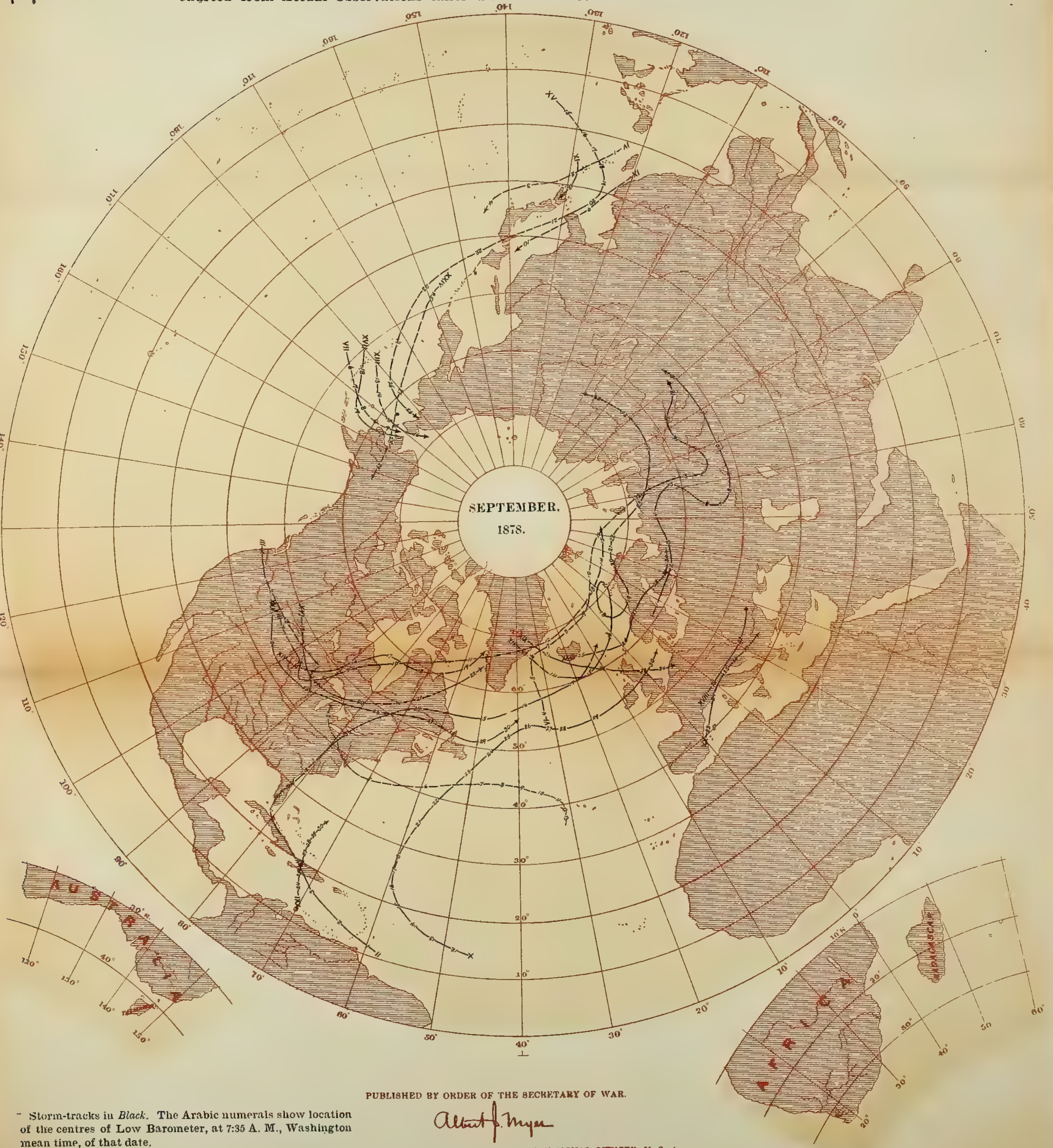
Showing Tracks of Centres of Low Barometer for September, 1878.

Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously, Series commencing October, 1877.

No. VI.



Storm-tracks in *Black*. The Arabic numerals show location of the centres of Low Barometer, at 7:35 A. M., Washington mean time, of that date.

Broken or dotted lines, are doubtful.

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BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A

INTERNATIONAL CHART.

Showing Tracks of Centres of Low Barometer for September, 1878.

WINDS ACCOMPANYING THE ATLANTIC STORMS.

American Coast.					European Coast.			
No.	DATE.	Direction.	Miles per Hour.	Meters per Second.	DATE.	Direction.	Miles per Hour.	Meters per Second.
I.	August 30.	—	—	—	Sept. 2	SW	*30 to 70	13.4 to 31.1
III.	Sept. 9.....	W	35	15.6	Sept. 12......	S'ly	*30 to 70	13.4 to 31.1
VI.	Sept. 25.....	W	25	11.2	Sept. 27......	SW'ly	*30 to 70	13.4 to 31.1

* Estimated from a scale of 0 to 9.

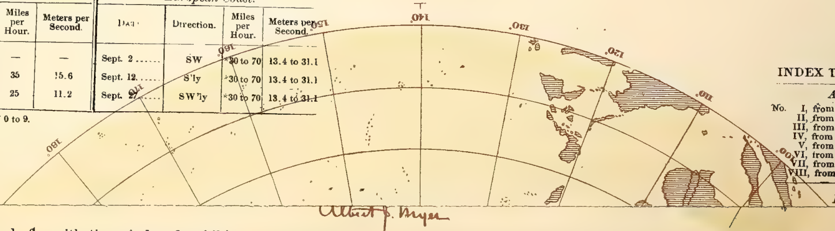
are doubtful.

Arrows, when charted, fly with the wind and exhibit wind-direction.

The tracks charted in black have appeared in previous *Reviews*.

The tracks charted in red have been made from data collected since preceding *Review*.

CHART No. IV.



Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A

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No. I, from Aug. 28th to Sept. 6th, 1879.
II, from Sept. 4th to Sept. 10th, 1879.
III, from Sept. 7th to Sept. 17th, 1879.
IV, from Sept. 14th to Sept. 18th, 1879.
V, from Sept. 20th to Sept. 22nd, 1879.
VI, from Sept. 20th to Sept. 29th, 1879.
VII, from Sept. 21st to Sept. 25th, 1879.
VIII, from Sept. 30th to Oct. 10th, 1879.

Pacific Ocean.

WINDS ACCOMPANYING THE ATLANTIC STORMS.

	American Coast.				European Coast.			
No.	Date.	Direction.	Miles per Hour.	Meters per Second.	Date.	Direction.	Miles per Hour.	Meters per Second.
I.	August 30.	—	—	—	Sept. 2	SW	*30 to 70	13.4 to 31.1
III.	Sept. 9	W	35	15.6	Sept. 12	S'ly	*30 to 70	13.4 to 31.1
VI.	Sept. 25	W	25	11.2	Sept. 27	SW'ly	*30 to 70	13.4 to 31.1

* Estimated from a scale of 0 to 9.

CHART No. IV.

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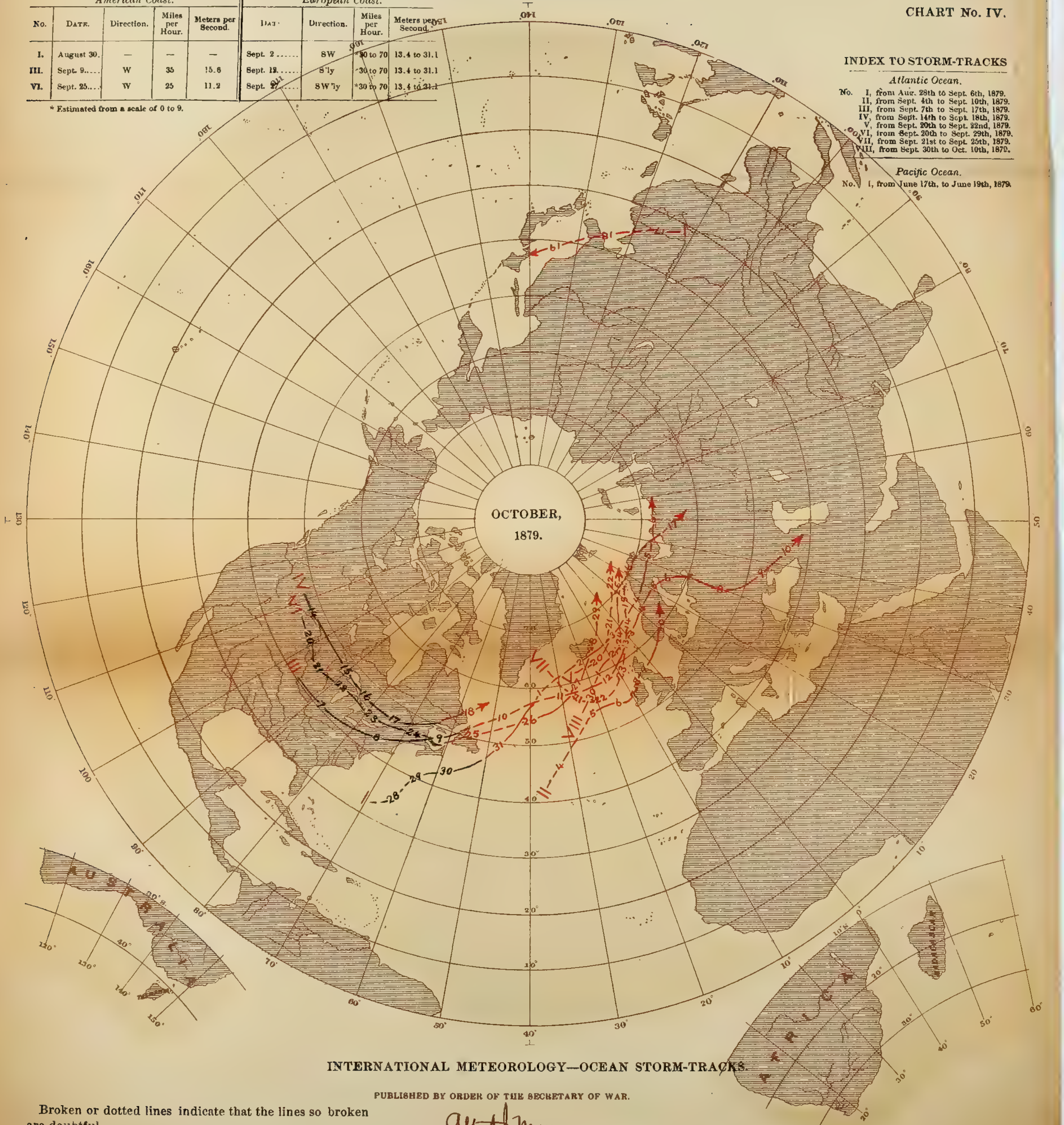
No. I, from Aug. 28th to Sept. 6th, 1879.
II, from Sept. 4th to Sept. 10th, 1879.
III, from Sept. 7th to Sept. 17th, 1879.
IV, from Sept. 14th to Sept. 18th, 1879.
V, from Sept. 20th to Sept. 22nd, 1879.
VI, from Sept. 20th to Sept. 29th, 1879.
VII, from Sept. 21st to Sept. 25th, 1879.
VIII, from Sept. 30th to Oct. 10th, 1879.

Pacific Ocean.

No. I, from June 17th, to June 19th, 1879.



INTERNATIONAL METEOROLOGY—OCEAN STORM-TRACKS.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A

Broken or dotted lines indicate that the lines so broken are doubtful.

Arrows, when charted, fly with the wind and exhibit wind-direction.

The tracks charted in black have appeared in previous *Reviews*.

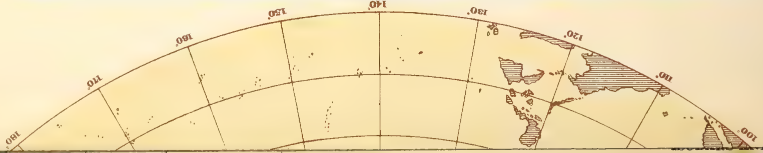
The tracks charted in red have been made from data collected since preceding *Review*.

No. V.

Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously. Series commencing September, 1877.



→	1, 2	0 to 9	0 to 4.0
→	3, 4	9.1 to 22.5	4.1 to 10.1
→	5, 6	22.6 to 40.5	10.1 to 18.1
→	7, 8	40.6 to 67.5	18.1 to 30.2
→	9, 10	67.6 up.	30.2 & over.

INTERNATIONAL MONTHLY CHART.

Showing mean pressure, mean temperature, mean force and prevailing direction of winds at 7:35 A. M., Washington mean time, for the month of October, 1878, based on the daily charts of the International Bulletin.

Isobars in *blue*; detached barometer means in English inches.

Isotherms in *red*; detached temperature means in degrees Fahrenheit.

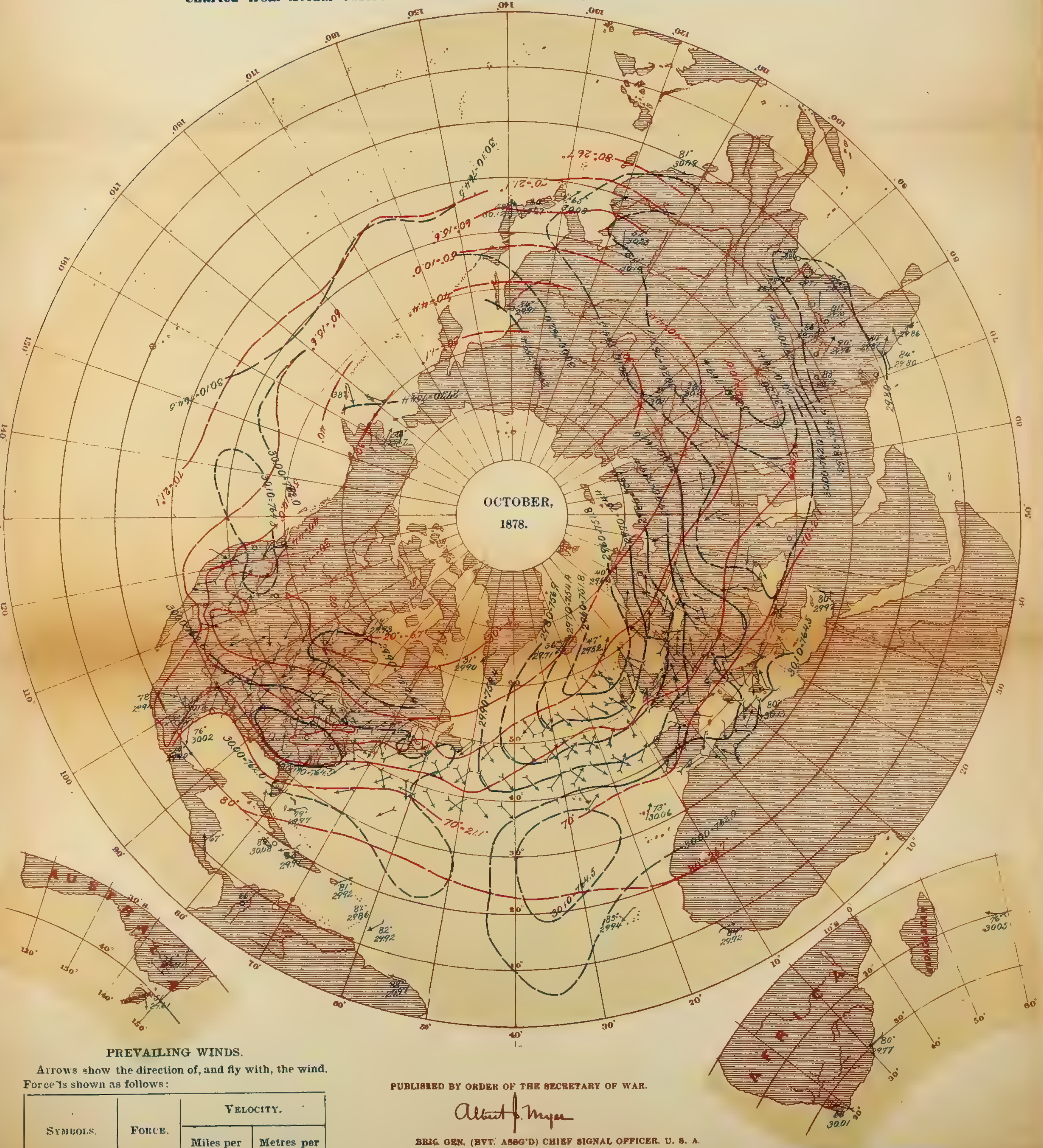
Broken lines are doubtful.

Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously. Series commencing September, 1877.

No. V.



PREVAILING WINDS.

Arrows show the direction of, and fly with, the wind. Force is shown as follows:

Symbols.	Force.	Velocity.	
		Miles per hour.	Metres per second.
⟶	1, 2	0 to 9	0 to 4.0
≻⟶	3, 4	9.1 to 22.5	4.1 to 10.1
≻≻⟶	5, 6	22.6 to 40.5	10.1 to 18.1
≫⟶	7, 8	40.6 to 67.5	18.1 to 30.2
⋙⟶	9, 10	67.6 up.	30.2 & over.

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UNITED STATES ARMY.

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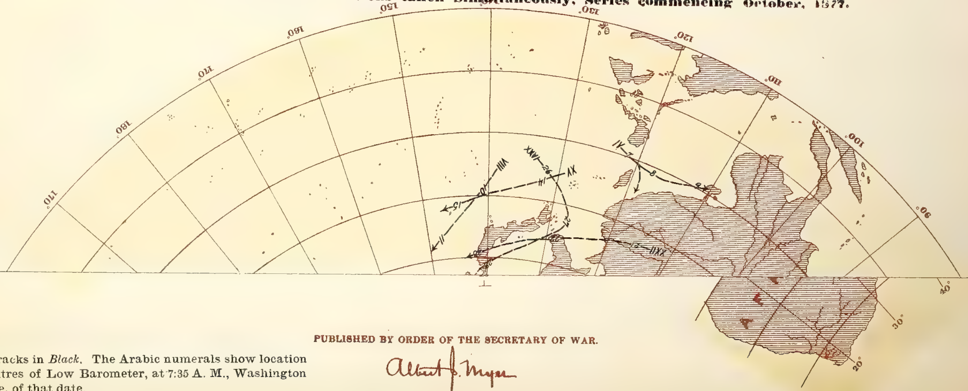

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Storm-tracks in *Black*. The Arabic numerals show location of the centres of Low Barometer, at 7:35 A. M., Washington mean time, of that date.

Broken or dotted lines, are doubtful.

INTERNATIONAL CHART.

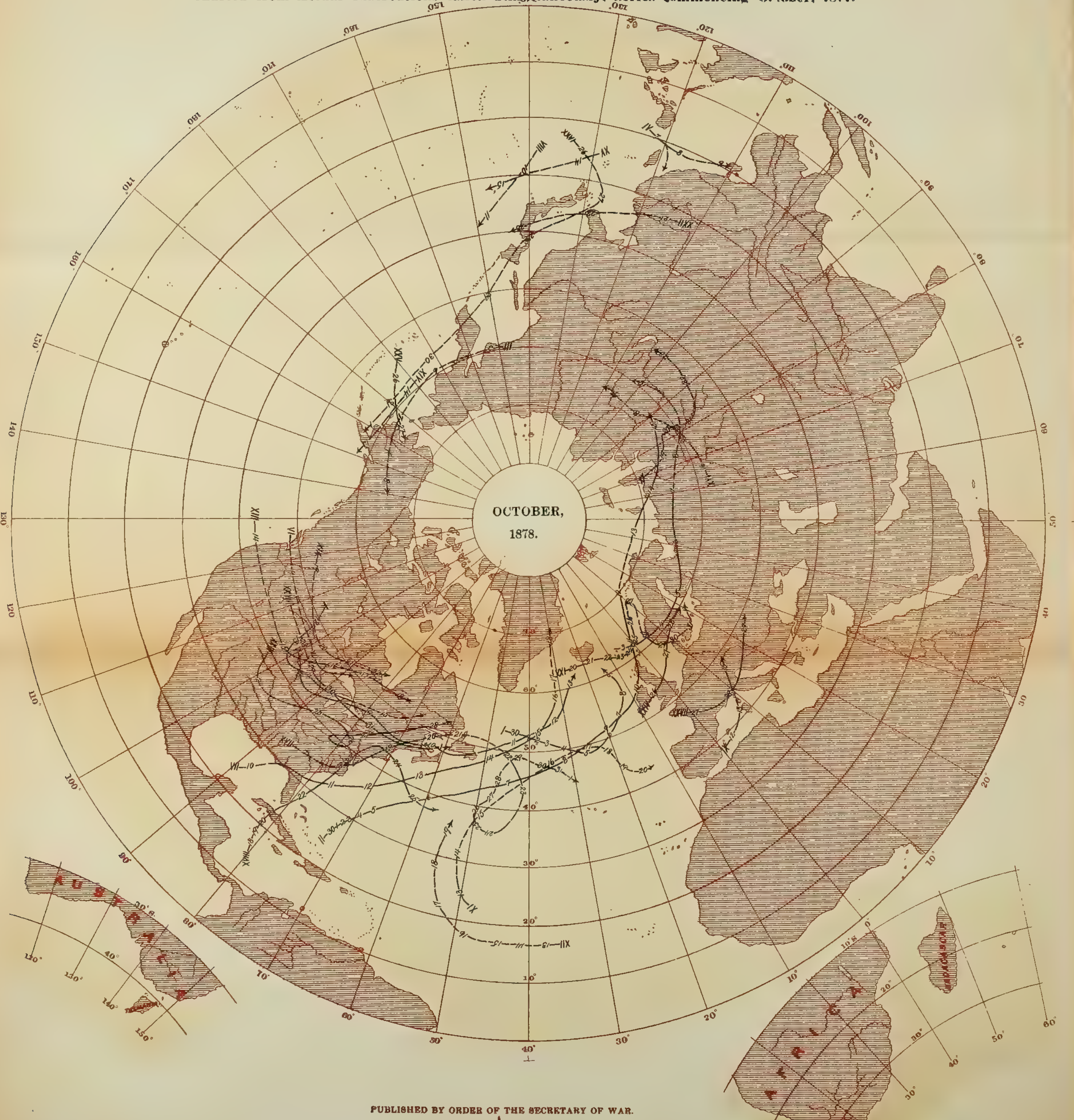
Showing Tracks of Centres of Low Barometer for October, 1878.

Office of the Chief Signal Officer,

UNITED STATES ARMY.

No. VI.

Charted from Actual Observations taken Simultaneously, Series commencing October, 1877.



Storm-tracks in *Black*. The Arabic numerals show location of the centres of Low Barometer, at 7:35 A. M., Washington mean time, of that date.

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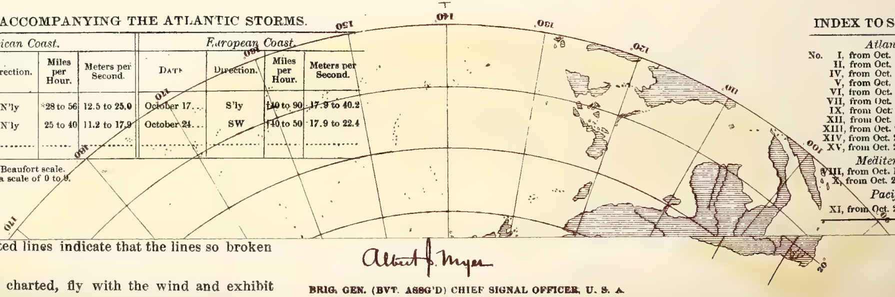
INTERNATIONAL CHART.
Showing Tracks of Centres of Low Barometer for
October, 1878.

CHART No. IV.

WINDS ACCOMPANYING THE ATLANTIC STORMS.

American Coast.					European Coast.			
No.	DATE.	Direction.	Miles per Hour.	Meters per Second.	DATE	Direction.	Miles per Hour.	Meters per Second.
IV.	Oct. 11 & 12	N'ly	*28 to 56	12.5 to 25.0	October 17	S'ly	†40 to 90	17.9 to 40.2
VI.	October 19.	N'ly	25 to 40	11.2 to 17.9	October 24	SW	†40 to 50	17.9 to 22.4

Estimated from Beaufort scale.
† Estimated from a scale of 0 to 9.



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IV,	from Oct. 9th to Oct. 18th, 1879.
V,	from Oct. 10th to Oct. 17th, 1879.
VI,	from Oct. 11th to Oct. 25th, 1879
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IX,	from Oct. 19th to Oct. 22nd, 1879.
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XIV,	from Oct. 27th to Oct. 30th 1879.
XV,	from Oct. 21st to Nov. 1st, 1879,
	Mediterranean Sea.
VIII,	from Oct. 14th to Oct. 19th, 1879.
X,	from Oct. 21st to 23rd, 1879.
	Pacific Ocean.
XI,	from Oct. 21st to Oct. 23rd, 1879.

Broken or dotted lines indicate that the lines so broken are doubtful.

Arrows, when charted, fly with the wind and exhibit wind-direction.

The tracks charted in black have appeared in previous *Reviews.*

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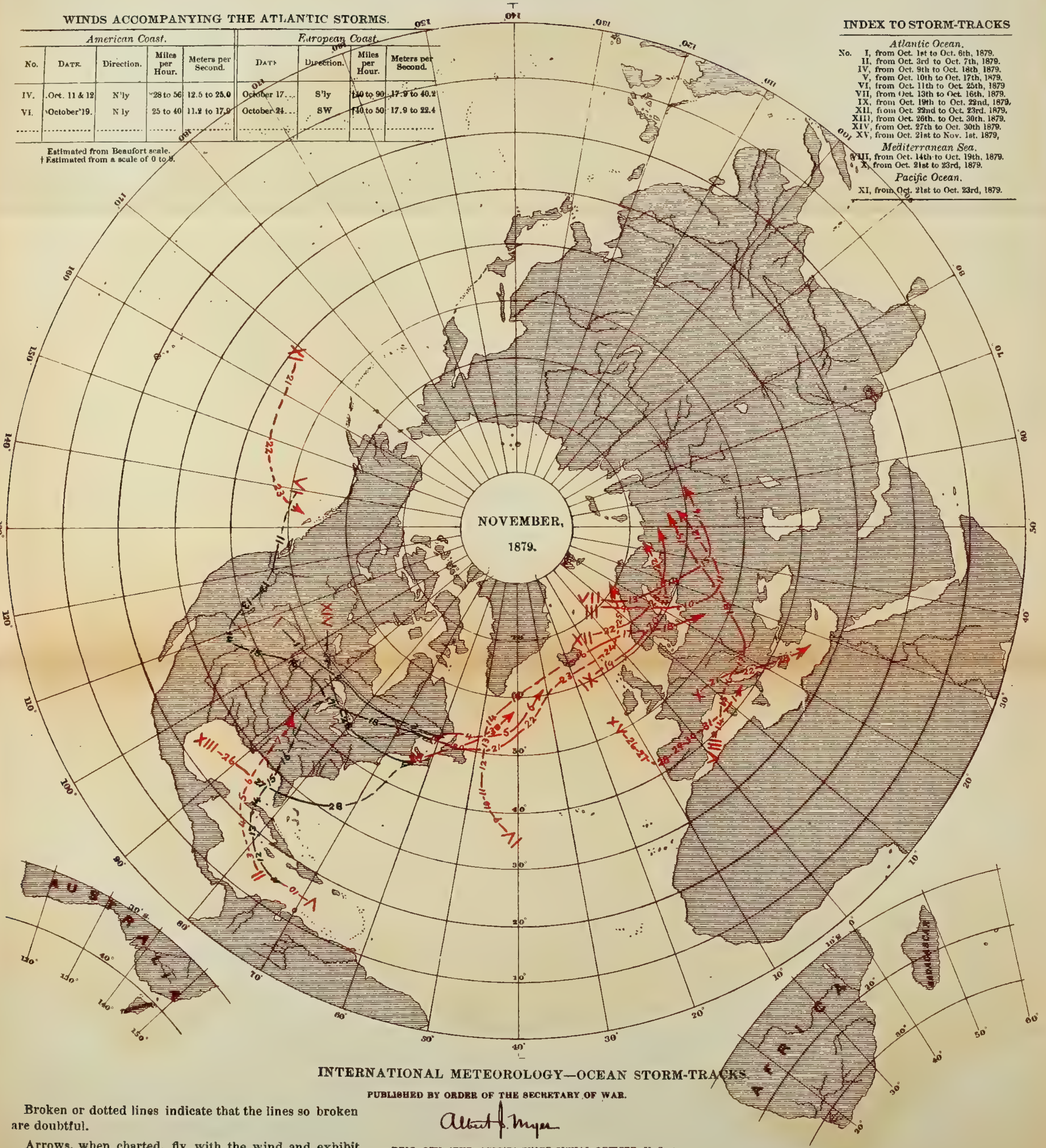
Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

CHART No. IV.



WINDS ACCOMPANYING THE ATLANTIC STORMS.

	American Coast.				*European Coast.*			
No.	DATE.	Direction.	Miles per Hour.	Meters per Second.	DATE.	Direction.	Miles per Hour.	Meters per Second.
IV.	Oct. 11 & 12	N'ly	*28 to 56	12.5 to 25.0	October 17	S'ly	†40 to 90	17.9 to 40.2
VI.	October 19.	N'ly	25 to 40	11.2 to 17.9	October 24	SW	†40 to 50	17.9 to 22.4

* Estimated from Beaufort scale.
† Estimated from a scale of 0 to 9.

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IV, from Oct. 9th to Oct. 18th, 1879.
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VI, from Oct. 11th to Oct. 25th, 1879
VII, from Oct. 13th to Oct. 16th, 1879.
IX, from Oct. 19th to Oct. 22nd, 1879.
XII, from Oct. 22nd to Oct. 23rd, 1879.
XIII, from Oct. 26th, to Oct. 30th, 1879.
XIV, from Oct. 27th to Oct. 30th 1879.
XV, from Oct. 21st to Nov. 1st, 1879,

Mediterranean Sea.

VIII, from Oct. 14th to Oct. 19th, 1879.
X, from Oct. 21st to 23rd, 1879.

Pacific Ocean.

XI, from Oct. 21st to Oct. 23rd, 1879.

INTERNATIONAL METEOROLOGY—OCEAN STORM-TRACKS.

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BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

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The tracks charted in red have been made from data collected since preceding *Review*.

CHART No. I

WINDS ACCOMPANYING THE ATLANTIC STORMS.

	American Coast.				*European Coast.*			
No.	DATE.	Direction.	Miles per Hour.	Meters per Second	DATE	Direction.	Miles per Hour.	Meters per Second.
II.	Nov. 3rd	NE'ly & w'ly	25 to 40	11.2 to 17.9	Nov. 9th.	W'ly	*40 to 50	*17.9 to 26.8

* Estimated from scale of 0 to 9

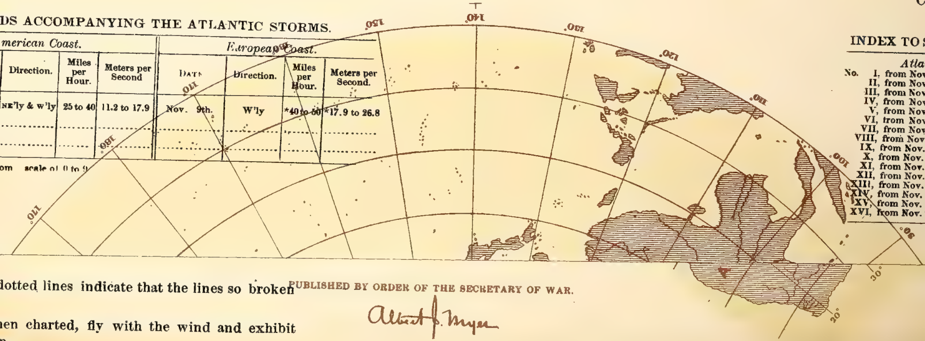

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CHART No. IV.

WINDS ACCOMPANYING THE ATLANTIC STORMS.

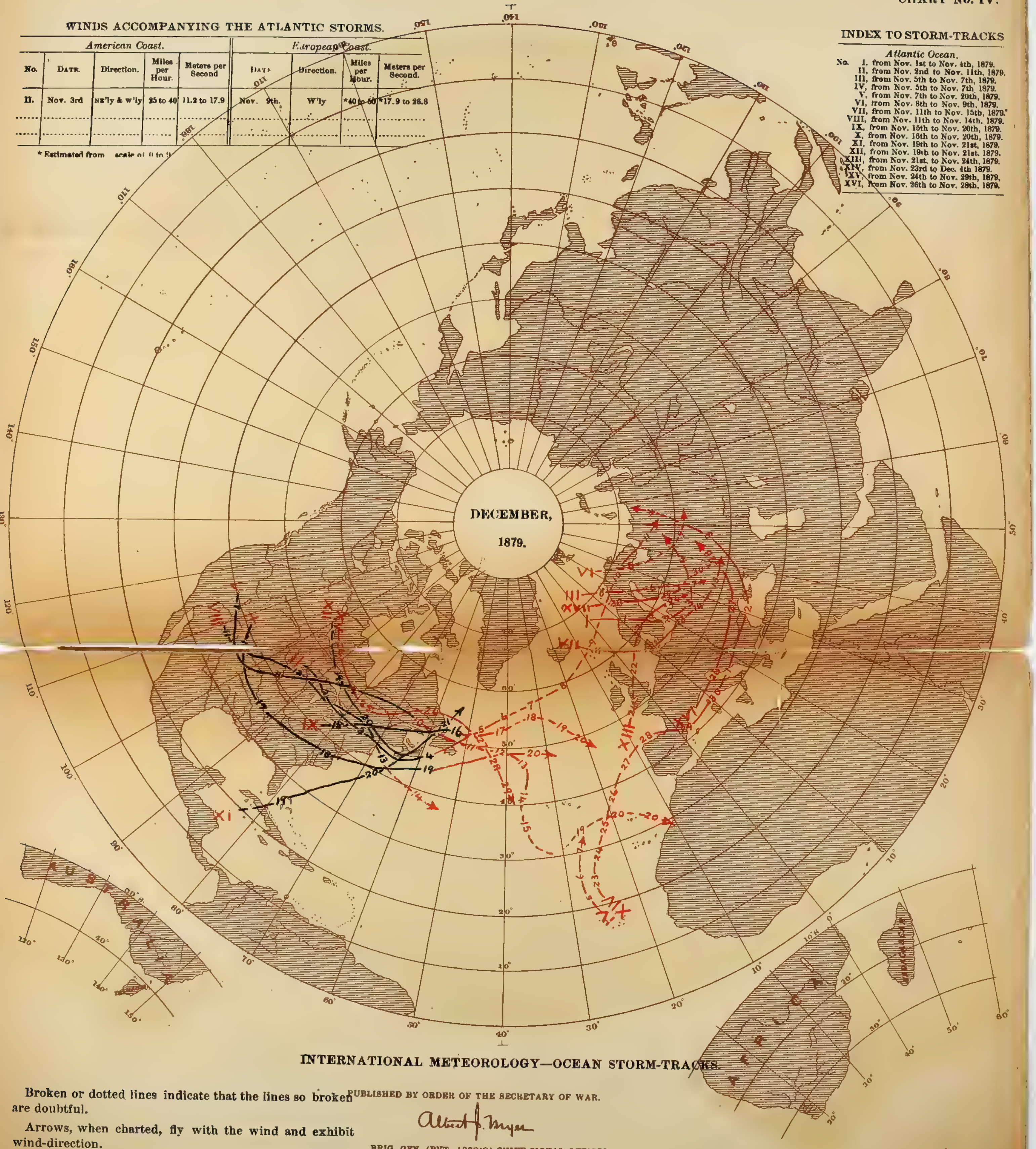
	American Coast.				European Coast.			
No.	Date.	Direction.	Miles per Hour.	Meters per Second	Date.	Direction.	Miles per Hour.	Meters per Second.
II.	Nov. 3rd	NE'ly & W'ly	25 to 40	11.2 to 17.9	Nov. 9th.	W'ly	*40 to 60	*17.9 to 26.8

* Estimated from scale of 0 to

INDEX TO STORM-TRACKS

Atlantic Ocean.

No. I, from Nov. 1st to Nov. 4th, 1879.
II, from Nov. 2nd to Nov. 11th, 1879.
III, from Nov. 5th to Nov. 7th, 1879.
IV, from Nov. 5th to Nov. 7th, 1879.
V, from Nov. 7th to Nov. 20th, 1879.
VI, from Nov. 8th to Nov. 9th, 1879.
VII, from Nov. 11th to Nov. 15th, 1879.
VIII, from Nov. 11th to Nov. 14th, 1879.
IX, from Nov. 15th to Nov. 20th, 1879.
X, from Nov. 16th to Nov. 20th, 1879.
XI, from Nov. 19th to Nov. 21st, 1879.
XII, from Nov. 19th to Nov. 21st, 1879.
XIII, from Nov. 21st, to Nov. 24th, 1879.
XIV, from Nov. 23rd to Dec. 4th 1879.
XV, from Nov. 24th to Nov. 29th, 1879.
XVI, from Nov. 26th to Nov. 28th, 1879.



INTERNATIONAL METEOROLOGY—OCEAN STORM-TRACKS.

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Arrows, when charted, fly with the wind and exhibit wind-direction.

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The tracks charted in red have been made from data collected since preceding *Review*.

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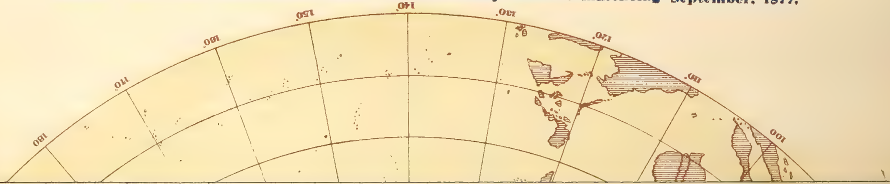
BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A

Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously. Series commencing September, 1877.

No. V.



→	1, 2	0 to 9	0 to 4.0
>→	3, 4	9.1 to 22.5	4.1 to 10.1
>>→	5, 6	22.6 to 40.5	10.1 to 18.1
>>>→	7, 8	40.6 to 67.5	18.1 to 30.2
>>>>→	9, 10	67.6 up.	30.2 & over.

INTERNATIONAL MONTHLY CHART,

Showing mean pressure, mean temperature, mean force and prevailing direction of winds at 7:35 A. M., Washington mean time, for the month of December, 1877, based on the daily charts of the International Bulletin.

ISOBARS AND ISOTHERMS.

Isobars in *blue*; detached barometer means in English inches.

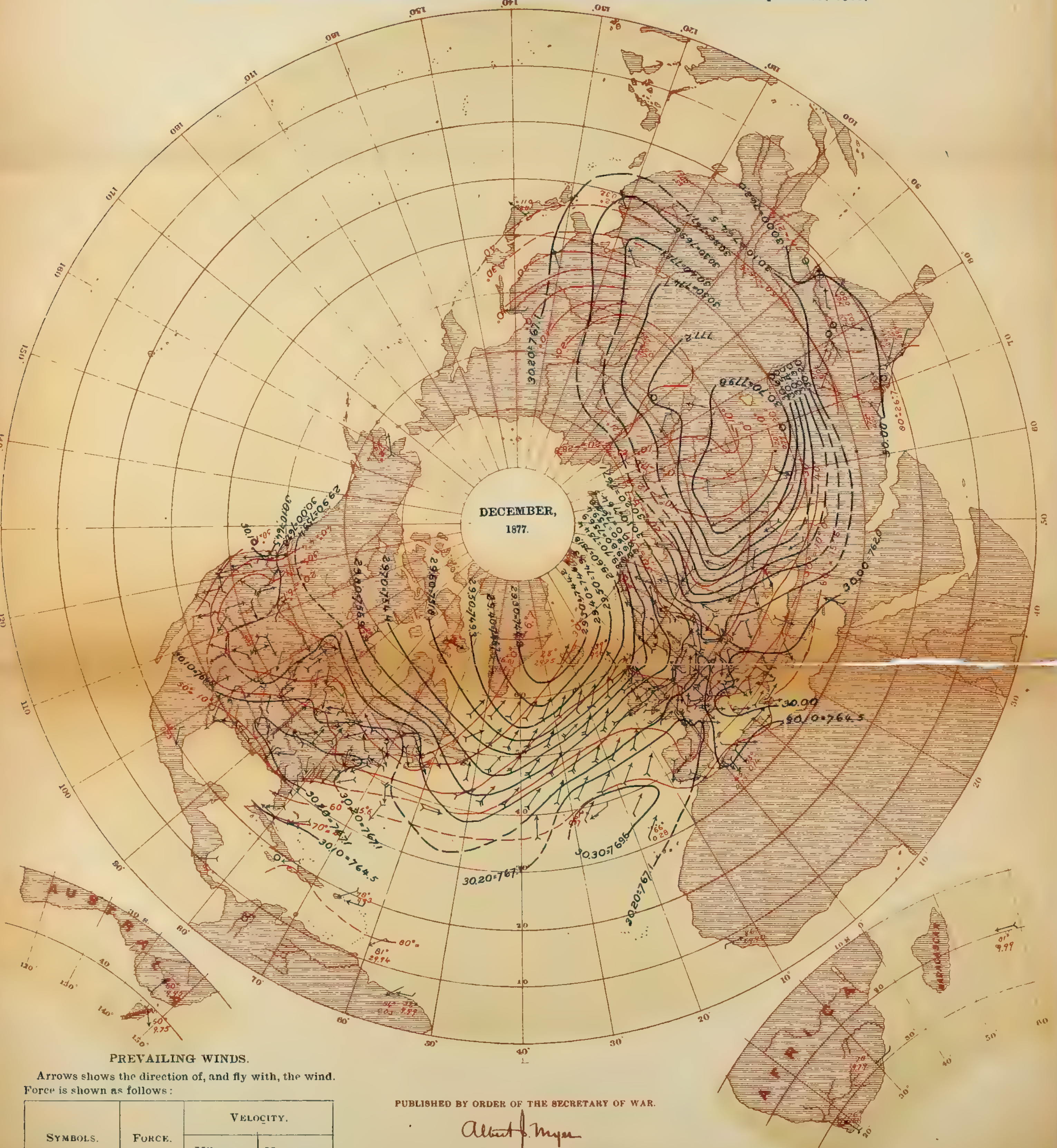
Isotherms in *red*; detached temperature means in degrees Fahrenheit.

Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously. Series commencing September, 1877.

No. V.



PREVAILING WINDS.

Arrows shows the direction of, and fly with, the wind. Force is shown as follows:

Symbols.	Force.	Velocity.	
		Miles per hour.	Metres per second.
⟶	1, 2	0 to 9	0 to 4.0
≻⟶	3, 4	9.1 to 22.5	4.1 to 10.1
⋙⟶	5, 6	22.6 to 40.5	10.1 to 18.1
⋙⟶	7, 8	40.6 to 67.5	18.1 to 30.2
⋙⟶	9, 10	67.6 up.	30.2 & over.

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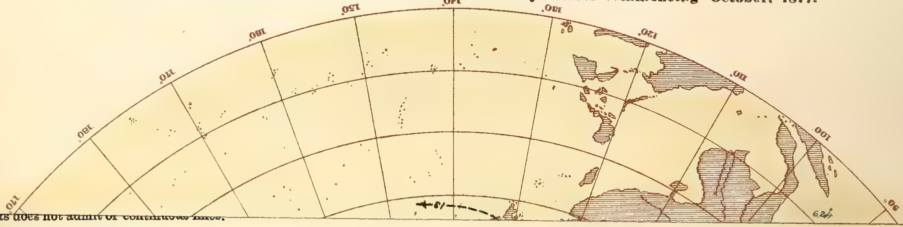


lack of reports does not admit of continuous lines.

Broken or dotted lines. are doubtful.

INTERNATIONAL CHART.

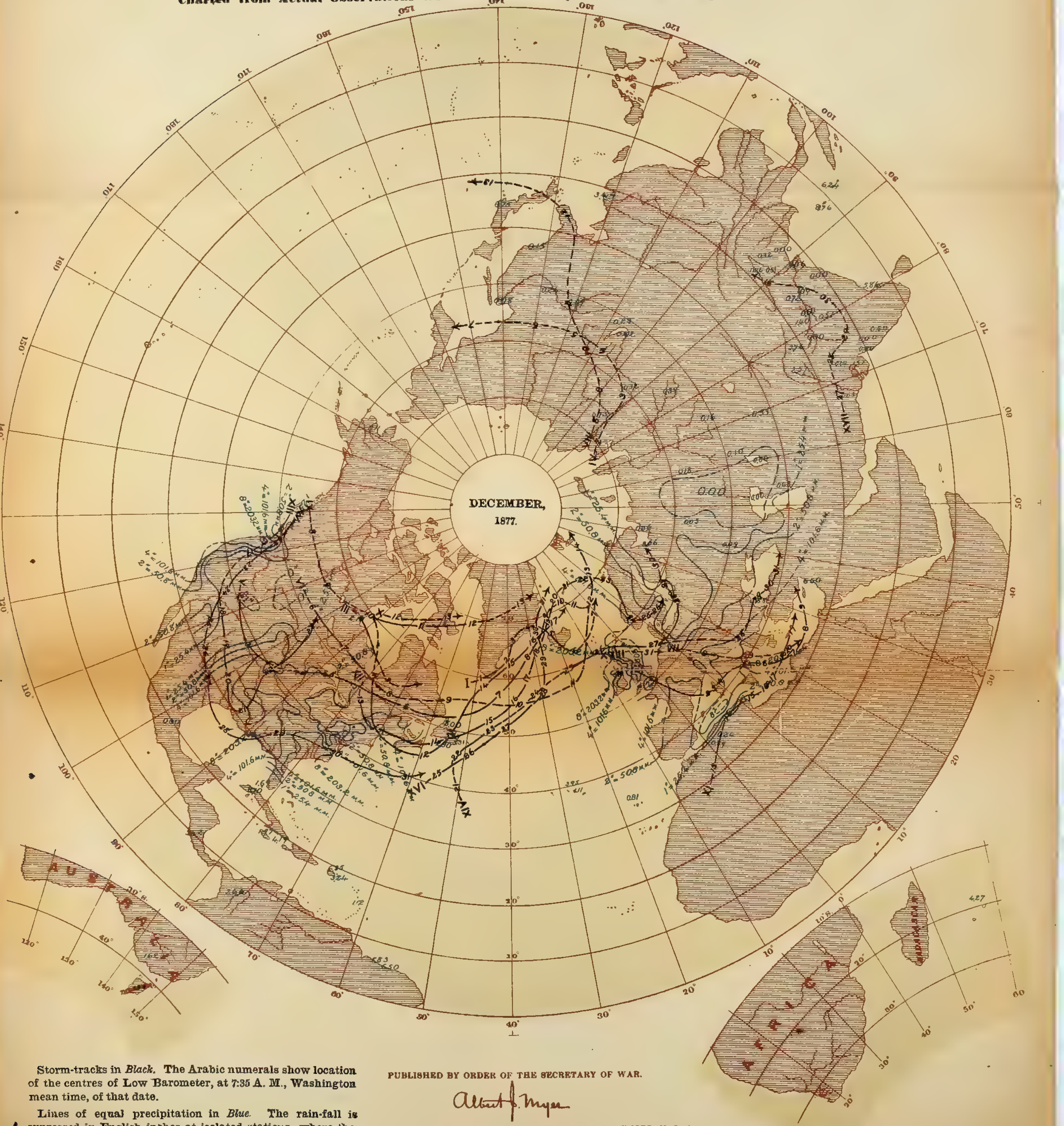
Showing Tracks of Centres of Low Barometer, and Precipitation Lines. for December, 1877.

Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously. Series commencing October, 1877.

No. VI.



Storm-tracks in *Black*. The Arabic numerals show location of the centres of Low Barometer, at 7:35 A. M., Washington mean time, of that date.

Lines of equal precipitation in *Blue*. The rain-fall is expressed in English inches at isolated stations, where the lack of reports does not admit of continuous lines.

Broken or dotted lines. are doubtful.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

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BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER. U. S. A.

INTERNATIONAL CHART.

Showing Tracks of Centres of Low Barometer, and Precipitation Lines. for December, 1877.

CHART No. IV.

WINDS ACCOMPANYING THE ATLANTIC STORMS.

American Coast.					European Coast.			
No.	DATE.	Direction.	Miles per Hour.	Meters per Second.	DATE.	Direction.	Miles per Hour.	Meters per Second.
II.	Dec 4.	Northerly.	30	13.4	Dec. 8 & 9.	SW.	*80 to 90	* 33.8 to 40.2
V	15	Easterly.	35	15,6	21	SE.	*40 to 80	* 17.9 to 33.8
VII	22	Northeast'ly	40	17·9	27	SSW.	*80 to 99	* 33.8 to 40.2
VIII	25	SW. & E.	35	15.6	28	SSW.	*80 to 99	* 33.8 to 40.2

* Estimated from a scale of 0 to 9.

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Atlantic Ocean.

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I,	from Nov. 29th to Dec. 7th, 1879.
II,	from Dec. 2nd to Dec. 10th, 1879.
III,	from Dec. 8th to Dec. 11th, 1879.
IV,	from Dec. 8th to Dec. 13th, 1879.
V,	from Dec. 14th to Dec. 25th, 1879.
VI,	from Dec. 21st to Dec. 22nd, 1879.
VII,	from Dec. 22nd to Dec. 29th, 1879.
VIII,	from Dec. 23rd to Dec. 28th, 1879.

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER. U. S. A.

wind-direction.

The tracks charted in black have appeared in previous *Reviews.*

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CHART No. IV.

WINDS ACCOMPANYING THE ATLANTIC STORMS.

	American Coast.				European Coast.			
No.	DATE.	Direction.	Miles per Hour.	Meters per Second.	DATE	Direction.	Miles per Hour.	Meters per Second.
II.	Dec 4.	Northerly.	30	13.4	Dec. 8 & 9.	SW.	*80 to 90	* 33.8 to 40.2
V	15	Easterly.	35	15,6	21	SE.	*40 to 80	* 17.9 to 33.8
VII	22	Northeast'ly	40	17.9	27	SSW.	*80 to 99	* 33.8 to 40.2
VIII	25	SW. & E.	35	15.6	28	SSW.	*80 to 99	* 33.8 to 40.2

* Estimated from a scale of 0 to 9.

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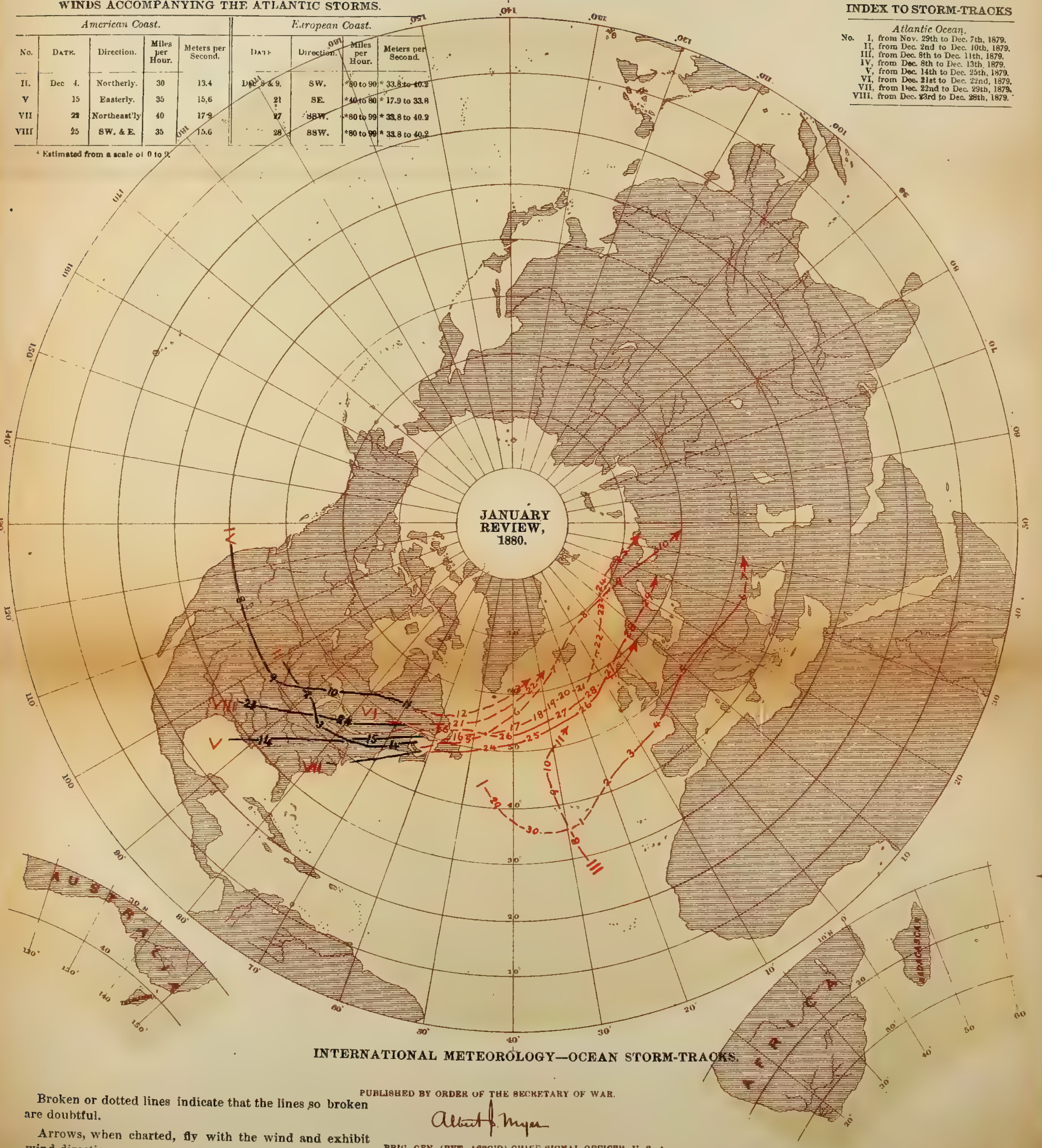
Atlantic Ocean.

No. I, from Nov. 29th to Dec. 7th, 1879.
II, from Dec. 2nd to Dec. 10th, 1879.
III, from Dec. 8th to Dec. 11th, 1879.
IV, from Dec. 8th to Dec. 13th, 1879.
V, from Dec. 14th to Dec. 25th, 1879.
VI, from Dec. 21st to Dec. 22nd, 1879.
VII, from Dec. 22nd to Dec. 29th, 1879.
VIII, from Dec. 23rd to Dec. 28th, 1879.



INTERNATIONAL METEOROLOGY—OCEAN STORM-TRACKS.

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Arrows, when charted, fly with the wind and exhibit wind-direction.

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PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

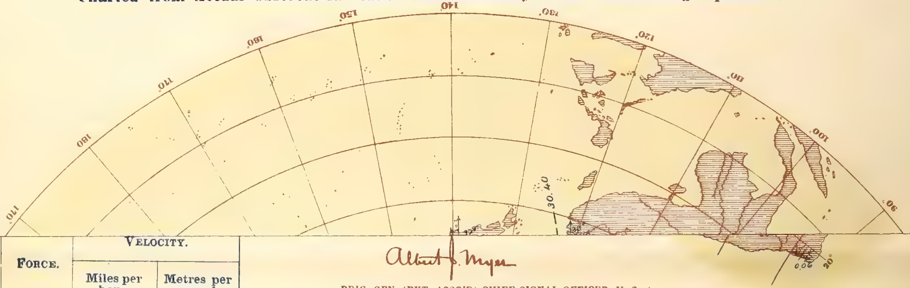
BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER. U. S. A.

Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously. Series commencing September, 1877.

No. V.



Albert J. Myer

BRIG. GEN. (BVT. ASS'D) CHIEF SIGNAL OFFICER. U. S. A

SYMBOLS.	FORCE.	VELOCITY.	
		Miles per hour.	Metres per second.
→	1, 2	0 to 9	0 to 4.0
→	3, 4	9.1 to 22.5	4.1 to 10.1
→	5, 6	22.6 to 40.5	10.1 to 18.1
→	7, 8	40.6 to 67.5	18.1 to 30.2
→	9, 10	67.6 up	30.2 & over.

INTERNATIONAL MONTHLY CHART.

Showing mean pressure, mean temperature, mean force and prevailing direction of winds at 7:35 A. M., Washington mean time, for the month of January, 1878, based on the daily charts of the International Bulletin.

ISOBARS AND ISOTHERMS.

Isobars in *blue*; detached barometer means in English inches.

Isotherms in *red*; detached temperature means in degrees Fahrenheit.

Office of the Chief Signal Officer,

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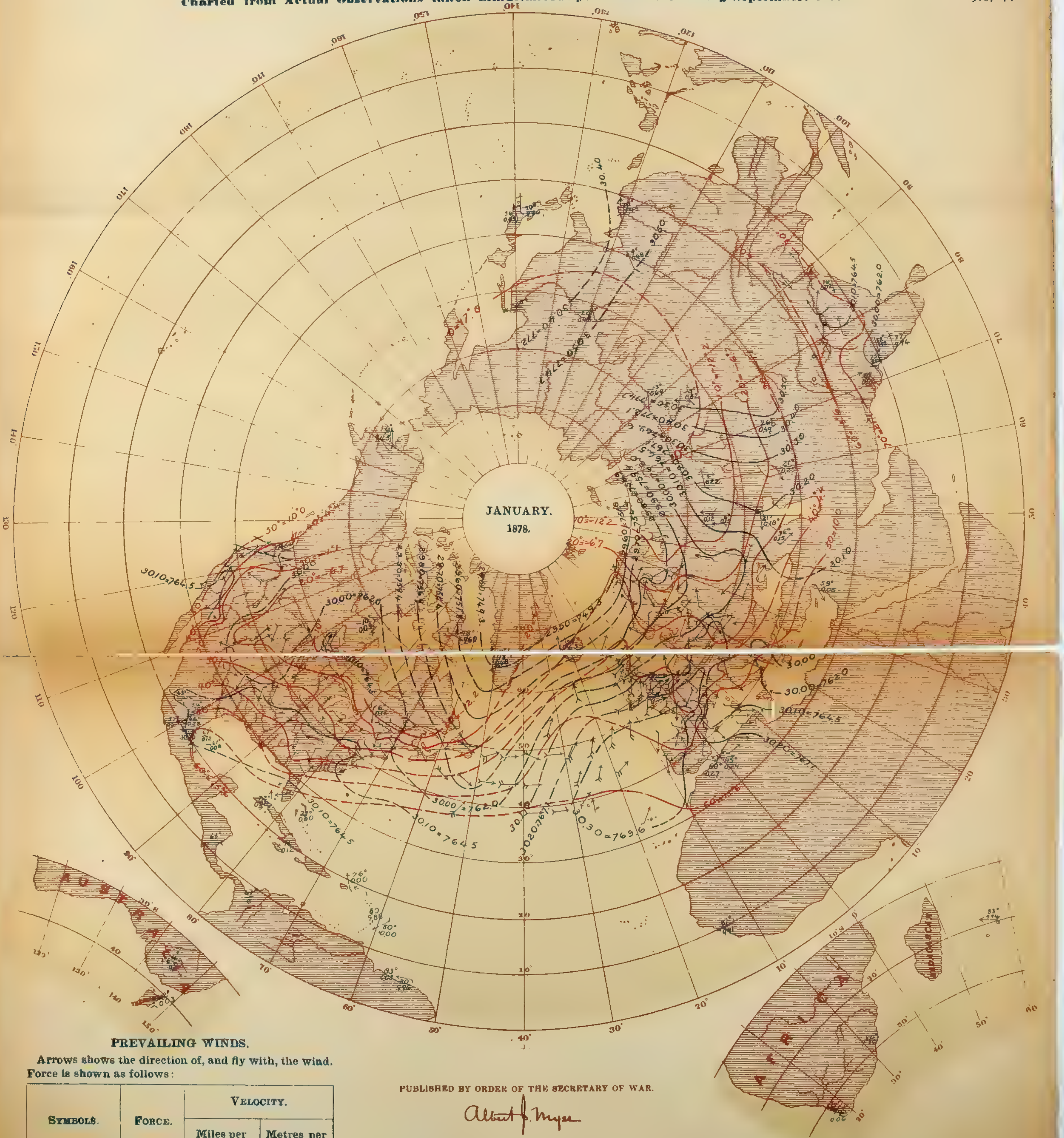

PREVAILING WINDS.

Arrows shows the direction of, and fly with, the wind. Force is shown as follows:

Symbols.	Force.	Velocity.	
		Miles per hour.	Metres per second.
→	1, 2	0 to 9	0 to 4.0
≻→	3, 4	9.1 to 22.5	4.1 to 10.1
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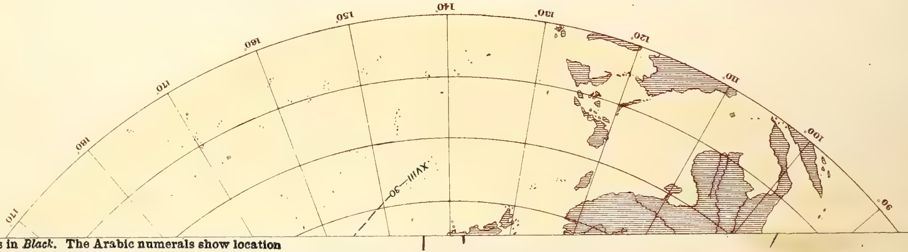
No. VI.

Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously, Series commencing October. 1877.



Storm-tracks in *Black*. The Arabic numerals show location of the centres of Low Barometer, at 7:35 A. M., Washington mean time, of that date.

Broken or dotted lines, are doubtful.

BRIG. GEN. (BVT ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

INTERNATIONAL CHART.

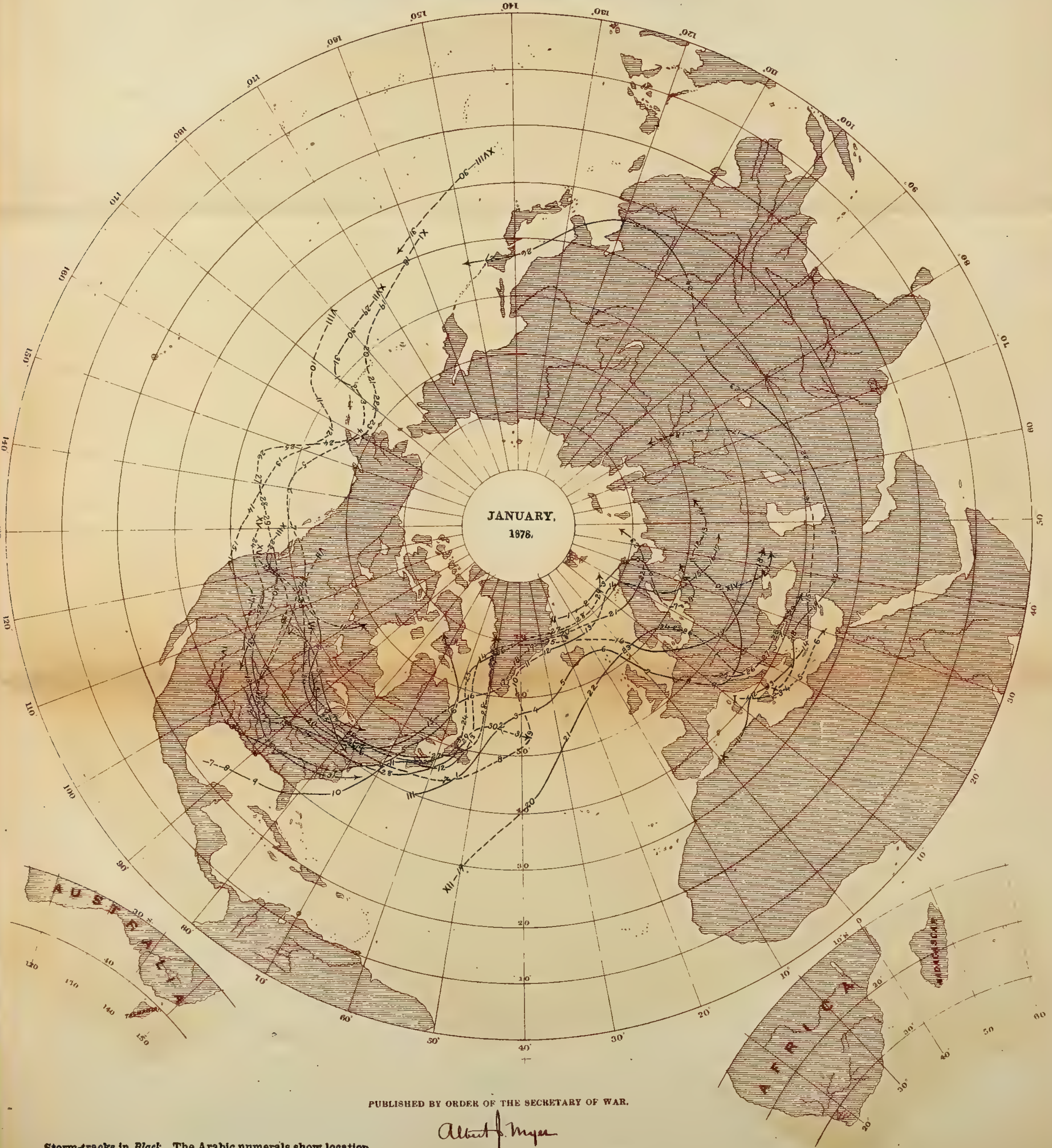
Showing Tracks of Centres of Low Barometer *for* January, 1878.

No. VI.

Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously, Series commencing October, 1877.



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INTERNATIONAL CHART.

Showing Tracks of Centres of Low Barometer for January, 1878.

CHART No. IV.

WINDS ACCOMPANYING THE ATLANTIC STORMS.

	American Coast.				European Coast.			
No.	DATE.	Direction.	Miles per Hour.	Meters per Second.	DATE.	Direction.	Miles per Hour.	Meters per Second.
I.	Dec. 29	E.	40	17.9	Jan. 2	WSW.	*70	*31.3
IV	Jan. 4	W.	40	17·9	9	SW.	*50	*22.3
VII	4	W.	35	15,6	25	SE.	*70	*31.3

* Estimated from a scale of 0 to 8

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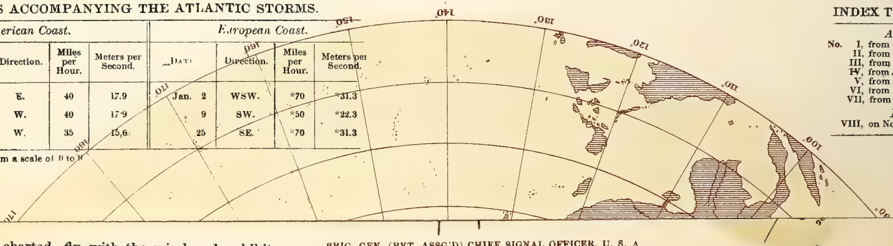
III, from Dec. 31, 1879, to Jan. 4, 1880.
IV, from Jan. 2, 1880, to Jan. 10, 1880.
V, from Jan. 12, 1880, to Jan. 24, 1880.
VI, from Jan. 18, 1880, to Jan. 20, 1880.
VII, from Jan. 22, 1880, to Jan. 27, 1880.

Pacific Ocean.

VIII, on November 28th, 1879.



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BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER. U. S. A

CHART No. IV.

WINDS ACCOMPANYING THE ATLANTIC STORMS.

	American Coast.				*European Coast.*			
No.	DATE.	Direction.	Miles per Hour.	Meters per Second.	DATE.	Direction.	Miles per Hour.	Meters per Second.
I.	Dec. 29	E.	40	17.9	Jan. 2	WSW.	*70	*31.3
IV	Jan. 4	W.	40	17·9	9	SW.	*50	*22.3
VII	4	W.	35	15,6.	25	SE.	*70	*31.3

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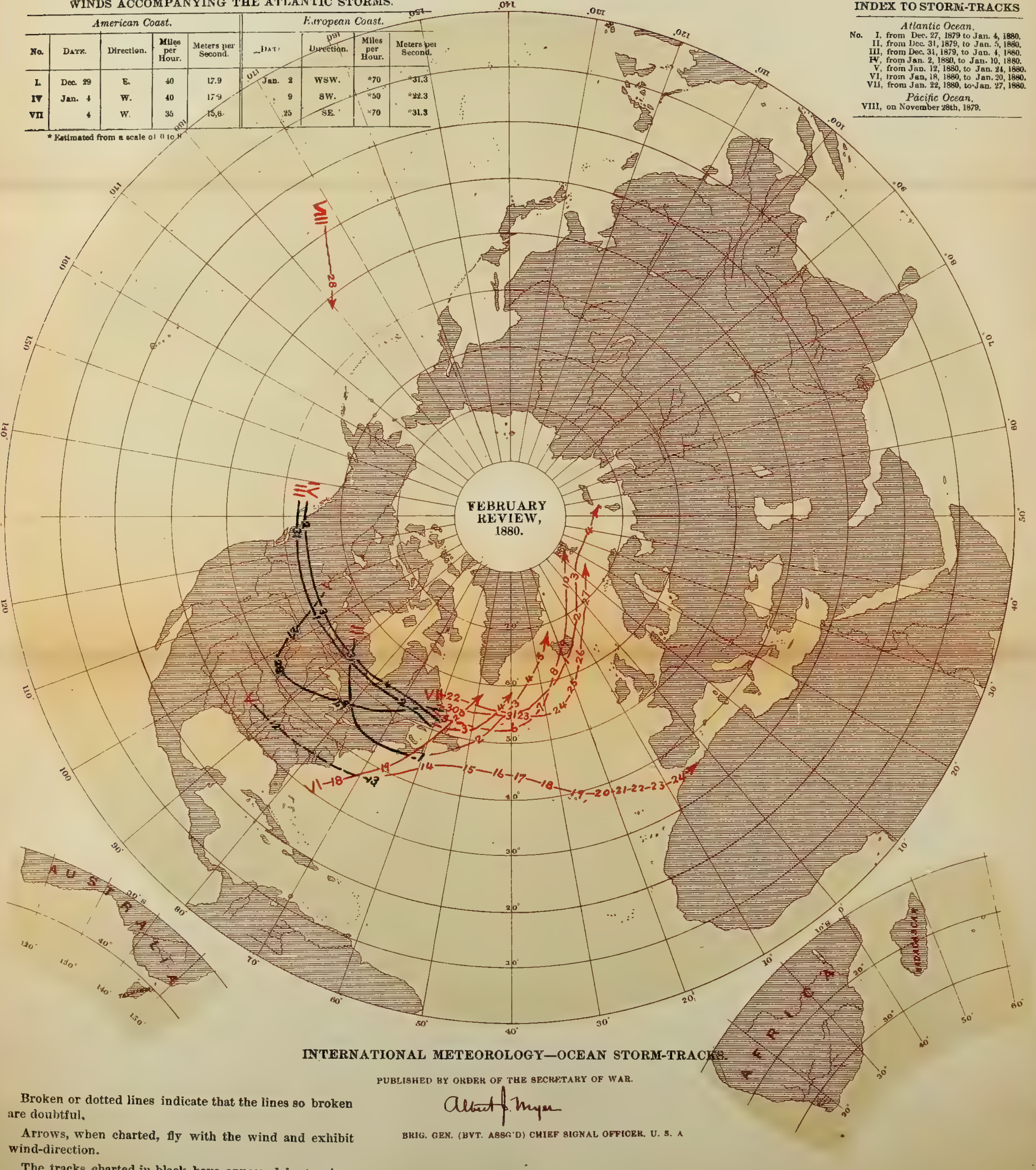

INTERNATIONAL METEOROLOGY—OCEAN STORM-TRACKS.

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Albert J. Myer

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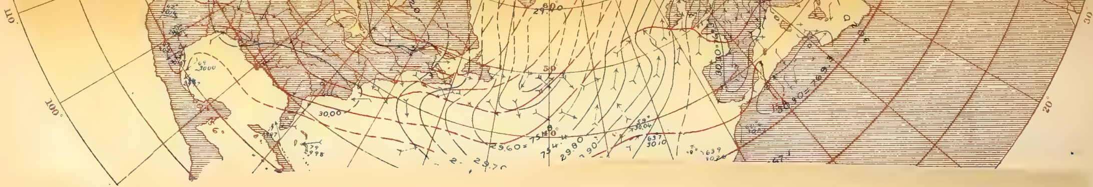

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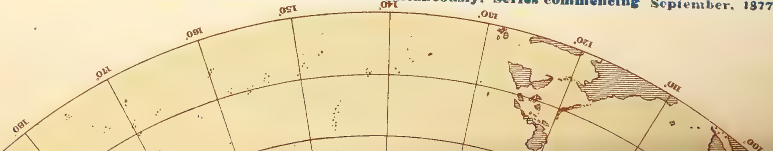
Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously. Series commencing September, 1877.

No. V.



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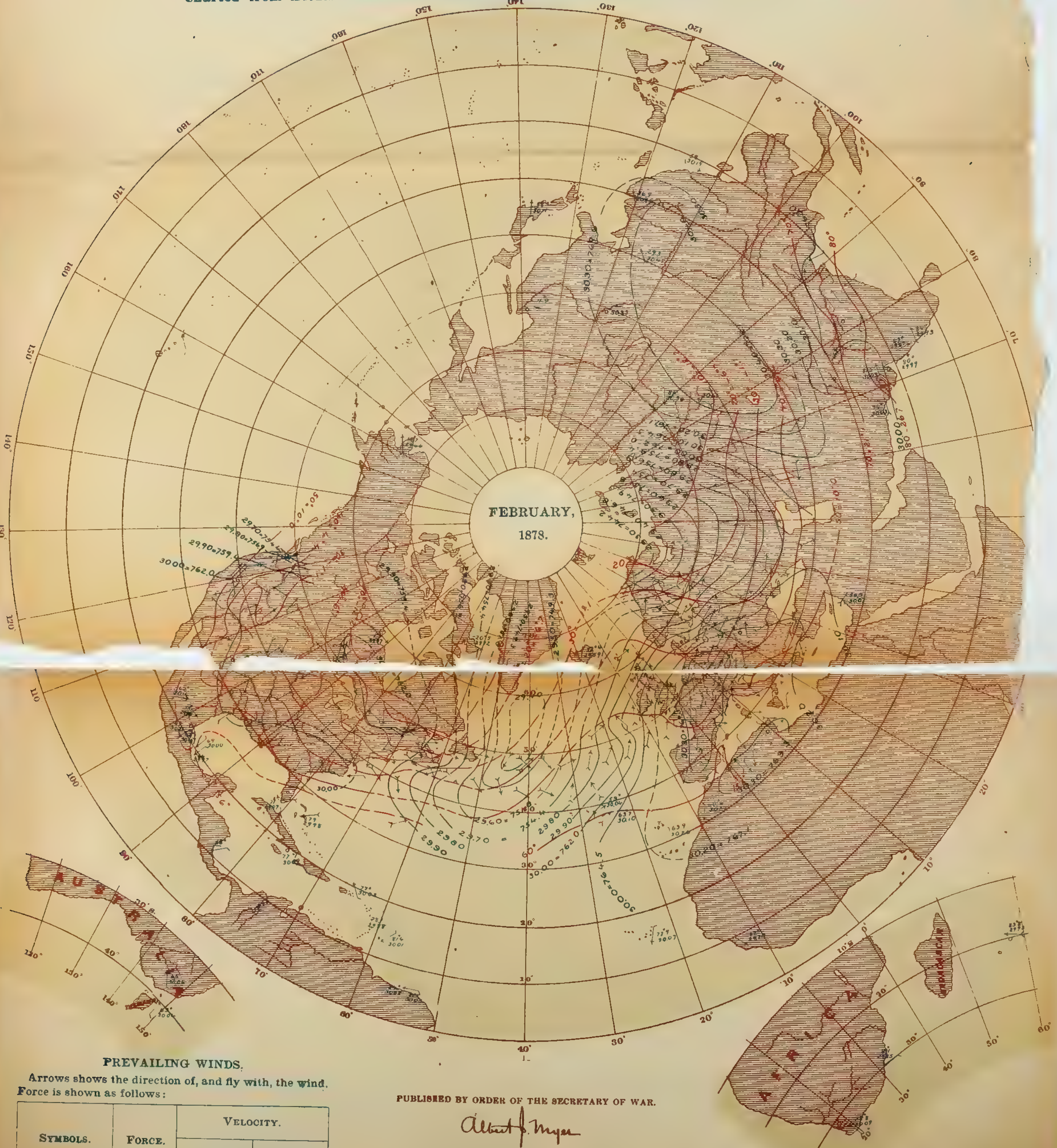

PREVAILING WINDS.

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Symbols.	Force.	Velocity.	
		Miles per hour.	Metres per second.
→	1, 2	0 to 9	0 to 4.0
>→	3, 4	9.1 to 22.5	4.1 to 10.1
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INTERNATIONAL MONTHLY CHART,

Showing mean pressure, mean temperature, mean force and prevailing direction of winds at 7:35 A. M., Washington mean time, for the month of February, 1878, based on the daily charts of the International Bulletin.

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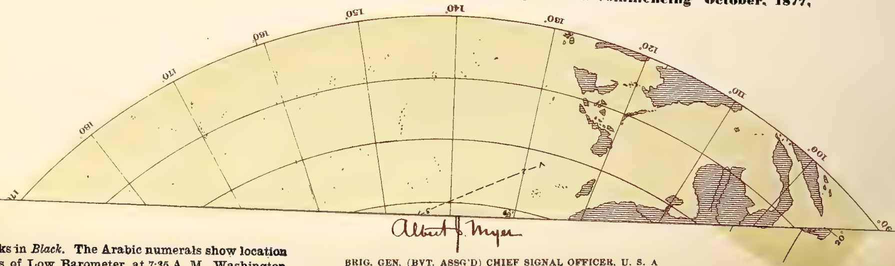

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER. U. S. A

Storm-tracks in *Black*. The Arabic numerals show location of the centres of Low Barometer, at 7:35 A. M., Washington mean time, of that date.

Broken or dotted lines, are doubtful.

INTERNATIONAL CHART.

Showing **Tracks of Centres of Low Barometer for February, 1878.**

Office of the Chief Signal Officer,

UNITED STATES ARMY.

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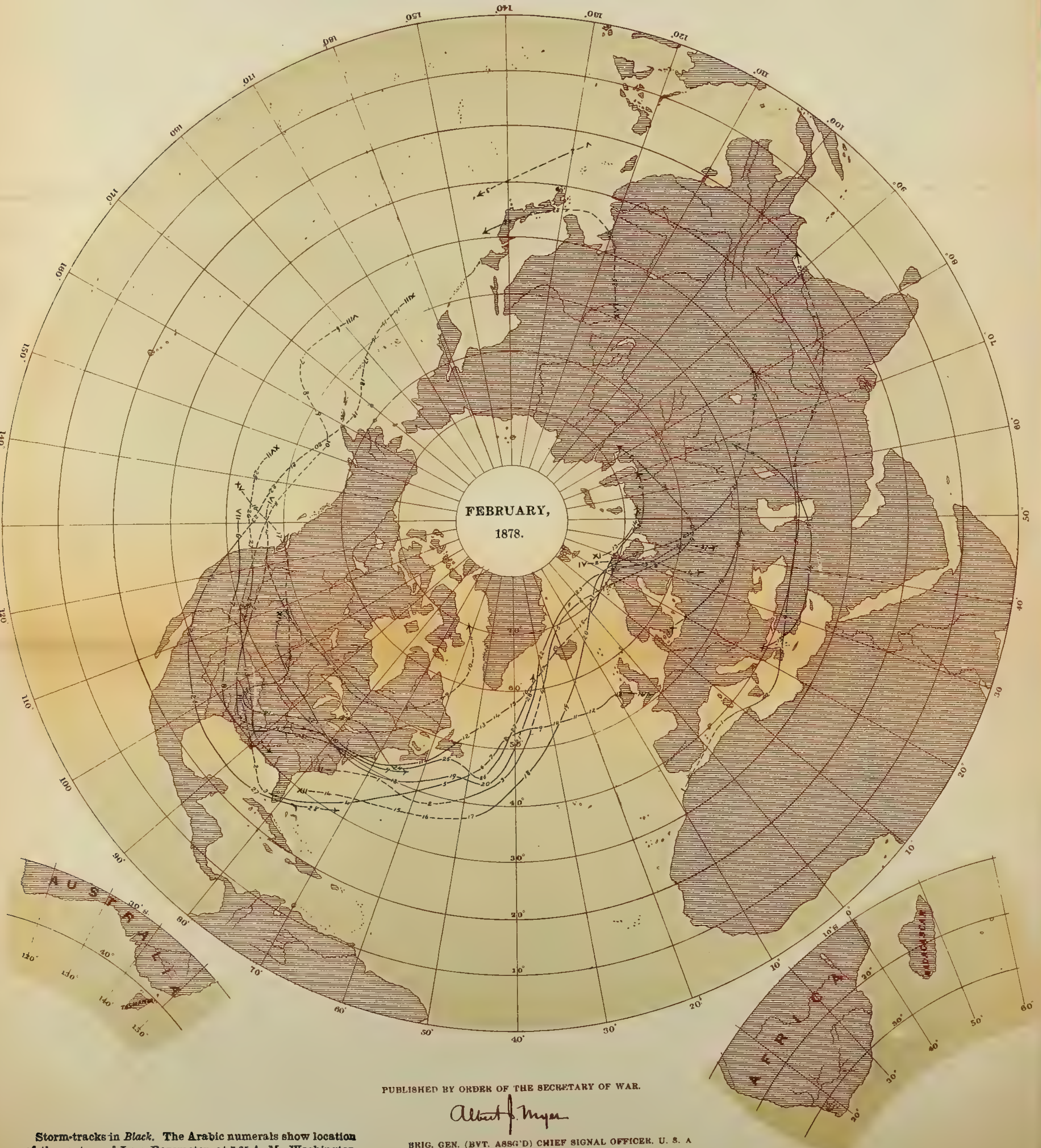

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INTERNATIONAL CHART.

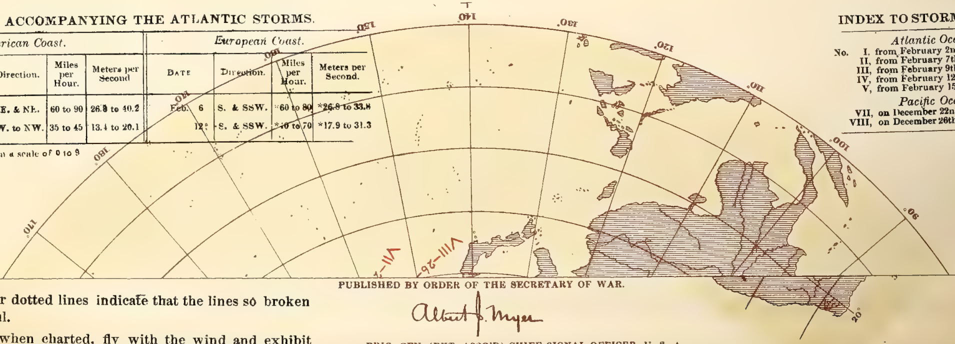
Showing Tracks of Centres of Low Barometer for February, 1878.

CHART No. IV.

WINDS ACCOMPANYING THE ATLANTIC STORMS.

American Coast.					European Coast.			
No.	DATE.	Direction.	Miles per Hour.	Meters per Second	DATE	Direction.	Miles per Hour.	Meters per Second.
I.	Feb. 3	SE. & NE.	60 to 90	26.8 to 40.2	Feb. 6	S. & SSW.	*60 to 80	*26.8 to 33.8
II	9	SW. to NW.	35 to 45	13.4 to 20.1	12	S. & SSW.	*40 to 70	*17.9 to 31.3

* Estimated from a scale of 0 to 9



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IV, from February 12th, to 22nd, 1880.
V, from February 15th, to 17th, 1880.

Pacific Ocean.

VII, on December 22nd, and 23rd, 1880.
VIII, on December 26th, and 27th 1880.

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American Coast.					European Coast.			
No.	Date.	Direction.	Miles per Hour.	Meters per Second	Date	Direction.	Miles per Hour.	Meters per Second.
I.	Feb. 3	SE. & NE.	60 to 90	26.8 to 40.2	Feb. 6	S. & SSW.	*60 to 80	*26.8 to 35.8
II	9	SW. to NW.	35 to 45	13.4 to 20.1	12	S. & SSW.	*40 to 70	*17.9 to 31.3

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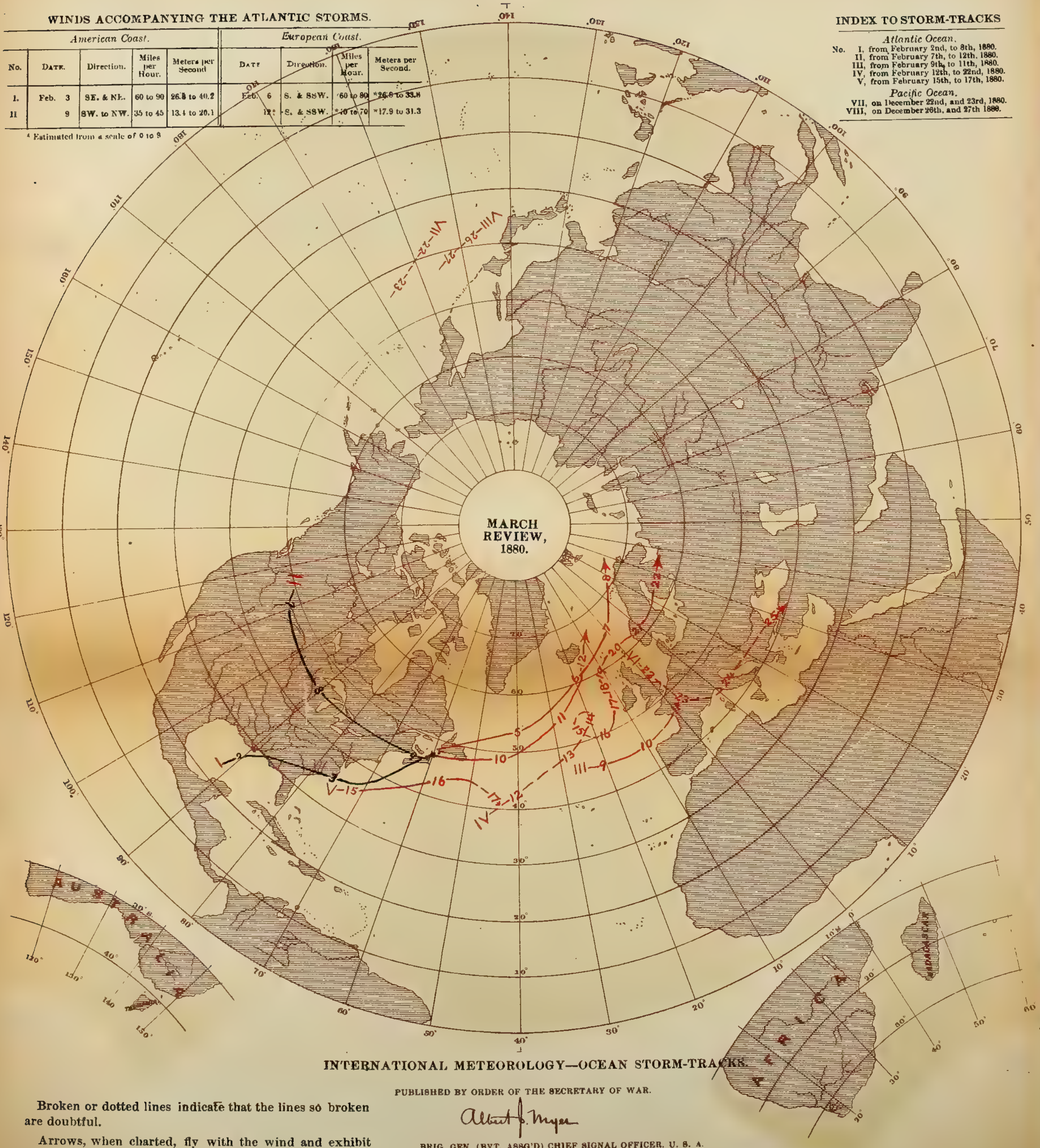

INTERNATIONAL METEOROLOGY—OCEAN STORM-TRACKS.

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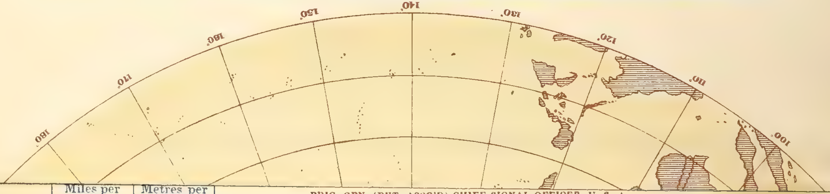

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER. U. S. A

		Miles per hour.	Metres per second.
→	1, 2	0 to 9	0 to 4.0
≻→	3, 4	9.1 to 22.5	4.1 to 10.1
≻≻→	5, 6	22.6 to 40.5	10.1 to 18.1
≫→	7, 8	40.6 to 67.5	18.1 to 30.2
≫≫→	9, 10	67.6 up	30.2 & over.

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Isobars in *blue*; detached barometer means in English inches.

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INTERNATIONAL MONTHLY CHART,

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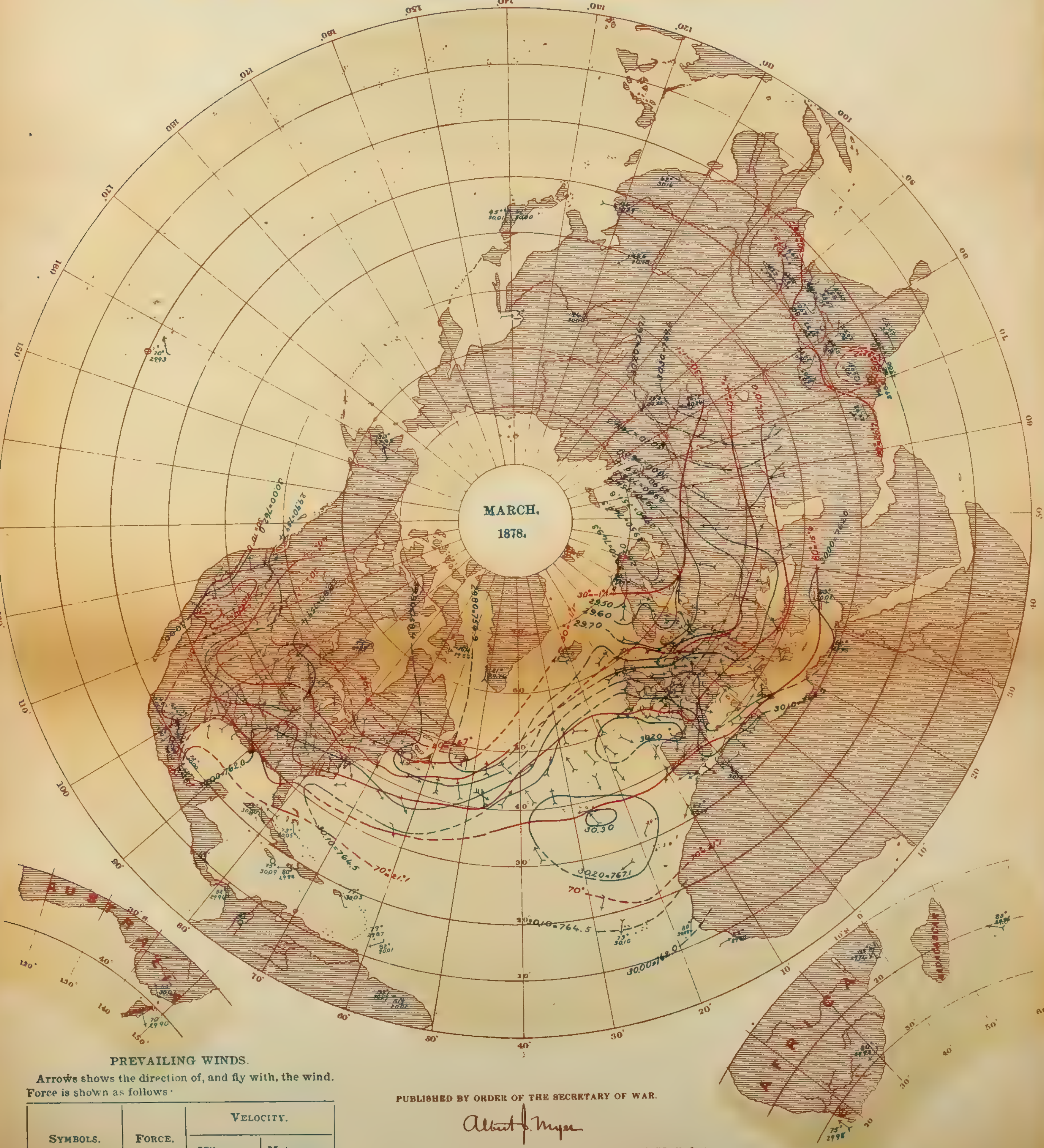

PREVAILING WINDS.

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Force is shown as follows·

SYMBOLS.	FORCE.	VELOCITY.	
		Miles per hour.	Metres per second.
→	1, 2	0 to 9	0 to 4.0
>→	3, 4	9.1 to 22.5	4.1 to 10.1
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No. VI.

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BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

Storm-tracks in *Black*. The Arabic numerals show location of the centres of Low Barometer, at 7:35 A. M., Washington mean time, of that date.

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INTERNATIONAL CHART.
Showing Tracks of Centres of Low Barometer for March, 1878.

Office of the Chief Signal Officer,

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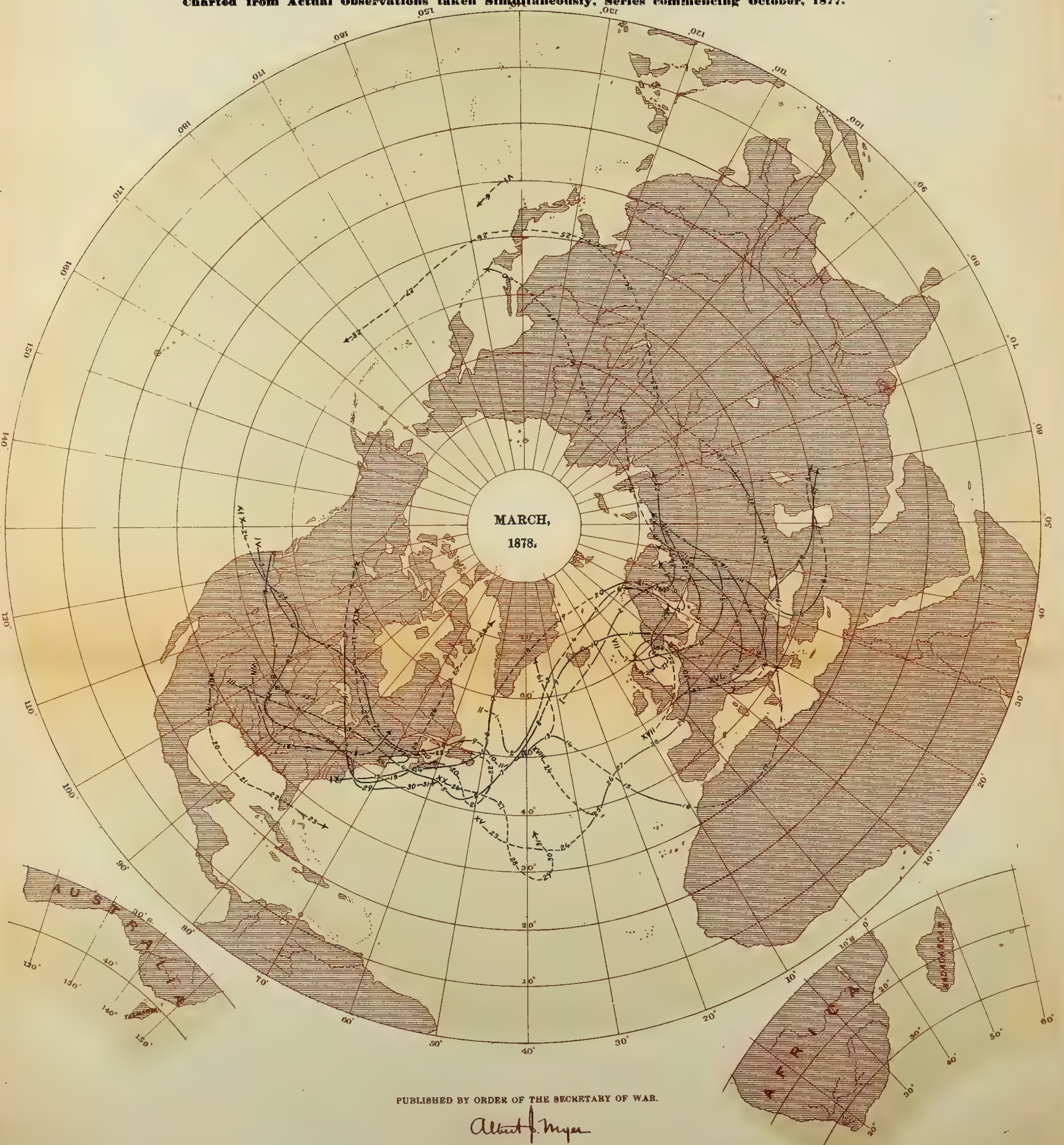

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INTERNATIONAL CHART.
Showing Tracks of Centres of Low Barometer for March, 1878.

CHART No. IV.

WINDS ACCOMPANYING THE ATLANTIC STORMS.

	American Coast.				*European Coast.*			
No.	DATE.	Direction.	Miles per Hour.	Meters per Second.	DATE.	Direction.	Miles per Hour.	Meters per Second.
XI.	March 28.	N'ly.	35	13.4	March 31.	S'ly.	*40 to 80	*17.9 to 33.8

* Estimated from a scale of 0 to 9.

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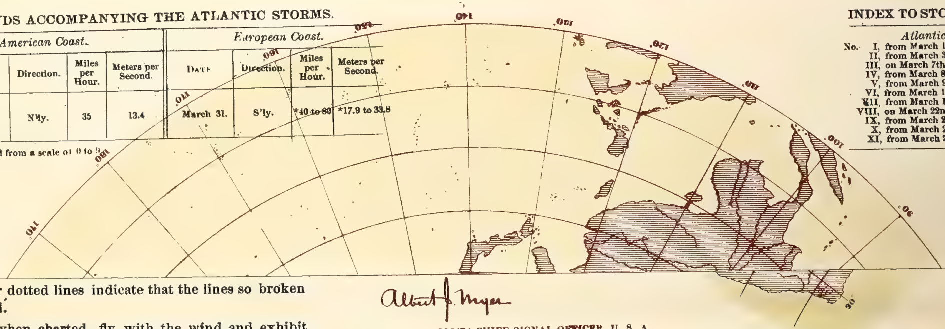
VIII, on March 22nd and 23rd, 1880.
IX, from March 22nd to 27th, 1880.
X, from March 28th to 31st, 1880.
XI, from March 28th to April 2nd, 1880.



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WINDS ACCOMPANYING THE ATLANTIC STORMS.

	American Coast.				European Coast.			
No.	DATE.	Direction.	Miles per Hour.	Meters per Second.	DATE.	Direction.	Miles per Hour.	Meters per Second.
XI.	March 28.	N'ly.	35	13.4	March 31.	S'ly.	*40 to 60	*17.9 to 33.8

* Estimated from a scale of 0 to [illegible]

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VI, from March 16th to 25th, 1880.
VII, from March 18th to 20th, 1880.
VIII, on March 22nd and 23rd, 1880.
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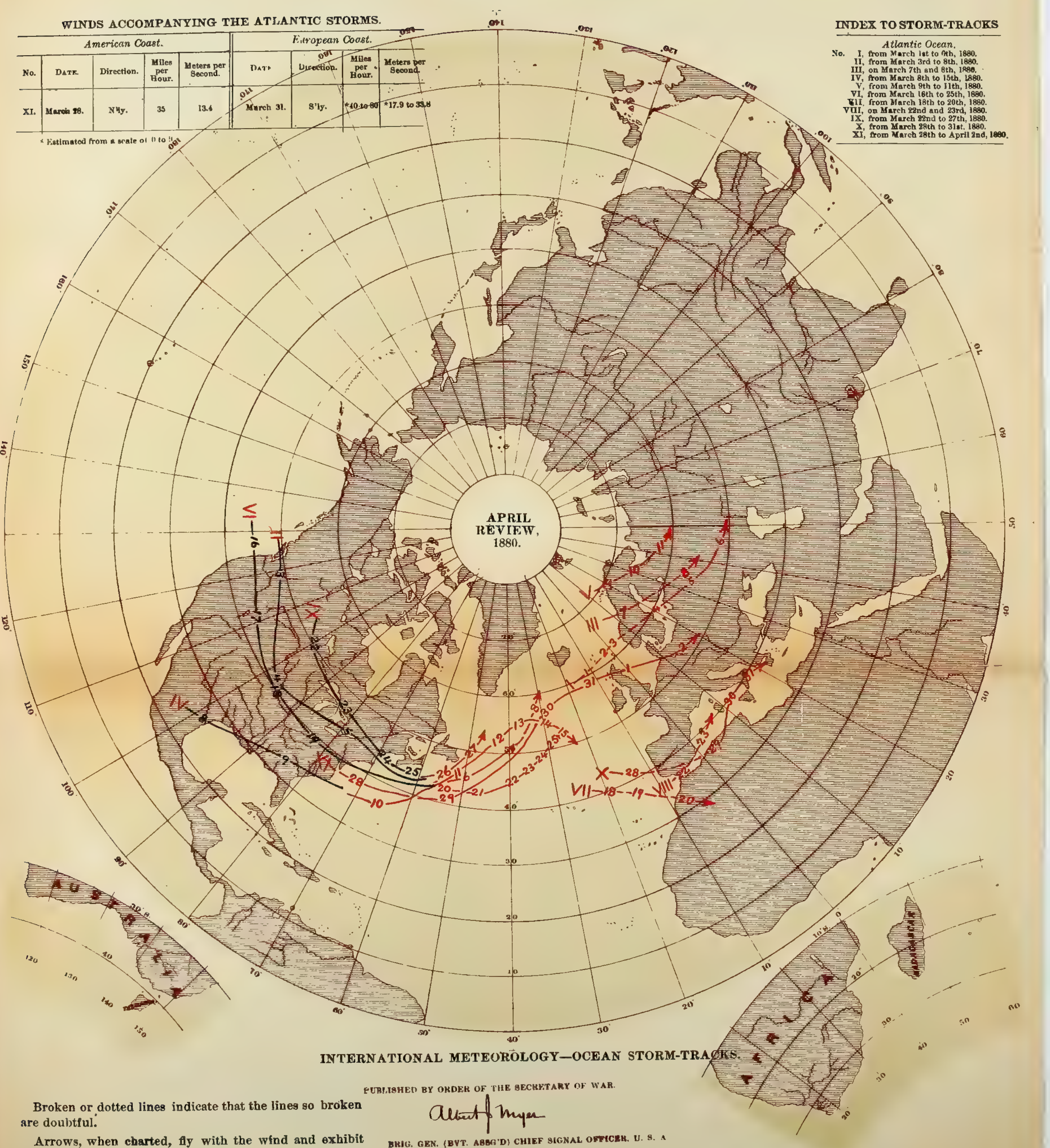

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Office of the Chief Signal Officer,

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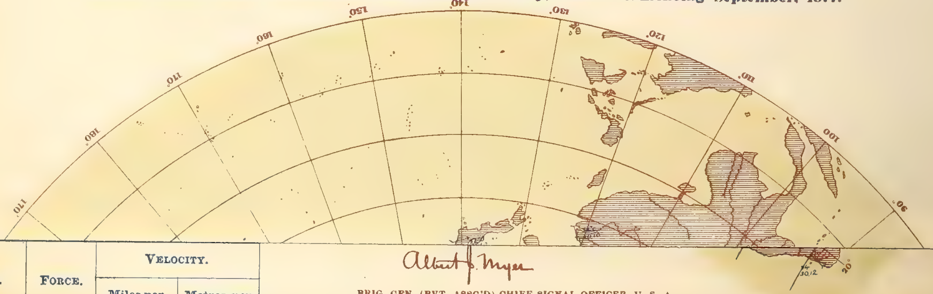

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BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER. U. S. A.

SYMBOLS.	FORCE.	VELOCITY.	
		Miles per hour.	Metres per second.
/⟶	1, 2	0 to 9	0 to 4.0
>⟶	3, 4	9.1 to 22.5	4.1 to 10.1
>/⟶	5, 6	22.6 to 40.5	10.1 to 18.1
>>⟶	7, 8	40.6 to 67.5	18.1 to 30.2
>>-⟶	9, 10	67.6 up	30.2 & over.

ISOBARS AND ISOTHERMS.

Isobars in *blue*; detached barometer means in English inches.

Isotherms in *red*; detached temperature means in degrees Fahrenheit.

INTERNATIONAL MONTHLY CHART.

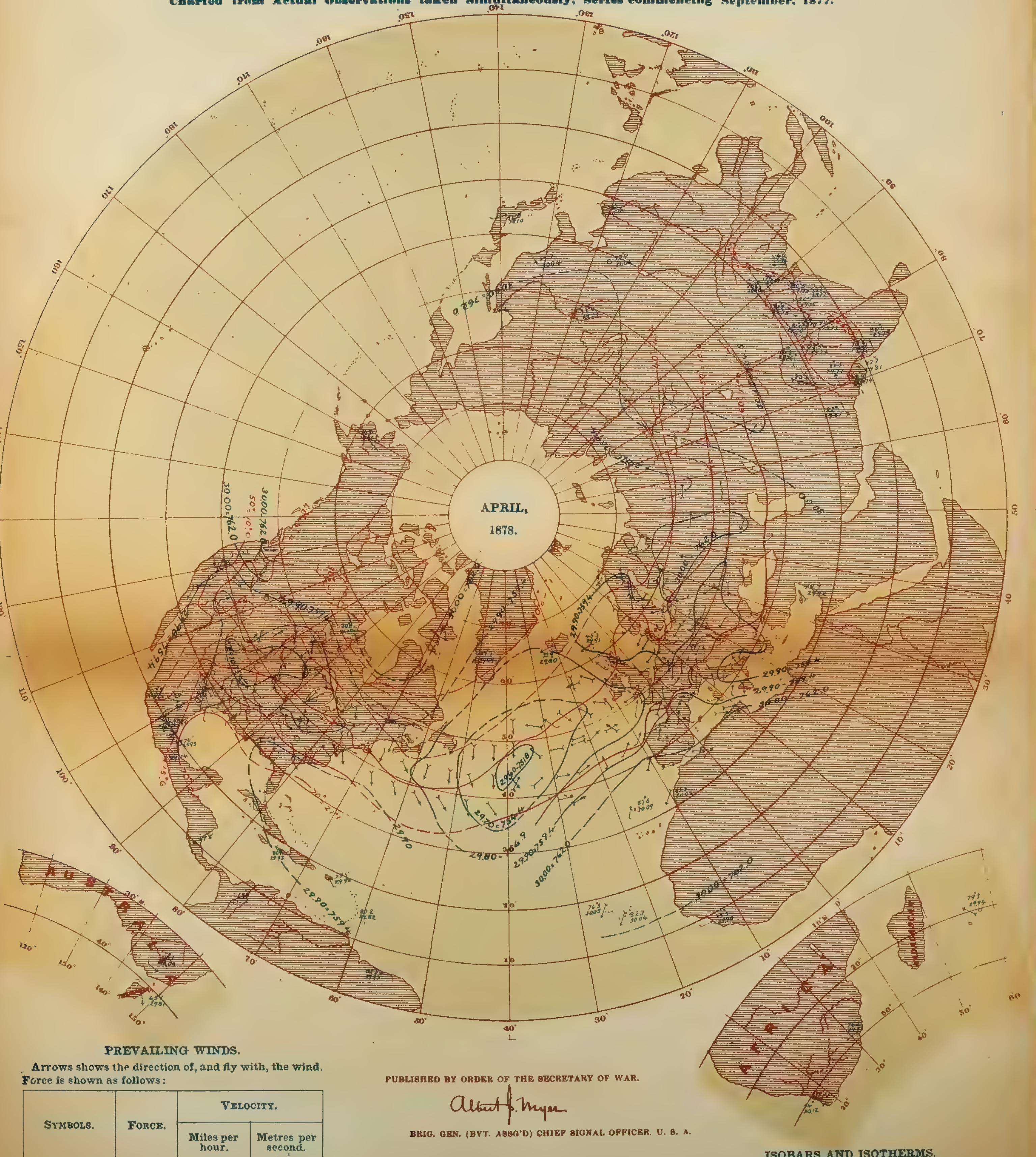
Showing mean pressure, mean temperature, mean force and prevailing direction of winds at 7:35 A. M., Washington mean time, for the month of April, 1878, based on the daily charts of the International Bulletin.

Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously, Series commencing September, 1877.

No. V.



PREVAILING WINDS.

Arrows shows the direction of, and fly with, the wind.
Force is shown as follows:

Symbols.	Force.	Velocity.	
		Miles per hour.	Metres per second.
→	1, 2	0 to 9	0 to 4.0
>→	3, 4	9.1 to 22.5	4.1 to 10.1
>>→	5, 6	22.6 to 40.5	10.1 to 18.1
>>>→	7, 8	40.6 to 67.5	18.1 to 30.2
>>>>→	9, 10	67.6 up	30.2 & over.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

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No. VI.

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Storm tracks in *Black*. The Arabic numerals show location of the centres of Low Barometer, at 7:35 A. M., Washington mean time, of that date.

Broken or dotted lines, are doubtful.

INTERNATIONAL CHART.

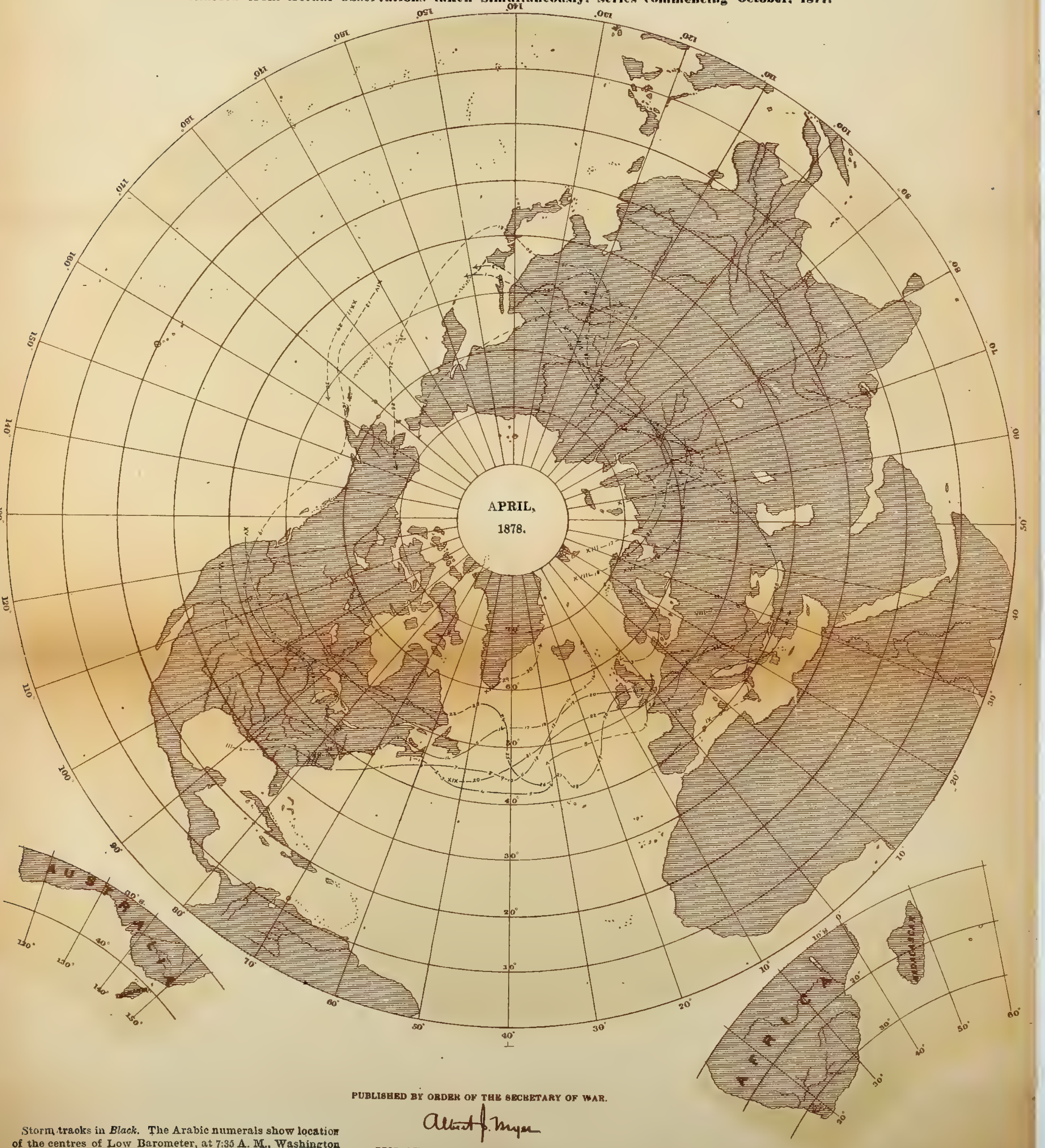
Showing Tracks of Centres of Low Barometer for
April, 1878

Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously. Series commencing October, 1877.

No. VI.



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Broken or dotted lines, are doubtful.

INTERNATIONAL CHART.
Showing Tracks of Centres of Low Barometer for
April, 1878

CHART No. IV.

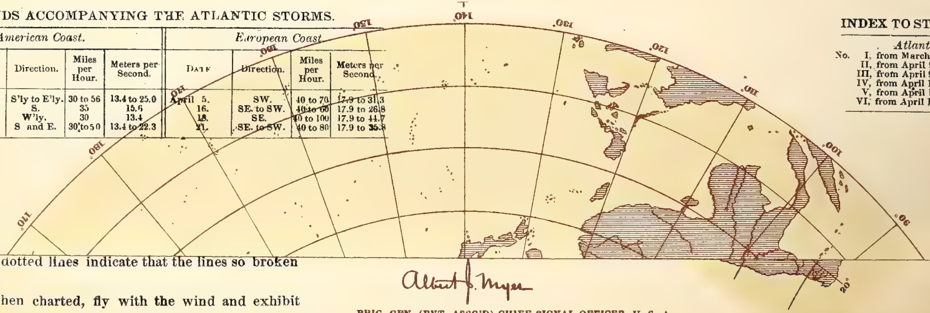
INDEX TO STORM-TRACKS

Atlantic Ocean.

No.	
I,	from March 24 to April 10, 1880
II,	from April 9 to April 13, 1880.
III,	from April 9, to April 17, 1880.
IV,	from April 11, to April 15, 1880.
V,	from April 12, to April 18, 1880.
VI,	from April 15, to April 25, 1880.

WINDS ACCOMPANYING THE ATLANTIC STORMS.

American Coast.					*European Coast.*			
No.	DATE.	Direction.	Miles per Hour.	Meters per Second.	DATE	Direction.	Miles per Hour.	Meters per Second.
I.	March 29.	S'ly to E'ly.	30 to 56	13.4 to 25.0	April 5.	SW.	40 to 70	17.9 to 31.3
III	April 10.	S.	35	15.6	16.	SE. to SW.	40 to 60	17.9 to 26.8
V.	15.	W'ly.	30	13.4	18.	SE.	40 to 100	17.9 to 44.7
VI.	17.	S and E.	30 to 50	13.4 to 22.3	21.	SE. to SW.	40 to 80	17.9 to 35.8



Broken or dotted lines indicate that the lines so broken are doubtful.

Arrows, when charted, fly with the wind and exhibit wind-direction.

The tracks charted in black have appeared in previous *Reviews.*

The tracks charted in red have been made from data collected since preceding *Review.*

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER. U. S. A.

CHART No. IV.

WINDS ACCOMPANYING THE ATLANTIC STORMS.

	American Coast.				European Coast.			
No.	DATE.	Direction.	Miles per Hour.	Meters per Second.	DATE	Direction.	Miles per Hour.	Meters per Second.
I.	March 29.	S'ly to E'ly.	30 to 56	13.4 to 25.0	April 5.	SW.	40 to 70	17.9 to 31.3
III	April 10.	S.	35	15.6	16.	SE. to SW.	40 to 60	17.9 to 26.8
V.	15.	W'ly.	30	13.4	18.	SE.	40 to 100	17.9 to 44.7
VI.	17.	S and E.	30 to 50	13.4 to 22.3	21.	SE. to SW.	40 to 80	17.9 to 35.8

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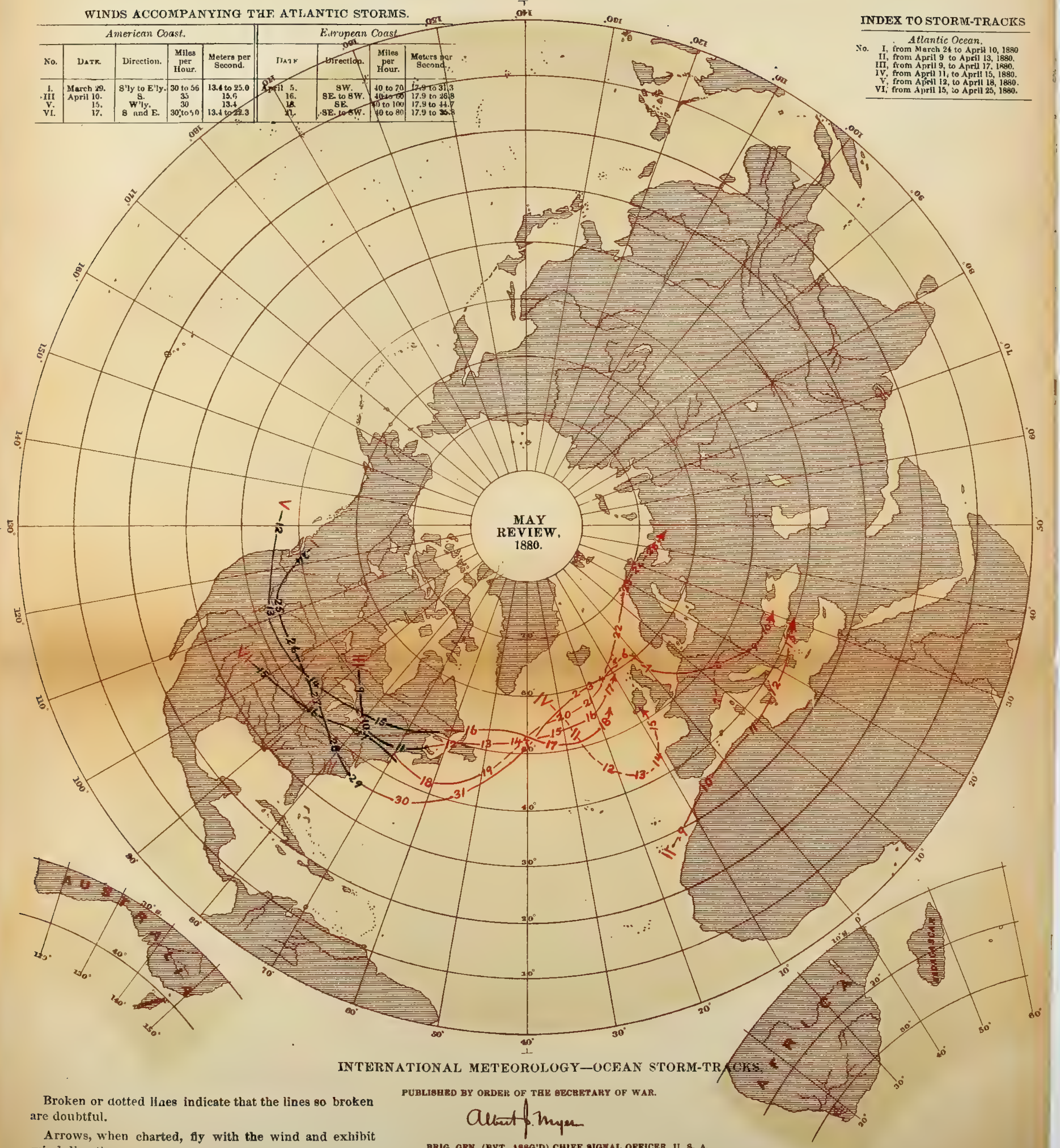

INTERNATIONAL METEOROLOGY—OCEAN STORM-TRACKS.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER. U. S. A.

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Office of the Chief Signal Officer,

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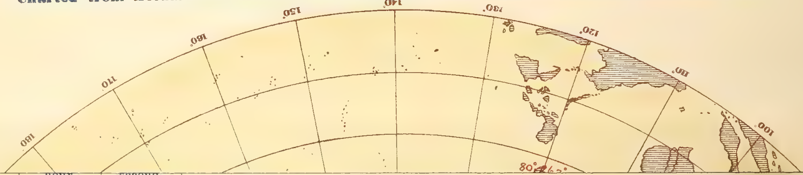
No. V.



		hour.	second.
⟶	1, 2	0 to 9	0 to 4.0
⟶	3, 4	9.1 to 22.5	4.1 to 10.1
⟶	5, 6	22.6 to 40.5	10.1 to 18.1
⟶	7, 8	40.6 to 67.5	18.1 to 30.2
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Showing mean pressure, mean temperature, mean force and prevailing direction of winds at 7·35 A. M., Washington mean time. for the month of May, 1878, based on the daily charts of the International Bulletin.

ISOBARS AND ISOTHERMS.

Isobars in *blue*; detached barometer **means** in English inches.

Isotherms in *red*; detached temperature **means** in degrees Fahrenheit.

Office of the Chief Signal Officer,

UNITED STATES ARMY.

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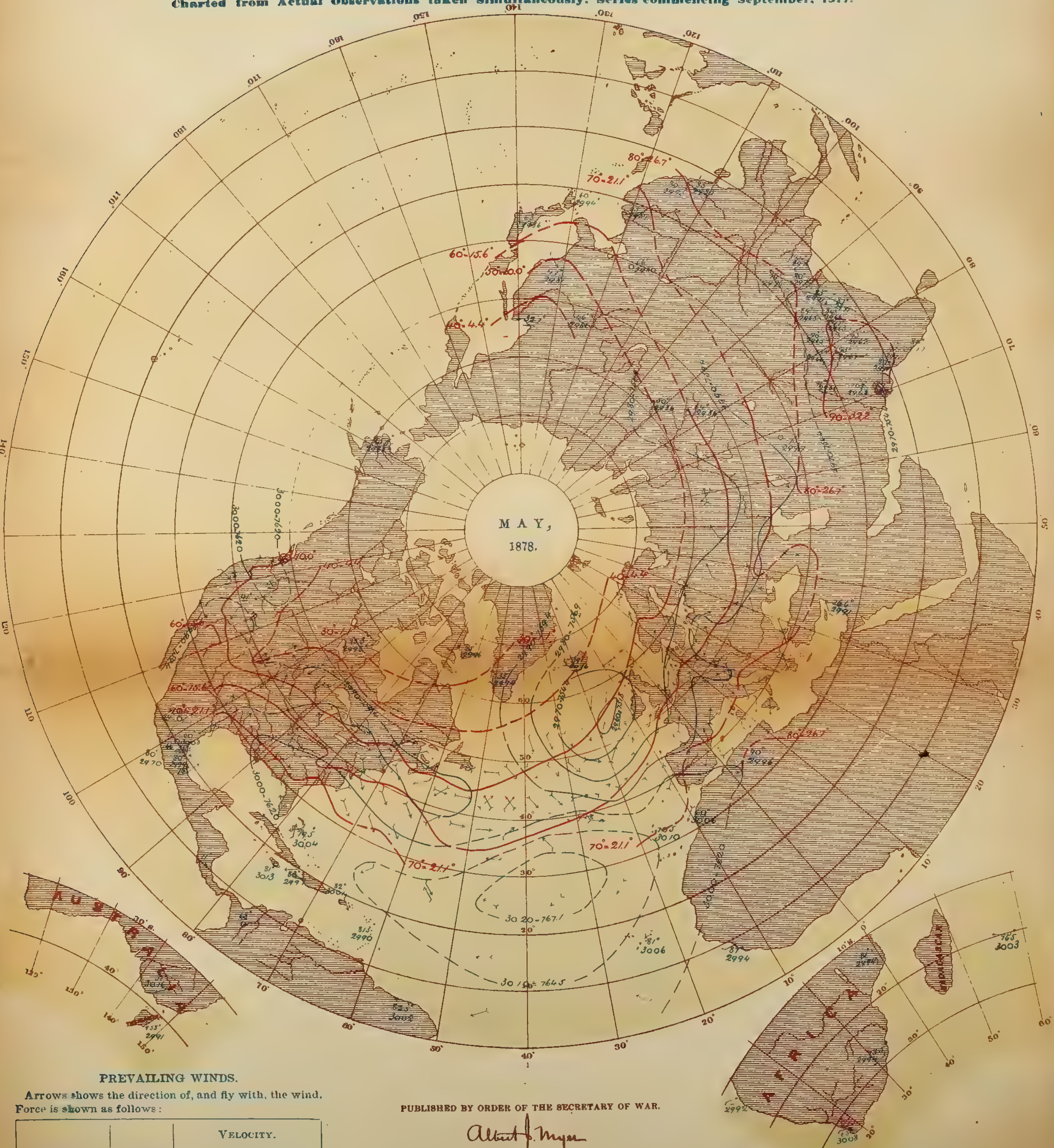

PREVAILING WINDS.

Arrows shows the direction of, and fly with, the wind. Force is shown as follows:

SYMBOLS.	FORCE.	VELOCITY.	
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—→	1, 2	0 to 9	0 to 4.0
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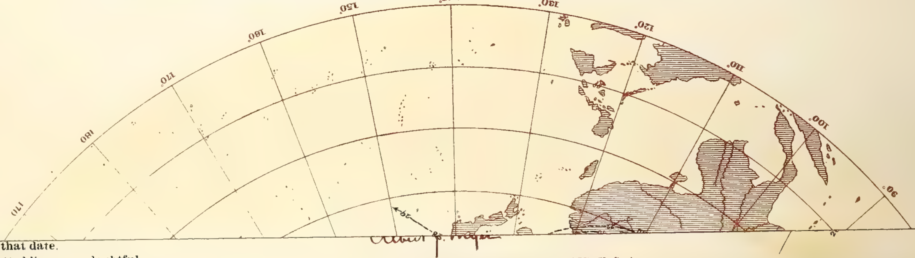
Charted from Actual Observations taken Simultaneously. Series commencing October, 1877.



mean time, of that date.

Broken or dotted lines, are doubtful.

Albert J. Myer

BRIG. GEN. (BVT ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

INTERNATIONAL CHART.

Showing Tracks of Centres of Low Barometer for May, 1878.

No. VI,

Office of the Chief Signal Officer,

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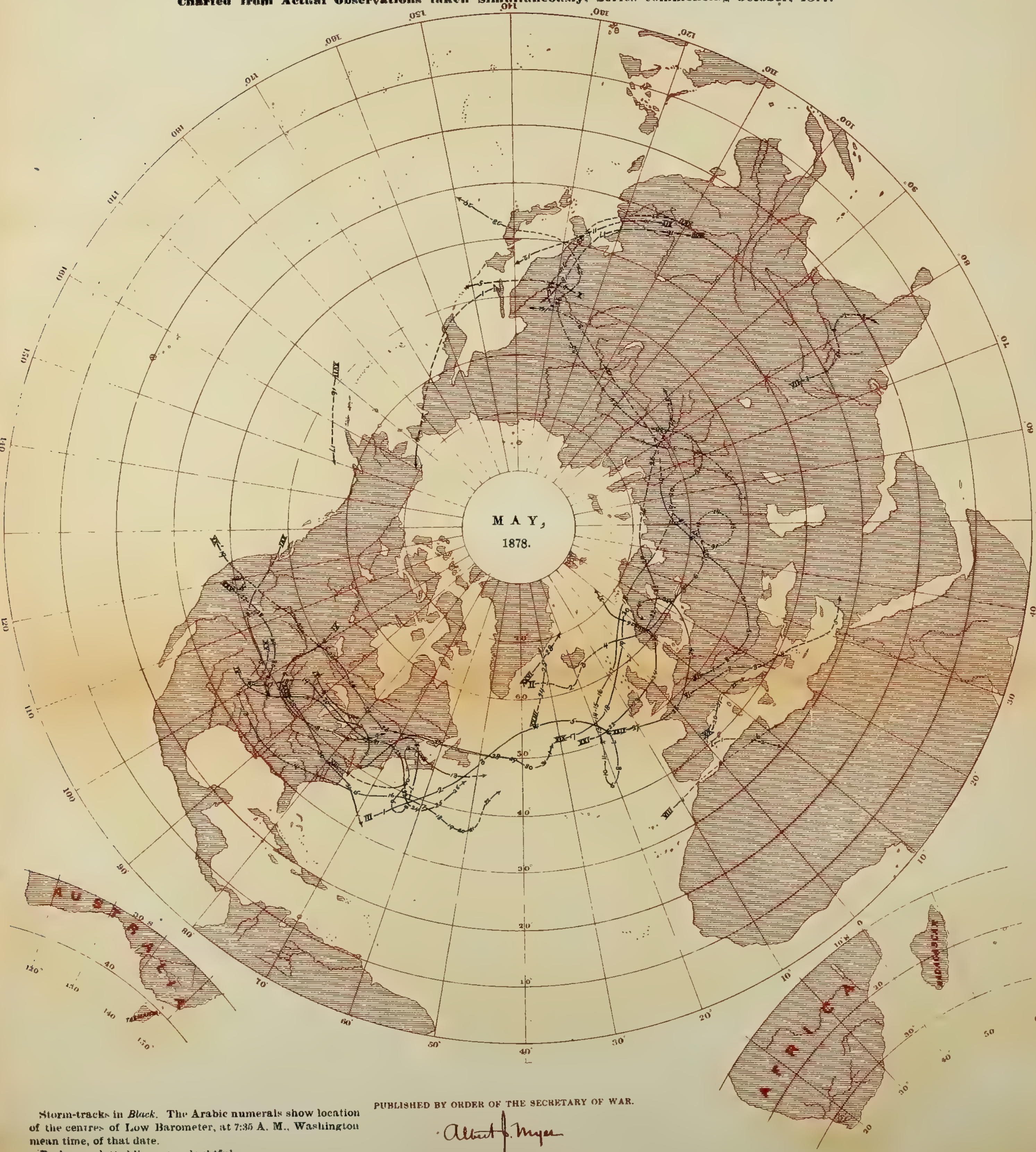

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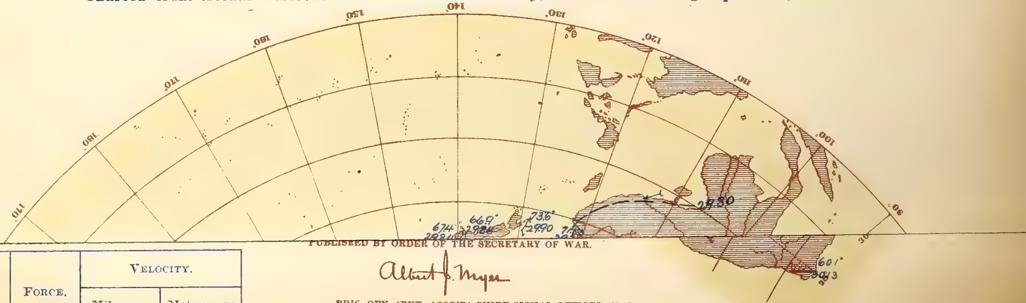

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BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER. U. S. A.

SYMBOLS.	FORCE.	VELOCITY.	
		Miles per hour.	Metres per second.
⟶	1, 2	0 to 9	0 to 4.0
⟶	3, 4	9.1 to 22.5	4.1 to 10.1
⟶	5, 6	22.6 to 40.5	10.1 to 18.1
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Office of the Chief Signal Officer,

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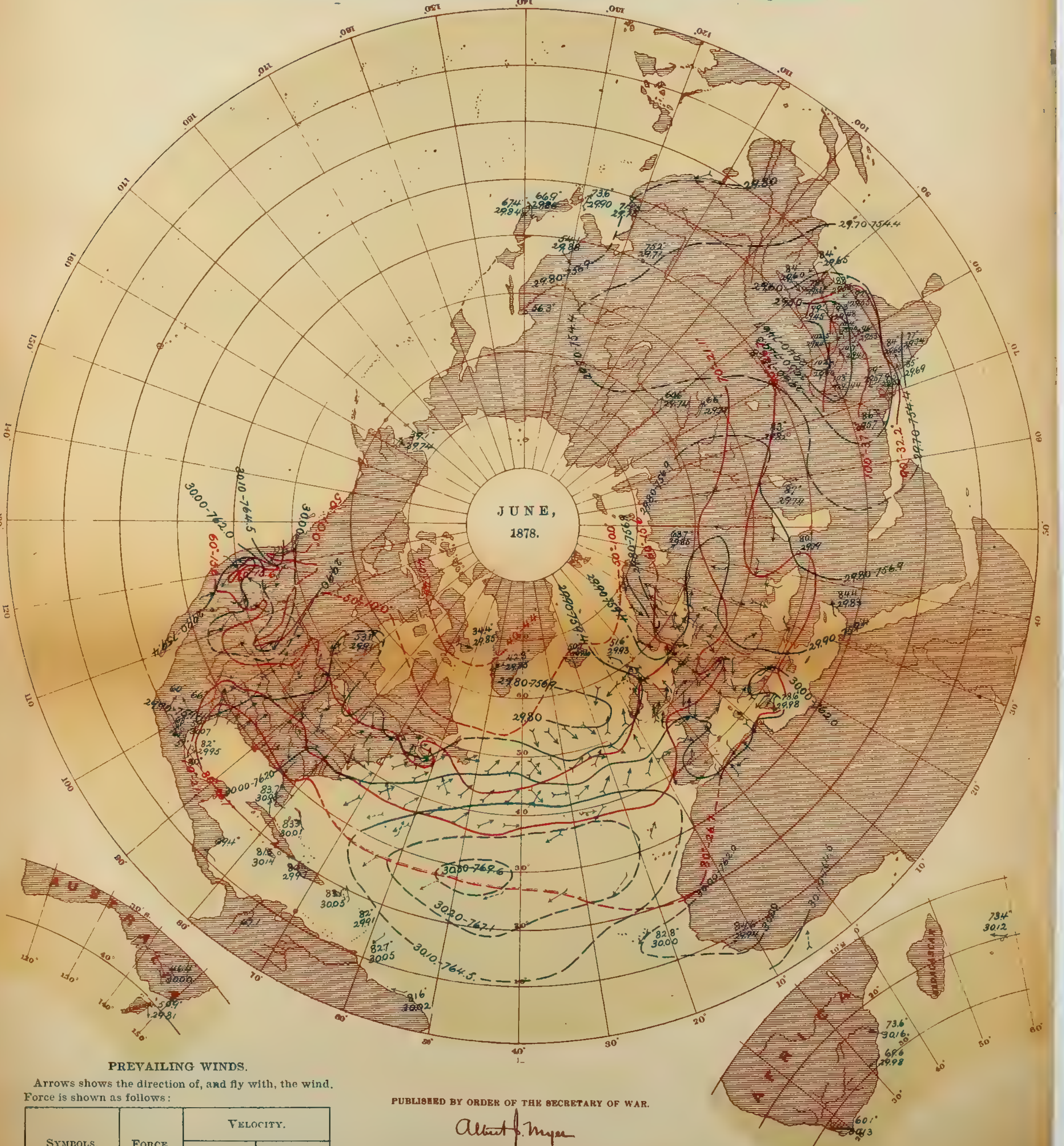

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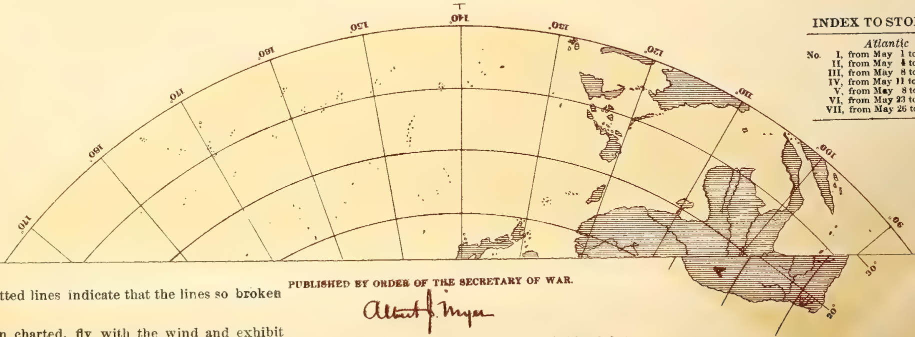
IV, from May 11 to May 21, 1880.
V, from May 8 to May 18, 1880.
VI, from May 23 to May 25, 1880.
VII, from May 26 to May 29, 1880.



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35A

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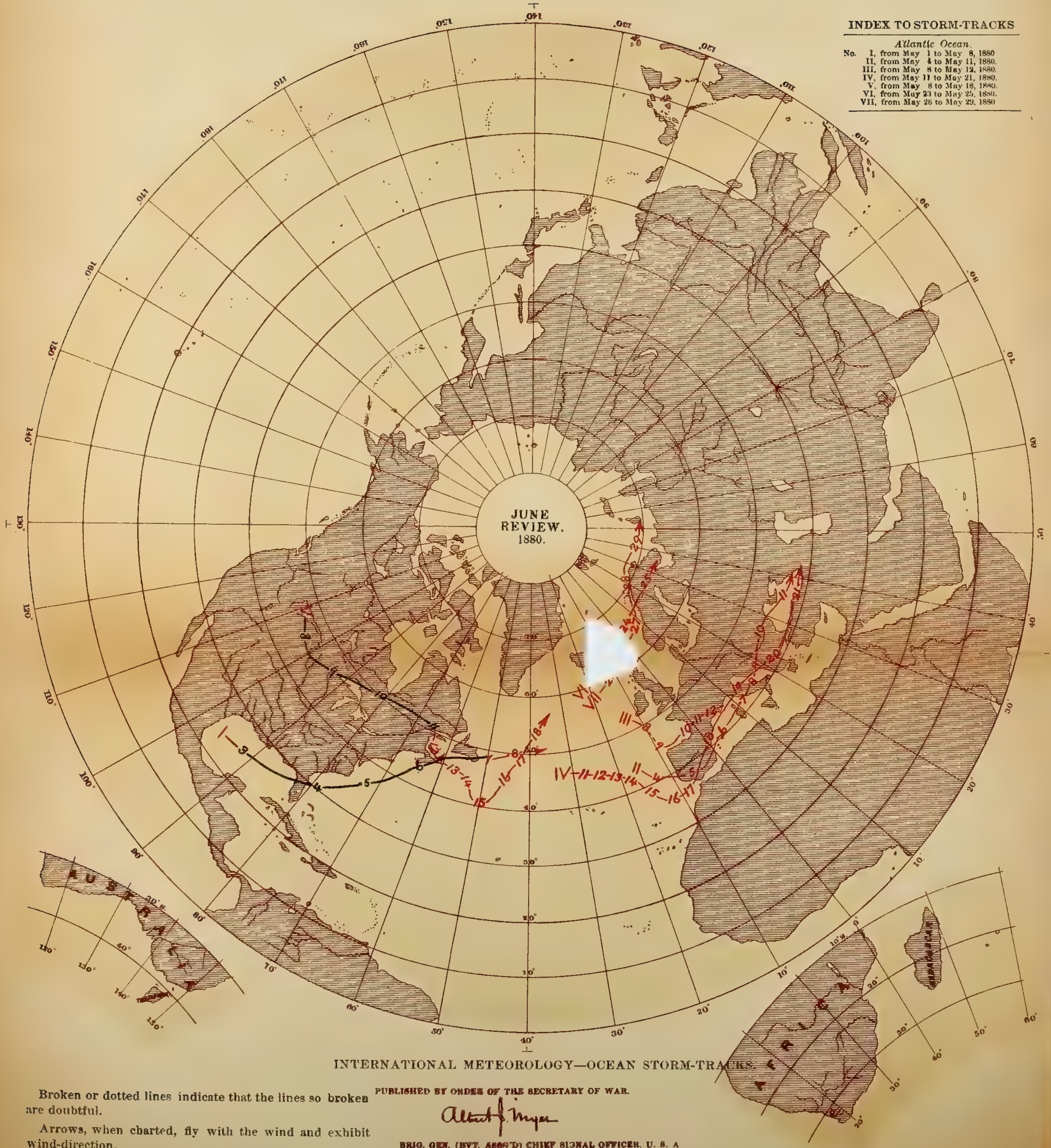

INTERNATIONAL METEOROLOGY—OCEAN STORM-TRACKS.

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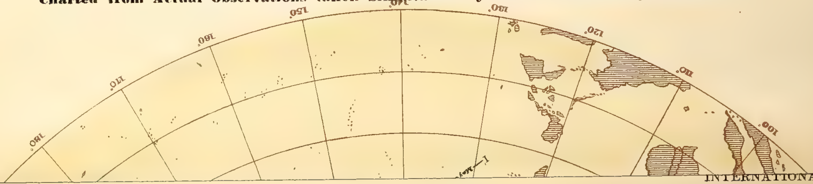


INTERNATIONAL CHART.

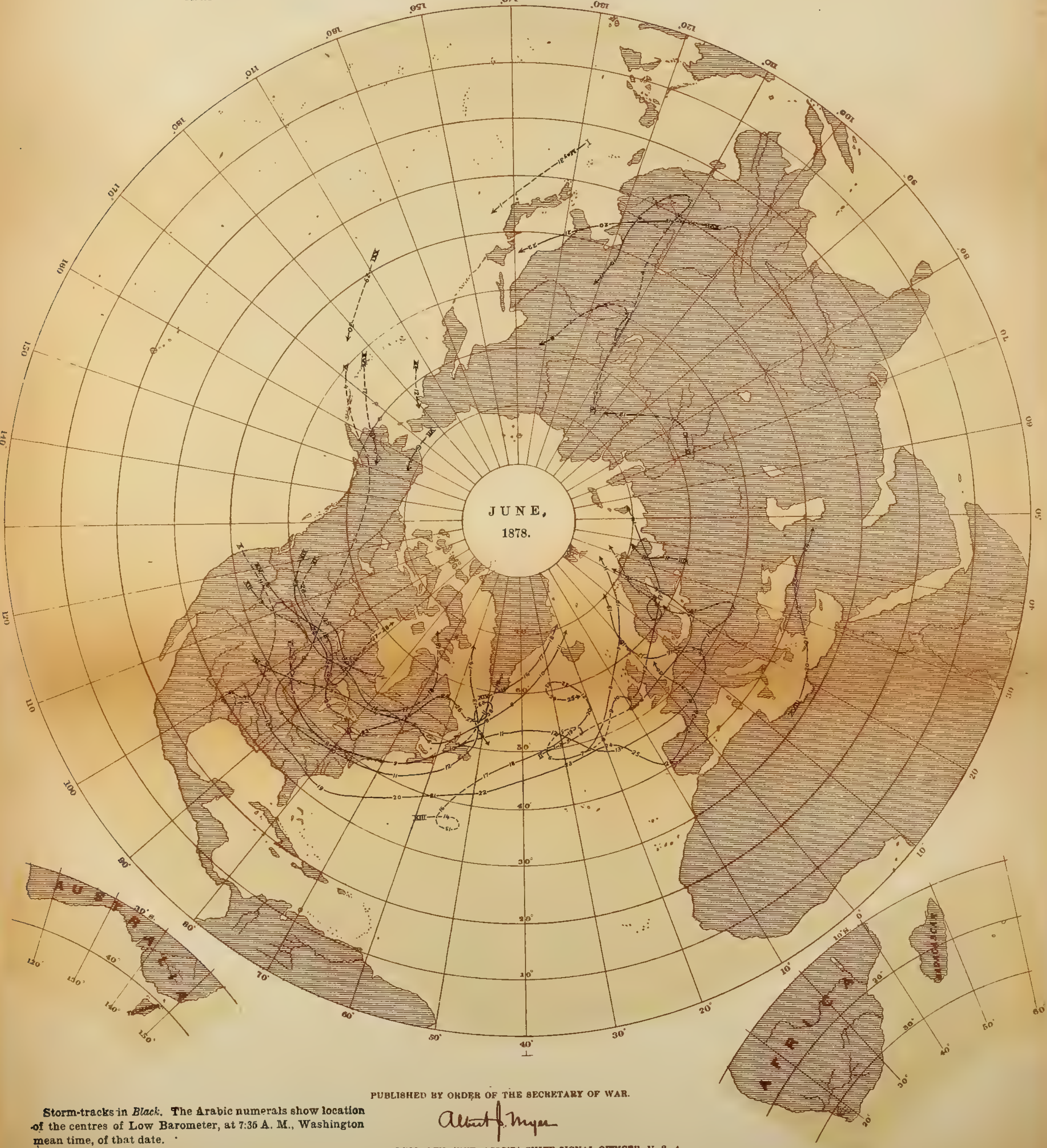
Showing Tracks of Centres of Low Barometer for June, 1878.

Office of the Chief Signal Officer,

UNITED STATES ARMY.

No. VI.

Charted from Actual Observations taken Simultaneously. Series commencing October, 1877.



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Storm-tracks in *Black*. The Arabic numerals show location of the centres of Low Barometer, at 7:35 A. M., Washington mean time, of that date.
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INTERNATIONAL CHART.

Showing Tracks of Centres of Low Barometer for June, 1878.

SUMMARY.

Furnished by the Allan Line	6
Furnished by the American Steamship Company	3
Furnished by the California and Mexican Steamship Line	1
Furnished by the Cunard Line	2
Furnished by the North German Lloyd of Bremen	5
Furnished by the Occidental and Oriental Steamship Company	3
Furnished by the Oregon Railway and Navigation Company	1
Furnished by the Pacific Coast Steamship Company	4
Furnished by the Pacific Mail Steamship Company	9
Furnished by the Red Star Line	2
Furnished by the White Star Line	4
Furnished by the co-operation of R. H. Scott, secretary of the Meteorological Council, London	59
Furnished by Capt. James Jorgensen	1
Furnished by Capt. A. R. Mehaffey	1
Furnished by Capt. L. L. Lewis	1
Furnished by Capt. B. F. Woodbury	1
Furnished by Capt. S. S. Miner	1
Furnished by Capt. W. H. Champlin	1
Furnished by Capt. N. B. Horner	1
Furnished by Capt. W. Shepherd	1
Furnished by Capt. George Gardner	1
Furnished by Capt. Beckwith	1
Furnished by Capt. E. Lewis	1
Furnished by Mr. F. Malmberg, director of the Nautical Meteorological Bureau, Stockholm, Sweden	4
Furnished by the Portuguese Navy	7
Furnished by the United States Navy	49
Total	170

PAPER 27.

Bulletin of international meteorological observations, taken simultaneously on June 8, 1880.

7.35 a. m., Washington mean time.
2.12 a. m., Honolulu mean time.
6.7 a. m., Mexico mean time.
7.7 a. m., San José mean time.
7.25 a. m., Toronto mean time.
9.2 a. m., Paramaribo mean time.
0.6 p. m., Lisbon mean time.
0.28 p. m., Madrid mean time.
0.43 p. m., Greenwich mean time.
0.53 p. m., Paris mean time.
1.1 p. m., Brussels mean time.
1.4 p. m., Utrecht mean time.
1.13 p. m., Berne mean time.
1.26 p. m., Christiana mean time.
1.33 p. m., Copenhagen mean time.
1.33 p. m., Rome mean time.
1.37 p. m., Berlin mean time.
1.49 p. m., Vienna mean time.
1.55 p. m., Stockholm mean time.
1.57 p. m., Capetown, C. G. H., mean time.
2.18 p. m., Athens mean time.
2.39 p. m., Constantinople mean time.
2.44 p. m., St. Petersburg mean time.
4.33 p. m., Mauritius mean time.
6.36 p. m., Calcutta mean time.
8.49 p. m., Zi-ka-wei mean time.
10.2 p. m., Tokei (Yeddo) mean time.
10.23 p. m., Melbourne mean time.

(On and after January 1, 1881, the times for simultaneous international meteorological observations will be 35 minutes earlier than the above; meanwhile any such earlier observations will be published with a §.)

ALGERIAN SERIES.

[Furnished by the co-operation of General Maritz, Commandant Supérieur du Génie in Algeria.]

Stations.	Barometer.				Temperature of the air.		Relative humidity.	Wind.				Clouds.				Rain-fall or melted snow in the past 24 hours.		Weather.	Observer.
	Corrected for instrumental error and temperature.		Reduced to sea-level.					Direction.	Velocity.		Force.	Amount.		Direction.					
												Upper.	Lower.	Upper.	Lower.				
	Inches.	Millimeters.	Inches.	Millimeters.	Fahrenheit.	Centigrade.	Per cent.	From—	Miles per hour.	Meters per second.	0—10.	0—10.	0—10.	From—	From—	Inches.	Millimeters.		
Mogador, Morocco	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	Dr. Ollive.
Nemours	......	......	30. 10	764. 5	74. 7	23. 7	73	N.	......	......	2	......	0	......	......	0	0	Clear	Metge.
Algiers	......	......	30. 15	765. 7	70. 2	21. 2	67	ENE.	......	......	3	......	0	......	......	0	0	Clear	Nicolas.
La Calle	......	......	30. 14	765. 6	72. 5	22. 5	66	NNW.	......	......	2	......	3	......	......	0	0	Pretty fair	Fonfrède.
Tunis	......	......	30. 18	766. 5	......	......	......	......	......	......	......	......	......	......	......	......	......	......	Jacques.
Sfax	......	......	30. 27	768. 8	......	......	......	......	......	......	......	......	......	......	......	......	......	......	Gau.
Saida	......	......	30. 15	765. 9	......	......	......	......	......	......	......	......	......	......	......	......	......	......	Charon.
Tebessa	......	......	30. 21	767. 4	68. 1	20. 1	41	W.	......	......	1	......	8	......	......	0	0	Very cloudy	Watrin.
Geriville	......	......	30. 23	767. 8	71. 2	21. 8	48	NW.	......	......	2	......	0	......	......	0	0	Clear	Lonchamp.
Laghouat	......	......	30. 25	768. 3	73. 8	23. 2	37	NE.	......	......	1	......	0	......	......	0	0	Clear	Herlin.
Biskra	......	......	30. 26	768. 6	81. 3	27. 4	43	E.	......	......	1	......	1	......	......	0	0	Very fair	Baudasse.

NOTE.—The originals give no distinction between upper and lower clouds. The weather is published as given. The rain-fall is measured at 7 a. m., local time. The elevation of Saida is 890 (?) meters, or 2,920 (?) feet; Tebessa, 1,088 (?) m., or 3,570 (?) feet; Geriville, 1,360 (?) m., or 4,462 (?) feet.

AUSTRO-HUNGARIAN SERIES.

[Furnished by the co-operation of Prof. Dr. Julius Hann, Director of the Imperial and Royal Central Meteorological Institute at Vienna.]

Agram	29.47	748.6	30.00	762.0	74.1	23.4	54	NE.	......	......	4	......	2	......	......	0	0	......	Prof. Ivan Stozir.
Cracow, I. R. Observatory	29.26	743.2	30.01	762.2	67.3	19.6	38	SW.	17.0	7.6	....	......	5	......	......	0.209	5.3	......	Dr. Wierzbicki.
Eperies	29.11	739.5	29.96	761.0	71.6	22.0	54	S.	......	......	2	......	5s:cs	......	......	0	0	......	Julius Mikolik.
Gratz	28.84	732.6	30.07	763.7	66.4	19.1	69	ENE.	......	......	1	......	9	......	......	0	0	......	Andreas Rospini.
Hermannstadt	28.67	728.1	30.03	762.8	76.6	24.8	36	NW.	......	......	2	......	0	......	......	0.069	1.75	......	Prof. A. Gottschling.
Kremsmünster, Obs'y	28.68	728.5	29.98	761.6	65.8	18.8	66	Calm.	......	......	0	......	2	......	......	0.055	1.4	......	The Staff.
Lemberg	29.00	736.6	29.95	760.8	68.0	20.0	56	NW.	......	......	3	......	6	......	......	0	0	......	Dr. T. Stanecki.
Pola	29.92	760.0	30.03	762.8	73.6	23.1	63	SW.	......	......	1	......	0	......	......	0	0	......	I.R. Hydrographic Office.
Szathmar	29.63	752.7	30.08	764.1	74.1	23.4	56	E.	......	......	4	......	5	......	......	0	0	......	Pet. Pancsics, S. J.
Szegedin	29.76	755.9	30.03	762.7	75.2	24.0	53	E.	......	......	1	......	4	......	......	0	0	......	Karl Stancel.
Trieste	29.94	760.5	30.04	763.1	72.5	22.5	78	WSW.	......	......	....	......	0	......	......	0	0	......	P. Busin.
Vienna	29.35	745.4	30.09	764.2	69.1	20.6	48	W.	......	......	2	......	8	......	......	0	0	......	I. R. Central Met. Obs'y.

NOTE.—The originals occasionally give the weather by the Vienna symbols or in general terms, but it is not always certain that they refer to the moment of simultaneous observation. The distinction between upper and lower clouds is not made. The rainfall is measured at Vienna at 2 p. m., local time; at Lemberg at 7 p. m., local time; at Trieste at 7 a. m., of the following day. The elevation of Gratz is 357 meters, or 1,171 feet; Hermannstadt, 411.6 meters, or 1.350.4 feet; Kremsmünster, 384 meters or 1,260 feet. At Eperies the observations have been taken at 2, instead of 2.8 p. m., local time.

BELGIAN SERIES.

[Furnished by the co-operation of J. C. Houzeau, Director of the Royal Observatory at Brussels.]

Arlon	......	......	......	......	......	......	....	......	......	......	....	......	......	......	......	......	......	......	Prof. M. Passau.
Brussels	29.67	753.5	29.86	758.5	58.6	14.8	58	SW.	......	......	4	5	5	SW.	SW.	0	0	......	Royal Observatory.
Furnes	29.84	758.0	29.87	758.6	58.3	14.6	68	SW.	......	......	5	......	10	......	......	0	0	......	M. E. de Cae.
Maeseyck	......	......	......	......	......	......	....	......	......	......	....	......	......	......	......	......	......	......	M. Pierrot.

NOTE.—The originals occasionally give the weather by the Vienna symbols. Except for Brussels, the distinction between upper and lower clouds is not made. The elevation of Arlon is 418 meters, or 1,371 feet. At Arlon the observations have been taken at 1.0 instead of 1.6 p. m.; Furnes, 1.0 instead of 0.54 p. m.; Maeseyck, 1.0 instead of 1.6 p. m., local time.

BRITISH SERIES.

[Furnished by the co-operation of the Meteorological Council, London, Robert H. Scott, esq., F. R. S., Secretary; and Alexander Buchan, M. A., F. R. S. E., Secretary of the Scottish Meteorological Society, Edinburgh, and the respective observers.]

Aberdeen	29.50	749.3	29.60	751.8	47.6	8.7	....	S.	8	3.6	....	......	7	......	......	0.050	1.27	Gloomy	W. Boswell.
Ardrossan	29.57	751.1	29.59	751.6	52	11.1	....	WNW.	......	......	3	......	3	......	......	......	......	Blue sky	G. Carrick.
Armagh (Observatory)	29.41	747.0	29.64	752.8	49.0	9.4	....	NE.	2	0.9	....	......	9	......	......	......	......	Showery	S. Call.
Bidston (Liverpool Obs'y)	......	......	29.58	751.3	46.0	7.8	....	W.	21	9.4	....	......	10	......	......	......	......	Overcast	John Hartnup.
Bolton (Sharples)	28.92	734.6	29.43	747.5	47.8	8.8	....	SE.	12	5.4	....	......	10	......	......	......	......	Gloomy	Thomas Mackereth.
Bradford, Yorkshire	29.17	740.9	29.57	751.1	49.3	9.6	84	SE.	......	......	3	......	10	......	......	0.17	4.3	Raining	J. McLandsborough
Bridgetown, Barbadoes	30.00	762.0	30.04	763.0	84	28.9	....	NE.	......	......	2	......	3	......	......	......	......	D. clouds	Pvt. G. Surgener, A.H.C.
Cambridge (Observatory)	29.55	750.6	29.65	753.1	57.0	13.9	....	SSW.	......	......	2	......	10	......	......	......	......	Raining	H. Todd.
Cardington	......	......	29.66	753.4	56.6	13.7	....	W.	......	......	4	......	10	......	......	Blank	Blank	Overcast	John McLaren.
Chatham (School M. E.)	29.62	752.3	29.75	755.6	56.1	13.4	....	SW.	......	......	4	......	9k	......	......	......	......	D. clouds	Lance Crp'l Hocker, R.E.
Donaghadee	29.58	751.3	29.63	752.6	51	10.6	....	ENE.	......	......	3	......	5	......	......	......	......	D. clouds	J. McGowan.

Bulletin of international meteorological observations, taken simultaneously on June 8, 1880—**Continued.**

BRITISH SERIES—Continued.

Stations.	Barometer.				Temperature of the air.		Relative humidity.	Wind.				Clouds.				Rainfall or melted snow in the past 24 hours.		Weather.	Observer.
	Corrected for instrumental error and temperature.		Reduced to sea-level.					Direction.	Velocity.		Force.	Amount.		Direction.					
												Upper.	Lower.	Upper.	Lower.				
	Inches.	Millimeters.	Inches.	Millimeters.	Fahrenheit.	Centigrade.	Per cent.	From—	Miles per hour.	Meters per second.	0—10.	0—10.	0—10.	From—	From—	Inches.	Millimeters.		
Dover	29.77	756.1	29.80	756.9	54	12.2	....	WSW.	......	......	5	......	10	......	......	......	......	Showery	J. Costello.
Falmouth (Observatory)	29.62	752.3	29.84	757.9	57.9	14.4	....	W.	......	......	5	......	6	......	......	......	......	Overcast	The Staff.
Fort Napier, Natal	27.89	708.4	30.10	764.5	72.6	22.6	....	NE.	......	......	1	......	0	......	......	......	......	Blue sky	Corp'l H. Coombs, A.H.C.
Free Town, Sierra Leone	29.75	755.6	29.98	761.5	87	30.6	....	NW.	......	......	1	......	8	......	......	......	......	Drizzling	
Galway (Queen's College)	......	......	29.66	753.4	55	12.8	....	NW.	......	......	1	......	7	......	......	......	......	D. clouds	J. O'Donaghadue.
Gibraltar, Mediterranean	30.13	765.3	30.18	766.6	72.6	22.6	....	NE.	......	......	3	......	0	......	......	......	......	Blue sky	Pvt. O. Baldwln.
Glasgow (Observatory)	29.35	745.5	29.55	750.6	56.9	13.8	....	W.	......	......	2	......	5k	......	......	......	......	D. clouds	D. G. Maclean.
Great Yarmouth	29.71	754.6	29.71	754.6	53	11.7	....	SW.	......	......	1	......	6	......	......	......	......	Showery	G. T. Watson.
Greenwich (Royal Obs'y)	29.54	750.3	29.71	754.6	58.9	14.9	....	SW.	......	......	5	......	8	......	......	......	......	D. clouds	The Staff, for G.B. Airy.
Guernsey	29.65	753.1	29.87	758.7	59	15.0	....	WSW.	......	......	4	......	5	......	......	......	......	D. clouds	Dr. S.E. Hoskins, F.R.S.
Helston	30.04	763.0	30.16	766.1	61	16.1	....	W.	......	......	6	1c	......	......	......	0	0	Fine	M. P. Moyle.
Holyhead	29.57	751.1	29.62	752.3	47	8.3	....	WSW.	......	......	4	......	10	......	......	......	......	Showery	John Tilston.
Jersey	29.64	752.8	29.93	760.2	58.0	14.4	....	WSW.	......	......	5	8ck	......	......	......	......	......	Gloomy	J. Fisher.
Kew (Observatory)	29.68	753.9	29.71	754.6	58.0	14.4	....	SSW.	24	10.7	....	......	10	......	......	......	......	Threatening	The Met'g'l Office.
Leicester (Museum)	29.36	745.7	29.62	752.3	49.0	9.4	....	SW.	......	......	2	......	9	......	......	Blank	Blank	D. clouds	Wm. J. Harrison, F.G.S.
Malta, Mediterranean	29.96	761.0	30.04	763.0	75.2	24.0	....	NW.	......	......	2	......	1	......	......	......	......	Blue sky	A. King.
Nairn	29.51	749.5	29.60	751.8	55	12.8	....	NW.	......	......	2	......	5	......	......	......	......	½ clouded	W. D. Penny.
Nassau, Bahamas	......	......	30.03	762.7	81.5	27.5	....	SE.	......	......	1	......	7	......	......	......	......	D. clouds	C. S. Duncombe.
Nottingham (Observatory)	29.43	747.5	29.62	752.3	51.3	10.7	....	WSW.	......	......	1	......	8k;ks;d	......	WSW	0.250	6.35	D. clouds	E. J. Lowe, F. R. S.
Oscott (St. Mary's College)	29.08	738.6	29.60	751.8	56.0	13.3	....	WSW.	......	......	6	......	6	......	......	......	......	D. clouds	Rev. Stephen J. Whitty.
Oxford (Radcliffe Obs'y)	29.26	743.2	29.52	749.8	53.5	11.9	....	SW.	......	......	3	......	7	......	......	......	......	D. clouds	The Staff, for E.J. Stone.
Plymouth	29.73	755.1	29.81	757.2	61.4	16.3	....	WSW.	......	......	4	......	7	......	......	......	......	D. clouds	John Merrifield.
Roche's Point*	29.68	753.9	29.78	756.4	60	15.6	....	NW.	......	......	6	......	10	......	......	......	......	Raining	William Kennedy.
St Ann's Head	29.55	750.6	29.71	754.6	54	12.2	....	W.	......	......	7	......	1	......	......	......	......	Blue sky	John C. Walker.
Sandwick Manse, Orkneys	......	......	29.60	751.8	49.7	9.8	....	NNW.	21	9.4	....	......	5	......	......	......	......	Showery	Rev. C. Clouston, LL. D.
Scutari Cemetery, Turkey	29.86	758.4	29.92	760.0	82.4	28.0	....	NE.	......	......	2	......	2	......	......	......	......	D. clouds	Serg't W. H. Lyne.
Sheffield	29.28	743.7	29.55	750.6	52.5	11.4	....	SSW.	......	......	2	......	8	......	......	0.09	2.3	Overcast	W. F. Cooper.
Silloth Rectory	29.54	750.3	29.57	751.1	60.5	15.8	58	SW.	......	......	2	......	0	......	......	0.207	5.26	Blue sky	Rev. F. Redford, A. M.
Stonyhurst (Observatory)	......	......	29.57	751.1	44.0	6.7	....	NW.	8	3.6	....	......	10	......	......	......	......	Raining	Rev. S. J. Perry.

Stratfield Turgiss	29. 50	749. 3	29. 72	754. 9	58. 0	14. 4		SW.			4–5		10					Showery	Rev. C. H. Griffith, F. M. S.
Truro (Royal Institution)	29. 83	757. 7	29. 85	758. 2	61	16. 1		W.			6		10					Gloomy	W. Newcombe.
Valencia (Observatory)	29. 77	756. 1	29. 80	756. 9	53. 8	12. 1		WNW.	23	10. 3			5					Squally	The Met'g'l Office.
SUBSERIES.																			
Beaufort West, Cape Colony																			
Cape Town (C. G. H. Obs)	29. 85	758. 2	29. 89	759. 2	69. 9	21. 1	45	NNW.	4. 5	2. 0		10	10			0. 500	12. 70	Threatening	The Staff, for D. Gill.
Hobart Town, Tasmania			29. 74	755. 4	57. 0	13. 9	76	W.			3		10kn			0. 02	0. 5	Covered	Francis Abbott, F. R. A. S
Leith (Restalrig Park), Sc't'd			29. 61	752. 1	50. 0	10. 0		E.			2		7k	W.		0. 01	0. 3	H'vy clouds.	Andrew Gibb.
Mauritius (Observatory)	29. 96	761. 0	30. 16	765. 9	72. 0	22. 2	63	ESE.	14. 5	6. 5		0	7		SE.	0. 13	3. 3	Cloudy	C. Meldrum.
Melbourne (Observatory)	30. 05	763. 3	30. 14	765. 5	51. 2	10. 7	92	SW.	2	0. 9			10			0. 41	10. 4	Dull	R. L. J. Ellery.
Monach Lt-house, Hebrides			29. 70	754. 4	47	8. 3		NE.			6	3	3	NE.		0. 1	3		J. Youngclause.
North Unst, Shetland I's			29. 46	748. 3				N.			6	10	8	Calm.		0	0		Robert Burnet.

NOTE.—Generally, the originals do not give the relative humidity, rainfall or distinction between upper and lower clouds. They give the wind direction to 32 points; the weather by the Beaufort notation; the barometer for Cardington, Galway, Oxford, Sandwick, Leith, Monach, and North Unst as read off; Freetown reduced to freezing, but not to sea-level.

* Second barometer is corrected for index error, but the first is not. The wind-force is given by the scale 0 to 12 in the official series, and by 0 to 6 in the subseries, except in pounds per square foot for Greenwich and Hobart Town. The rainfall is measured at Bradford at 9 a. m.; Hobart Town, 7.30 a. m.; Nottingham, 6 p. m.; Mauritius, 9 a.m.; and on the following day at Aberdeen at 10 a. m.; Helston, 9 a. m.; Sheffield, 8 a. m. The elevation of Fort Napier is 2,200 feet, or 670 meters.

‖ These observations are taken at 1 h. 9 m., instead of 12 h. 43 m., p. m., Greenwich time.

BRITISH MARINE SERIES.															Sea or swell.			
Vessels.															Height scale 0-9	Direction from—		
H. M. S. Alert																		Capt. J. P. Maclear, R. N.
City of Agra																		Capt. Thomas Young.
City of Cashmere																		Capt. W. M. Grieve.
Bark Commewyne																		Capt. James Buchan.
Ship British Commodore, N. 46° 00′, W. 30° 50′.			30. 39	771. 9	63	17. 2		NNW.			3		4			3	NW.	Misty	Capt. J. W. Thorne.
Bark Decapolis																		Capt. T. M. Almond.
Bark Dochra																		Capt. H. Spalding.
S. S. Ethiopia																		Capt. A. Campbell.
Bark Fedalma																		Capt. H. L. Fox.
Brig Fylde																		Capt. L. C. Dart.
S. S. German, N. 25° 20′, W. 17° 24′.			30. 15	765. 8	69	20. 6		N.			6		5					Misty	Capt. C. D. Coxwell.
S. S. Gordon Castle																		Capt. William Waring.
Bark Hope																		Capt. James Campbell.
S. S. Richmond																		Capt. W. H. Stuart.
Bark Royal Alexandra																		Capt. W. P. Hughes.
S. S. Strathleven																		Capt. C. W. Pearson.
S. S. Sunbeam																		Capt. C. M. Dobson.

NOTE.—The originals give the wind directions to 32 points, which have been corrected for magnetic variation at this office when necessary; the force by the Beaufort scale 9 to 12; the distinction between upper and lower clouds is made as to direction, but not as to amount; the height of sea-disturbance by the scale 0 to 9; weather by the Beaufort notation. The barometers and thermometers used on these vessels have generally been carefully compared with English standards and corrected.

Bulletin of international meteorological observations, taken simultaneously on June 8, 1880—Continued.

COSTA RICA SERIES.

(By authority of the Minister of Foreign Affairs.)

[Furnished by the co-operation of Señor Federico Maison, Director of the Central Office of Statistics and Meteorology.]

Stations.	Barometer.				Temperature of the air.		Relative humidity.	Wind.				Clouds.				Rainfall or melted snow in the past 24 hours.		Weather.	Observer.
	Corrected for instrumental error and temperature.		Reduced to sea-level.					Direction.	Velocity.		Force.	Amount.		Direction.					
												Upper.	Lower.	Upper.	Lower.				
	Inches.	Millimeters.	Inches.	Millimeters.	Fahrenheit.	Centigrade.	Per cent.	From—	Miles per hour.	Meters per second.	0—10.	0—10.	0—10.	From—	From—	Inches.	Millimeters.		
San José	26.25	666.7	29.97	761.2	68.9	20.5	81	NE.	......	......	2	10ks	......	......	......	0	0	Cloudy......	Federico Maison.

NOTE.—For San José the barometer is given as read off; it is reduced to sea-level by the use of a constant 3.72 inches or 94.5 millimeters, for an altitude of 1,145 meters, or 3,757 feet; its instrumental error is not known. The rainfall is apparently measured at following midnight.

DANISH SERIES.

[Furnished by the co-operation of Capt. N. Hoffmeyer, Director of the Royal Danish Meteorological Institute at Copenhagen.]

Copenhagen	29.64	752.9	29.69	754.1	56.3	13.5	57	W.	......	......	4	......	9	......	......	......	......	....	
Fanöe	29.65	753.2	29.67	753.7	54.9	12.7	68	W.	......	......	6	......	8	......	......	......	......	....	
Godthaab (Greenland)	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	....	
Stykkisholm (Iceland)	30.12	765.0	30.16	766.1	40.3	4.6	68	NE.	......	......	7	......	8	......	......	......	......	....	
Thorshavn (Faröe)	29.64	752.8	29.67	753.7	46.9	8.3	63	NE.	......	......	5	......	7	......	......	......	......	....	
Vestervig	29.48	748.7	29.57	751.1	53.8	12.1	66	SW.	......	......	6	......	6	......	......	......	......	....	

NOTE.—The originals give the wind-force by the scale 0 to 6; occasionally, the weather by the Vienna symbols, but it is not certain that they always refer to the moment of simultaneous observation. No distinction between the amount of upper and lower clouds.

FRENCH SERIES.

[Furnished by the co-operation of the Central Meteorological Bureau of France, Prof. E. Mascart, Director, and the respective observers.]

Alençon, Normal School	29.43	747.4	29.98	761.4	57.2	14	95	NW.	......	......	3	......	8n	......	NW.	0.028	0.7	Raining	Collignon, Director.
Amiens, Normal School	29.81	757.1	29.92	759.9	66.9	19.4	96	SSE.	......	......	2	......	0	......	......	0	0	Clear	Vaillant, Director.
Arras, Engineer School	29.60	751.9	29.86	758.5	52.9	11.6	78	W.	......	......	4	......	4k	E.	......	0.020	0.5	......	Klein, Commandant.
Avignon, Normal School	29.99	761.7	30.07	763.7	75.2	24	42	NW.	......	......	1	......	0	......	......	0	0	Very clear	Giraud, Director.
Bar-sur-Seine	29.47	748.6	30.02	762.6	61.2	16.2	83	SW.	......	......	1	......	8kn	......	SW.	0.008	0.2	Very cloudy	C. Saillard, Director.
Beauvais, Normal School	29.64	752.9	29.90	759.4	65.7	18.7	49	WSW.	......	......	3	......	10	......	W.	0	0	Covered	Frère Eugene Marie.
Besançon, Normal School	29.22	742.1	30.10	764.4	61.7	16.5	69	S.	......	......	1	......	10	......	SW.	0.059	1.5	Covered	A. Carré, Director.
Bordeaux	29.91	759.7	30.11	764.7	66.0	18.9	52	WSW.	......	......	1	......	8	......	SW.	0	0	Very cloudy	M. Rayet, Director.
Bourg-en-Bresse, N. School	29.24	742.6	30.16	766.1	66.2	19	66	N.	......	......	1	......	8cn	S.	S.	0	0	Very cloudy	Marlot, Director.
Bourges, Normal School	29.54	750.3	30.08	764.0	66.2	19	74	S.	......	......	3	......	kn	......	S.	0.043	1.1	......	M. Gence, Director.
Brest, Naval Observatory	29.74	755.5	29.99	761.7	64.0	17.8	70	W.	......	......	3	......	10	......	W.	0	0	......	Ch. de Rermaree, Dir.
Caen, Normal School	29.80	757.0	29.87	758.8	62.8	17.1	68	W.	......	......	1	......	5	......	W.	0.031	0.8	Cloudy	M. Bietrix, Director.
Carcassonne, N. School	29.67	753.6	30.08	763.9	73.0	22.8	45	W.	......	......	1	......	2	......	W.	0	0	Slightly cl'dy	September, Director.
Châlons-sur-Marne, N. Sch'l	29.67	753.5	29.98	761.5	67.1	19.5	43	SSW.	......	......	4	......	5	......	W.	0.087	2.2	Cloudy	Jadot, Director.
Chartres, Normal School	29.35	745.6	29.91	759.7	61.5	16.4	83	SW.	......	......	2	......	10	......	E.	0.24	6.	Covered	E. Lequint, Director.
Clermont-Fd, Puy de D. Obs.	28.73	729.7	30.06	763.5	64.0	17.8	55	W.	......	......	2	......	10	......	W.	0	0	......	Alluard, Director.
Commercy, Normal School	29.13	740.0	29.97	761.3	63.3	17.4	43	W.	......	......	4	......	k	......	W.	0.260	6.6	......	Dr. Coullet, Director.
Commune de Gréasque*	28.98	736.1	30.12	765.1	72.0	22.2	38	SW.	......	......	2	......	5	......	SW.	0	0	......	L. Kina, Director.
Grenoble, Normal School	29.27	743.4	30.02	762.4	68.4	20.2	59	NNW.	......	......	2	......	k	......	......	0	0	......	Ablard, Director.
La Roche-sur-Yon, N. Sch'l.	29.85	758.2	30.07	763.7	59.2	15.1	89	WSW.	......	......	4	......	2	......	WSW.	0.165	4.2	Slightly cl'dy	Mouillot, Director.
Le Mans, Normal School	29.67	753.5	29.95	760.7	62.2	16.8	92	W.	......	......	4	......	5	SSW.	WSW.	0.008	0.2	Cloudy	Poirrier, Director.
Lons-Le-Saulnier, N. School	29.17	740.9	30.10	764.5	63.5	17.5	80	W.	......	......	1	......	10n	......	W.	......	......	Covered	M. Cadoret, Director.
Lorient, Naval Observatory	29.91	759.8	30.02	762.4	61.5	16.4	69	W.	......	......	4	......	5	......	W.	0.157	4.00	½ covered	Lt. T. Carré, Director.
Lyons Obs'y (Park Station)	29.47	748.6	30.08	764.0	69.4	20.8	49	SW.	......	......	1	......	......	......	SW.	0	0	......	Ch. André, Director.
Mâcon, Normal School	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	Galzin, Director.
Marseilles, Observatory	29.80	757.0	30.07	763.8	66.9	19.4	59	W.	......	......	2-3	......	3	......	W.	0	0	......	E. Stephan, Director.
Mirecourt, Normal School	28.91	734.4	29.94	760.5	63.3	17.4	67	SW.	......	......	3	......	k	......	SW.	0	0	......	Barbier, Director.
Mont-Louis	24.94	633.4	30.17	766.4	55.0	12.8	77	E.	13.0	5.8	......	......	3	......	NW.	0	0	......	M. Cave, for Dr. Fines.
Nice	30.03	762.8	30.07	763.7	70.9	21.6	70	S.	......	......	2	......	......	SE.	SE.	0	0	Misty	Capt. Bossiere, Dir.
Nismes, Normal School	29.87	758.7	30.08	763.9	72.1	22.3	47	W.	......	......	1	......	0	......	......	0	0	Clear	M. Boyer, Director.
Perpignan	30.00	762.0	30.10	764.6	69.4	20.8	50	NW.	5.6	2.5	......	......	3	......	SW.	0	0	......	Dr. Fines.
Pic du Midi (Plantade) H. P.	22.64	575.1	......	......	49.1	9.5	......	......	......	......	......	......	1	......	SW.	0	0	Clear	M. Baylac, for Gen. de Nansouty.
Pic du Midi (Summit) H. P.	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	
Privas, Normal School	29.02	737.1	30.05	763.3	72.0	22.2	49	N.	......	......	1	......	1	N.	N.	0	0	Clear	M. Tallieu.
Puy de Dome (Summit) Obs.	25.21	640.4	......	......	40.3	4.6	100	WSW.	......	......	4	......	8	......	......	0.075	1.9	......	Alluard, Director.
Rochefort, Naval Obs'y	30.10	764.6	30.13	765.4	66.2	19.0	63	WSW.	......	......	2	......	8	WSW.	WSW.	0.04	1.	¾ covered	Lt. E. Desante, Dir.
Rouen, Normal School	29.79	756.7	29.88	758.9	63.3	17.4	47	SSW.	......	......	1	......	8	......	W.	0.047	1.2	Very cloudy	Platrier, Director.
Saint Malo (Port) Obs'y	29.90	759.4	29.93	760.1	63.3	17.4	65	NW.	......	......	3	......	1	NW.	NW.	0	0	Clear	Lt. Hercouet, Dir.
Saint Maur (near Paris)	29.79	756.7	29.96	760.9	64.0	17.8	63	SSW.	......	......	3	......	10	W.	SW.	0.016	0.4	Covered	E. Renou, Director.
Tarbes, Normal School	29.07	738.4	30.15	765.8	57.2	14	78	W.	......	......	1	......	......	......	......	......	......	......	T. Huguet, Director.
Toulouse, Observatory	29.46	748.3	30.19	766.8	66.7	19.3	63	NW.	......	......	1	......	8	......	......	0	0	Very cloudy	B. Bailland, Director.
Tours	29.81	757.2	30.01	762.2	62.2	16.8	73	WSW.	......	......	3	......	8	......	WSW.	0	0	¾ covered	M. de Tastes.
Versailles, Observatory	29.45	748.1	29.95	760.6	60.4	15.8	73	SW.	......	......	3	......	......	......	......	0.195	4.96	......	Dr. A. Berigny, Dir.
Villefranche-sur-Saône, N.S.	29.48	748.8	30.18	766.5	65.8	18.8	59	ENE.	......	......	1	......	8	......	W.	0	0	Very cloudy	Nicot, Director.

* Bouches-du-Rhône.

Bulletin of international meteorological observations, taken simultaneously on June 8, 1880—Continued.

FRENCH SERIES—Continued.

Stations.	Barometer.				Temperature of the air.		Relative humidity.	Wind.				Clouds.				Rainfall or melted snow in the past 24 hours.		Weather.	Observer.
	Corrected for instrumental error and temperature.		Reduced to sea-level.					Direction.	Velocity.		Force.	Amount.		Direction.					
												Upper.	Lower.	Upper.	Lower.				
	Inches.	Millimeters.	Inches.	Millimeters.	Fahrenheit.	Centigrade.	Per cent.	From—	Miles per hour.	Meters per second.	0—10.	0—10.	0—10.	From—	From—	Inches.	Millimeters.		
SUBSERIES.																			
Fort de France, Martinique	30.24	763.0	30.26	768.7	80.6	27	...	...	...	...	...	...	...	...	...	0.16	4.	...	L'Abbé Marchési.
Paris, Montsouris Obs'y	29.67	753.7	...	...	63.9	17.7	69	SSW.	...	...	2	...	10	...	SW.	0.059	1.5	Sprinkling	Marié Davy, Director.
Zi-Ka-Wei (near Shanghai)	29.80	756.8	29.82	757.4	67.6	19.8	86	SSE.	4.5	2.0	...	...	10	...	...	0	0	Covered	Marc Dechevrens, S. J.

NOTE.—The originals give the wind-force by the scale 0 to 6, except Mont-Louis, Perpignan, and Zi-Ka-Wei, in meters per second; the rainfall as measured at 9 a. m., local times, except Toulouse at 7 a. m., and Lyons, Pic du Midi (Plantade), Fort de France, and Zi-Ka-Wei at the moment of simultaneous observation; clouds on the scale 0 to 4 for Clermont-Ferrand, Commune de Gréasque, and Puy de Dome, the rest on the scale 0 to 10, or in general terms, from which the amount of cloudiness is inferred; no distinction between upper and lower clouds; weather occasionally by Vienna symbols for Mont-Louis and Perpignan, but otherwise in general terms. At St. Maur the observations have been taken at 1.00 instead of 0.53 p. m., local time. The elevation of Clermont-Ferrand is 388 meters, or 1,273 feet; Commune de Gréasque, 322 meters, or 1,056 feet; Mont-Louis, 1,586.40 meters, or 5,264.8 feet; Pic du Midi (Plantade), 2,366 meters, or 7,763 feet; Pic du Midi (Summit), 2,877 meters, or 9,439 feet; Puy de Dome (Summit), 1,467 meters, or 4,813 feet; Tarbes, 308.41 meters, or 1,032.97 feet. In correcting the Mont-Louis barometric observations for altitude the constant, 133 millimeters or 5.24 inches, has been added.

GERMAN SERIES.

[Furnished by the co-operation of Prof. Dr. G. Neumayer, Director of the German Marine Observatory, Hamburg.

Stations.	Corrected: Inches.	Corrected: Millimeters.	Sea-level: Inches.	Sea-level: Millimeters.	Fahrenheit.	Centigrade.	Per cent.	Wind from—	Miles per hour.	Meters per second.	Force 0—10.	Clouds upper 0—10.	Clouds lower 0—10.	Upper from—	Lower from—	Rainfall inches.	Rainfall millimeters.	Weather.	Observer.
Bamberg	29.12	739.7	29.98	761.6	66.7	19.3	59	SW.	...	...	6	...	3k	W.	...	0.102	2.6	...	Prof. Dr. Hoh.
Berlin	29.74	755.0	29.89	759.3	61.7	16.5	51	SW.	...	...	5	...	8	...	...	0.063	1.6	...	Prof. Dr. Arndt.
Breslau	29.48	748.8	30.01	762.3	63.5	17.5	40	W.	...	...	3	...	4	...	...	0.028	0.72	...	Royal University Obs'y.
Carlsruhe	29.54	750.4	29.96	761.0	66.9	19.4	59	SW.	...	...	3	...	5	SW.	...	0.071	1.8	...	Albert Senz.
Cassel	29.28	743.8	29.89	759.2	65.1	18.4	67	SW.	...	...	2	...	7	SW.	...	0.359	9.12	...	Dr. H. Möhl.
Emden	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Prof. Dr. Prestel.
Frankfort-on-the-Main	29.64	752.8	30.00	762.0	68.0	20.0	34	W.	...	...	3	...	6	...	...	0.087	2.2	...	Physical Society.

Friedrichshafen	28.61	726.6	30.01	762.2	65.5	18.6	60	SW.	......	......	4	......	6	SW.	......	0	0	Hazy	Chief Telegrapher Wilhelm.
Hamburg	29.74	755.4	29.81	757.2	57.9	14.4	76	WSW.	......	......	6	......	10	......	......	0.366	9.3	......	Dr. Reinhold Kleeman.
Kiel	29.74	755.3	29.75	755.7	57.4	14.1	57	W.	......	......	5	......	7	......	......	0.220	5.60	......	Prof. Dr. G. Karsten.
Königsberg (Prussia)	29.67	753.6	29.75	755.6	51.5	12.5	56	W.	......	......	10	......	2	W.	......	0.150	3.8	......	Prof. E. Luther.
Köslin	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	H. Müller.
Leipsic Observatory	29.54	750.4	29.96	760.9	64.8	18.2	39	WSW.	......	......	4	......	6	W.	......	0.256	6.5	......	Prof. Dr. Bruhns, Privy Counselor.
Magdeburg	29.69	754.0	29.91	759.7	62.4	16.9	49	SW.	......	......	6	......	7ks	SW.	......	0.209	5.3	......	Dr. Assman.
Memel	29.61	752.1	29.66	753.8	52.3	11.3	76	W.	......	......	6-7	......	5k	......	......	......	......	......	Reinbrecht & Issermann.
Munich	28.21	716.5	30.08	763.9	67.3	19.6	44	SW.	......	......	2	......	9	SW.	......	0.039	1.0	......	Dr. C. Lang.
Neufahrwasser	29.79	756.7	29.81	757.1	60.4	15.8	52	WNW.	......	......	5	......	7	......	......	0.035	0.9	......	A. Lothes.
Neustadt (Palatinate)	29.43	747.6	29.96	761.0	65.5	18.6	45	SW.	......	......	2	......	10	......	......	0	0	......	Realiehrer Dicknether.
Posen	29.46	748.3	29.74	755.4	62.8	17.1	97	W.	......	......	8	......	10	......	......	0.055	1.4	......	Prof. Dr. Magener.
Strassburg (in Alsace)	29.50	749.2	30.04	762.9	66.7	19.3	46	W.	......	......	5	......	5	W.	......	0.183	4.64	......	Imperial University Observatory.
Stuttgart	29.04	737.5	29.91	759.6	67.1	19.5	44	W.	......	......	......	......	4	W.	......	0	0	......	Prof. Dr. Schoder.
Thorn	29.71	754.6	29.89	759.3	60.8	16.0	52	W.	......	......	5	......	4	......	......	0.106	2.7	......	Dr. Cunerth.
Weissenburg (Bavaria)	28.51	724.2	30.09	764.3	65.1	18.4	53	WSW.	5.4	2.4	......	......	6k.	......	W.	0.079	2.0	......	Reallehrer J. Hopfner.
Wustrow	29.78	756.5	29.81	757.2	56.7	13.7	68	SW.	......	......	5	......	10ks	......	......	0.283	7.2	......	E. Schütz, Director.

NOTE.—The elevation of Friedrichshafen is 413.3 meters, or 1,356.0 feet; Munich, 528.5 meters, or 1,405.9 feet; Weissenburg, 431 meters, or 1,414 feet. In the originals the distinction between the amount of upper and lower clouds is not made; the wind-force at Carlsruhe is given by the scale 0 to 4. Except for Munich, it is not certain that the rainfall has been measured at, or that the remarks in the weather column refer to, the moment of simultaneous observation. At Königsberg observations have been taken at 2.0, instead of 2.5 p. m.; Memel, 2.1, instead of 2.7 p. m.; Posen, 2.0, instead of 1.51 p. m., local time.

GREEK SERIES.

[Furnished by the co-operation of Prof. Dr. J. F. Julius Schmidt, Director of the Royal Observatory at Athens.]

Athens	29.64	752.9	30.01	762.3	89.2	31.8	....	SW.	......	......	2.0	......	0	......	......	......	......	Hazy	Dr. J. F. J. Schmidt.

NOTE.—The originals give the barometer reduced to freezing but not to sea-level; the weather as published; occasionally the kind of clouds, and the amount is inferred from the general terms published in the weather column.

INDIAN SERIES.

[Furnished by the co-operation of H. F. Blanford, Meteorological Reporter to the Government of India.]

Kurrachee	29.42	747.2	29.47	748.4	87.0	30.6	86	SSW.	32.4	14.5	....	......	8	SW.	......	0	0	Misty
Deesa	29.04	737.7	29.50	749.3	96.2	35.7	35	SW.	23.5	10.5	....	......	0	......	......	0.05	1.3	Blue sky
Bombay	29.68	753.8	29.71	754.7	86.9	30.5	73	WSW.	15.0	6.7	....	......	3	......	W.	0.01	0.3	D. clouds
Poona (Yarrowda)	27.87	707.8	29.70	754.5	81.5	27.5	55	WSW.	24.0	10.7	....	......	2	......	W.	0	0	D. clouds
Belgaum	27.26	692.3	29.80	757.0	72.6	22.6	88	WSW.	5.0	2.2	....	......	6	E.	SW.	0.06	1.5	D. clouds
Lahore	28.62	727.1	29.32	744.6	109.8	43.2	14	SW.	2.1	0.9	....	......	3	......	......	0	0	Blue sky
Roorkee	28.44	722.3	29.27	743.5	107.3	41.8	13	W.	5.0	2.2	....	......	......	......	......	0	0	Hazy
Agra	28.86	733.0	29.38	746.4	106.6	41.4	26	S.	7.2	3.2	....	......	3	......	S.	0	0	......
Nagpur	28.51	724.0	29.52	749.7	92.2	33.4	41	W.	7.7	3.4	....	......	9	......	SW.	0	0	D. clouds

Bulletin of international meteorological observations, taken simultaneously on June 8, 1880—Continued.

INDIAN SERIES—Continued.

Stations.	Barometer.				Temperature of the air.		Relative humidity.	Wind.				Clouds.				Rainfall or melted snow in the past 24 hours.		Weather.	Observer.
	Corrected for instrumental error and temperature.		Reduced to sea-level.					Direction.	Velocity.		Force.	Amount.		Direction.					
												Upper.	Lower.	Upper.	Lower.				
	Inches.	Millimeters.	Inches.	Millimeters.	Fahrenheit.	Centigrade.	Per cent.	From—	Miles per hour.	Meters per second.	0—10.	0—10.	0—10.	From—	From—	Inches.	Millimeters.		
Jubbulpore	28.14	714.8	29.45	748.1	95.7	35.4	44	NW.	8.2	3.7	....	......	10	......	......	0	0	Overcast	
Lucknow	29.02	737.2	29.38	746.2	100.7	38.2	35	NW.	5.2	2.3	....	......	10	Calm.	......	0	0	Overcast	
Allahabad	29.08	738.5	29.37	746.0	103.6	39.8	34	NW.	4.6	2.1	....	......	7	......	NW.	0	0	D. clouds....	
Patna	29.25	743.0	29.43	747.4	95.1	35.1	49	SW,	2.7	1.2	....	......	10	SW.	SW.	0.02	0.5	Overcast	
Hazaribagh	27.54	699.6	29.53	750.0	79.8	26.6	73	SSE.	8.0	3.6	....	......	10	......	W.	0.07	1.8	Thunder-storm.	
Cuttack	29.41	747.1	29.49	749.1	90.1	32.3	58	SW.	2.5	1.1	....	......	6	......	......	0	0	D. clouds....	
Calcutta (Alipore)	29.49	749.1	29.52	749.7	84.7	29.3	87	S.	10	4.5	....	......	10	......	S.	0.01	0.3	Overcast	
Goalpara	29.16	740.6	29.57	751.0	73.1	22.8	98	SSE.	7.8	3.5	....	......	10	......	......	5.36	136.1	Raining.....	
Chittagong	29.49	749.0	29.58	751.2	83.1	28.4	82	ESE.	7.1	3.2	....	......	9	......	......	0	0	D. clouds....	
Sibsagar	29.27	743.4	29.60	751.9	81.6	27.6	89	SE.	2.1	0.9	....	......	10	E.	E.	0.49	12.4	D. clouds....	

NOTE.—The barometric observations refer to the Calcutta standard, which is believed to read 0.011 inch, or 0.28 millimeters higher than the Kew standard. All conversions are published as given in the originals, where the data are recorded to an additional decimal; the weather is given by the Beaufort notation, Vienna symbols, or special symbols; the distinction between the amount of upper and lower clouds is apparently not made. The elevation of Poona is 1,848.2 feet, or 563.3 meters; Belgaum, 2,550 feet, or 777 meters; Nagpur, 1,025 feet, or 312 meters; Hazaribagh, 2,010 feet, or 613 meters; Jubbulpore, 1,351 feet, or 412 meters. The velocity given is the average rate of wind since observation of the preceding day.

ITALIAN SERIES.

(By authority of the Minister of Agriculture, Industry, and Commerce.)

[Furnished by the co-operation of Prof. P. Tacchini, Director of the Central Office for Meteorology, Rome, and the respective observers.]

Udine	29.65	753.0	30.05	763.2	72.5	22.5	47	W.	0.7	0.3	....	......	9	......	......	0	0	....	Prof. Giovanni Clodig.
Milan	29.51	749.5	30.01	762.2	74.5	23.6	48	SE.	3.8	1.7	....	......	4	E.	......	0	0	....	Prof. Schiaparelli.
Padua	29.94	760.4	30.05	763.2	71.6	22.0	51	ENE.	9.4	4.2	....	......	4	NW.	......	0	0	....	Prof. Dott. Lorenzoni.

Moncalieri	29.11	739.4	30.00	762.0	70.5	21.4	59	N.	......	......	2	......	6	ENE.	......	0	0	....	Prof. P. F. Denza.
Genoa	29.90	759.4	30.09	764.2	67.1	19.5	60	SW.	4.9	2.2	....	......	0	......	......	0	0	....	Prof. G. M. Garibaldi.
Mondovi	28.14	714.7	30.01	762.3	68.2	20.1	56	SE.	......	......	2	......	4	W.	......	0	0	....	Prof. D. C. Bruno.
Pesaro	29.99	761.7	30.04	762.9	68.4	20.2	76	NE.	11.2	5.0	....	......	1	SSW.	......	0	0	....	Prof. Luigi Guidi.
Florence	29.78	756.3	30.03	762.8	73.4	23.0	43	W.	......	......	2	......	0	......	......	0	0	....	Cav. F. Meucci.
Leghorn	30.01	762.2	30.10	764.4	68.7	20.4	64	WSW.	3.8	1.7	....	......	2	......	......	0	0	....	Prof. P. Monte.
Rome	29.89	759.1	30.06	763.5	75.0	23.9	48	SSW.	9.4	4.2	....	......	4	......	......	0	0	....	Prof. P. S. Ferrari.
Lecce	29.77	756.1	30.02	762.4	73.9	23.3	48	NE.	12.5	5.6	....	......	5	......	......	0	0	....	Prof. C. De Giorgi.
Cosenza	29.15	740.4	30.00	762.1	82.4	28.0	66	SE.	0	0	....	......	3	......	......	0	0	....	Prof. D. Conti.
Cagliari	29.90	759.4	30.09	764.3	72.7	22.6	44	NW.	......	......	4	......	3	W.	......	0	0	....	Prof. A. Pacinotti.
Palermo	29.86	758.5	30.11	764.8	67.8	19.9	64	ENE.	6.9	3.1	....	......	1	......	......	0	0	....	Prof. G. Ciacciatore.
Syracuse	29.91	759.8	29.96	760.9	81.1	27.3	46	NE.	3.8	1.7	....	......	5	S.	......	0	0	....	Prof. V. G. Guliano.
SUBSERIES.																			
Naples, S. R	29.51	749.6	30.02	762.5	73.4	23.0	50	WSW.	1.8	0.8	....	......	3	......	......	0	0	....	Prof. F. Brioschi.

NOTE—The originals give the wind-force by the scale 0 to 4, or the velocity in kilometers per hour; no distinction between the amount of upper and lower clouds, and only the direction of the upper. The elevation at Mondovi is 556 m., or 1,824 ft.

JAPANESE SERIES.

[Furnished by the co-operation of I. Arai, Director of the Imperial Meteorological Observatory at Tokei.]

Hiroshima, I. M. Obs'y	......	......	......	......	68.7	20.4	83	Calm.	0	0	....	ck	10ks	......	......	0	0	Cloudy	K. Sasaki.
Nagasaki, I. M. Obs'y	29.61	752.1	29.81	757.2	64.1	17.8	95	SW.	1.0	0.4	....	......	1s	......	......	0	0	Clear	S. Takehayashi.
Tokei (Yeddo) Observatory	29.61	752.1	29.68	753.9	69.4	20.8	58	NNW.	4.0	1.8	....	2ck	0	......	......	0	0	Fair	The Staff.
Wakayama	29.73	755.1	29.78	756.4	68.8	20.4	83	S.	1.6	0.7	....	9ck	......	......	......	0.001	0.03	Cloudy	

NOTE.—The data are published as given. The rainfall is measured at 9.30 a. m., local time. For Nagasaki and Hiroshima no distinction is made between the amount of upper and lower clouds. The conversions are published as given in the originals.

MEXICAN SERIES.

(By authority of the Secretary of Public Works.)

[Furnished by the co-operation of Señor Mariano Bárcena, Director of the Central Meteorological Observatory in the city of Mexico, and the respective observers.]

Colima	......	......	......	......	......	......	....	......	......	......	....	......	......	......	......	......	......	....	R. Banda, C. E.
Guadalajara	25.08	637.0	30.09	764.3	58.1	14.5	72	W.	......	......	1	8ks	0	......	......	0	0	Cloudy	Prof. L. Perez.
Guanaxuato	23 68	601.6	......	......	63.9	17.7	85	Calm.	0	0	....	10n	3nk	Calm.	SW.	0.06	1.6	Covered	Vicente Fernandez.
Leon	24.43	620.5	29.97	761.3	70.0	21.1	79	S.	......	......	3	5k	0	SW.	......	0	0	Fair	Prof. M. Leal.
Mazatlan	29.73	755.2	29.99	761.7	78.5	25.8	86	Calm.	......	......	0	9k	0	NE.	......	0	0	Very cloudy	F. Quijano, C. E.
Mexico, Central Obs'y	23.08	586.6	29.99	761.7	60.6	15.9	72	Calm.	0	0	....	8k	0	N.	......	0	0	Cloudy	The Staff.
Morelia	......	......	......	......	......	......	....	......	......	......	....	......	......	......	......	......	......	....	M. Fena, M. D.
Pabellon (Aguascalientes)	23.92	607.5	29.82	757.4	70.0	21.1	62	NW.	......	......	1	5c	0	......	......	0	0	Fair	M. V. de Leon, M. E.
Puebla (Catholic Institute)	23.45	595.5	30.10	764.5	60.6	15.9	40	Calm.	0	0	...	2ck	0	E.	......	0.12	3.0	Clear	Prof. P. Spina.

Bulletin of international meteorological observations, taken simultaneously on June 8, 1880—Continued.

MEXICAN SERIES—Continued.

Stations.	Barometer.				Temperature of the air.		Relative humidity.	Wind.				Clouds.				Rainfall or melted snow in the past 24 hours.		Weather.	Observer.
	Corrected for instrumental error and temperature.		Reduced to sea-level.					Direction.	Velocity.		Force.	Amount.		Direction.					
												Upper.	Lower.	Upper.	Lower.				
	Inches.	Millimeters.	Inches.	Millimeters.	Fahrenheit.	Centigrado.	Per cent.	From—	Miles per hour.	Meters per second.	0—10.	0—10.	0—10.	From—	From—	Inches.	Millimeters.		
San Luis Potosi	24. 22	615. 3	30. 08	764. 0	66. 4	19. 1	49	E.	......	......	1	7	0	W.	......	0. 012	0. 3	Foggy	G. Barroeta, M. D.
Tlacotalpam	29. 90	759. 4	29. 91	759. 7	78. 3	25. 6	93	S.	......	......	1	4	1	SW.	S.	0	0	½ clouded	Prof. M. M. Chàzaro.
Vera-Cruz	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	Prof. J. Rossell.
Zacatecas	22. 60	574. 0	30. 14	765. 6	60. 8	16. 0	81	Calm.	......	......	0	6c	0	NW.	......	2. 05	52. 0	Fair	J. C. Castrillon.

NOTE.—The elevation of Colima is 507.3 m., or 1,664.4 ft.; Guadalajara, 1,569.3 m., or 5,148.7 ft.; Guanaxuato, 2,060.84 m., or 6,786.20 ft.; Leon, 1,798.6 m., or 5,901.0 ft.; Mexico, 2,265.8 m., or 7,433.9 ft.; Morelia, 1,940 m., or 6,365 ft.; Pabellon, 1,924.4 m., or 6,313.8 ft.; Puebla, Catholic Institute, 2,167.8 m., or 7,112.3 ft.; San Luis Potosi, 1,890.3 m., or 6,201.9 ft.; Zacatecas, 2,496 m., or 8,189 ft. †Aneroid.

NETHERLANDS SERIES.

[Furnished by the co-operation of Professor Buys Ballot, Director of the Royal Meteorological Institute of the Netherlands at Utrecht.]

Stations.	Bar. corr. Inches.	Bar. corr. Millimeters.	Sea-level Inches.	Sea-level Millimeters.	Fahrenheit.	Centigrado.	Per cent.	Wind from—	Miles per hour.	Meters per second.	Force 0—10.	Clouds upper 0—10.	Clouds lower 0—10.	Clouds upper from—	Clouds lower from—	Rain Inches.	Rain Millimeters.	Weather.	Observer.
Flushing	29. 85	758. 2	29. 85	758. 2	57. 6	14. 2	....	SW.	......	......	4	......	......	......	......	0. 264	6. 7	......	
Groningen	29. 73	755. 2	29. 79	756. 6	55. 4	13. 0	....	WSW.	......	......	5	......	......	......	......	0. 232	5. 9	......	
Helder	29. 77	756. 1	29. 77	756. 1	55. 0	12. 8	....	SW.	......	......	5	......	......	......	......	0. 024	0. 6	......	
Hellevoetsluis	29. 82	757. 4	29. 82	757. 4	57. 4	14. 1	61	SW.	......	......	4	......	......	......	......	0. 335	8. 5	......	
Utrecht	29. 80	756. 8	29. 84	758. 0	57. 7	14. 3	76	SW.	......	......	4	......	10	......	......	0. 004	0. 1	Dull	H. v. d. Brink.

NOTE.—The originals give the wind pressure in kilograms per square meter, except Hellevoetsluis, which gives force by the scale 0 to 12; the humidity is computed for Hellevoetsluis and Utrecht; for Utrecht, the weather as published, from which is inferred the amount of cloudiness by the scale 0 to 10, without distinguishing between upper and lower clouds.

NORWEGIAN SERIES.

[Furnished by the co-operation of Prof. H. Mohn, Director of the Royal Norwegian Meteorological Institute at Christiania.]

Stations.	Bar. corr. Inches.	Bar. corr. Millimeters.	Sea-level Inches.	Sea-level Millimeters.	Fahrenheit.	Centigrado.	Per cent.	Wind from—	Miles per hour.	Meters per second.	Force 0—10.	Clouds upper 0—10.	Clouds lower 0—10.	Clouds upper from—	Clouds lower from—	Rain Inches.	Rain Millimeters.	Weather.	Observer.
Bergen	29. 40	746. 7	29. 45	748. 1	56. 5	13. 6	56	S.	13. 4	6. 0	....	......	3	......	......	0	0	......	
Brōno	29. 43	747. 6	29. 47	748. 6	48. 2	9. 0	73	Calm.	0	0	....	......	10	......	......	0. 059	1. 5	Raining	

Christiania	29.30	744.1	29.44	747.7	57.7	14.3	49	SW.	9	4	....	....	7	....	....	0.024	0.6	....
Tromsö	29.55	750.6	29.61	752.0	39.9	4.4	59	NE.	11	5	....	....	8	....	....	0	0	....

NOTE.—The originals give the amount of cloudiness without distinguishing between upper and lower clouds; occasionally, the weather by Vienna symbols. The cloudiness and weather at Bergen refer to 2 h. p. m., instead of 1 h. 4 min. p. m.

PORTUGUESE SERIES.

[Furnished by the co-operation of J. C. de Brito Capello, Director of the Meteorological Observatory of the Infante Dom Luiz at Lisbon.]

Angra (Azores)	30.31	769.8	30.52	775.1	66.9	19.4	88	WSW.	....	....	2	....	6	....	....	0	0	....	Dr. J. A. Sampaio.
Campo Major	29.13	739.8	30.02	762.5	73.8	23.2	34	WNW.	9.8	4.4	....	....	2	....	....	0	0	....	Dr. A. M. R. dos Santos.
Funchal (Madeira)	30.19	766.9	30.28	769.1	67.8	19.9	57	SW.	4.9	2.2	....	....	8	....	....	0	0	....	Capt. D. A. de Cunha.
Lisbon Observatory	29.85	758.3	30.21	767.4	64.8	18.2	57	NNW.	16.1	7.2	....	....	2	SW.	....	0	0	....	The Staff.
Ponta Delgada (Azores)	30.41	772.3	30.48	774.1	64.4	18.0	77	Calm.	0	0	....	....	3	....	....	0.024	0.6	....	

NOTE.—The originals give the wind-velocity in kilometers for the hour preceding the observation except Angra, which gives force on scale 0 to 9; occasionally, the weather by Vienna symbols; the amount of cloudiness without distinguishing between upper and lower clouds. The rainfall at Lisbon is measured at noon instead of 0 h. 6 m. p. m.

PORTUGUESE NAVAL SERIES.															Sea or swell.			
Vessels and captains.															Height scale 0–9.	Direction from—		
Bartholomew Dias	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	A. G. da Silva Costa, Commandant.
D. Fernando	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	A. M. de Sande, Com'd't.
Duque da Terceira	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	J. C. M. Cabrate, 1st L't.
Mindello	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	J. F. R. R. Bastos, Commandant.
Quanza, Carlos Maria da Silva Costa (St. Paul de Loando).	....	....	29.87	758.7	74.8	23.8	....	WNW.	....	....	2	....	4	....	WNW.	1	WNW.	D. clouds ...	C. J. de Senna Barcellos, Q. M.
Rio Duro	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	J. T. d'Oliveria, Com'd't.
Rio Lima, S. C. da Silva Costa	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	Antonio Sarmento, Q. M.
Sà da Bandeirà	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	F. Teixeira da Silva, Commandant.
Sado, J. A. de Brito Capello, Mossamedes, Benguela.	....	....	30.07	763.7	67.3	19.6	....	WNW.	....	....	2	....	3	....	....	2	NW.	D. clouds ...	A. Tito da Silva, Q. M.
Tejo, J. M. T. Guimaraes, Macao, China.	....	....	29.90	759.4	82.4	28.0	....	NE.	....	....	1	....	4	....	NE.	....	....	D. clouds ...	J. G. Felgos, 2d Lieut.

NOTE.—The originals give the weather by the Beaufort notation; no distinction between upper and lower clouds; duration of rainfall in hours. The Sà da Bandeirà gives the barometer reduced to freezing, but not to sea-level.

Bulletin of international meteorological observations, taken simultaneously on June 8, 1880—Continued.

RUSSIAN SERIES.

[Furnished by the co-operation of Prof. H. Wild, Director of the Imperial Central Physical Observatory of Russia at St. Petersburg.]

Stations.	Barometer.				Temperature of the air.		Relative humidity.	Wind.				Clouds.				Rainfall or melted snow in the past 24 hours.		Weather.	Observer.
	Corrected for instrumental error and temperature.		Reduced to sea-level.					Direction.	Velocity.		Force.	Amount.		Direction.					
												Upper.	Lower.	Upper.	Lower.				
	Inches.	Millimeters.	Inches.	Millimeters.	Fahrenheit.	Centigrade.	Per cent.	From—	Miles per hour.	Meters per second.	0—10.	0—10.	0—10.	From—	From—	Inches.	Millimeters.		
Archangel	29.44	747.7	29.46	748.2	60.4	15.8	61	NW.	13	6	...	...	6ks	...	...	...	...	...	Capt. Sseliwerstow.
Astrakhan	30.22	767.6	30.14	765.5	82.2	27.9	28	SSE.	16	7	...	...	0	...	...	...	...	...	Capt. Wisganow.
Barnaul	29.16	740.6	29.63	752.7	66.6	19.2	61	SW.	0	0	...	...	10	...	...	...	...	...	Meteorological Obs.
Dorpat	29.28	743.8	29.52	749.8	60.4	15.8	59	ESE.	7	3	...	...	9kn	...	...	...	...	...	Prof. Dr. Weihrauch.
Ekaterinburg	28.94	735.0	29.85	758.1	78.6	25.9	39	W.	18	8	...	4ck	...	...	...	...	...	Light clouds	Meteorological Obs.
Irkutsk	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Kasan	29.52	749.7	29.78	756.3	64.8	18.2	93	WSW.	20	9	...	...	10n	...	...	...	...	...	Physical Cabinet.
Kertch	30.10	764.5	30.12	765.0	74.8	23.8	96	S.	4	2	...	...	0	...	...	...	...	...	Lagorio.
Kieff	29.32	744.6	29.92	760.0	72.9	22.7	45	WSW.	11	5	...	...	8cks	...	...	...	...	...	Physical Cabinet.
Krotkowo*	29.43	747.5	29.87	758.8	76.6	24.8	50	S.	9	4	...	...	10	...	...	...	...	...	Cand. Fatjanow.
Lugan	29.76	756.0	29.96	761.0	79.7	26.5	41	WNW.	9	4	...	...	2	...	...	Bla'k	Bla'k	...	Meteorological Obs.
Moscow	29.26	743.1	29.78	756.5	68.9	20.5	43	S.	10.1	4.5	...	...	7ks	...	...	...	...	...	Meteorological Obs.
Nertchinsk	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Meteorological Obs.
Nikolaiev	30.04	763.1	30.11	764.9	80.1	26.7	45	S.	18	8	...	...	2k	...	...	...	...	...	Kurdakof.
Nikolaievsk, on the Amoor	29.86	758.5	29.95	760.7	47.7	8.7	84	SE.	16	7	...	...	0	...	...	...	...	...	
Nukuss	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Orenburg	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Pekin (China)	29.57	751.0	29.71	754.6	77.2	25.1	38	S.	11	5	...	...	1k	...	...	...	...	...	Physical Observatory.
St. Petersburg	29.54	750.2	29.55	750.6	57.6	14.2	64	NNW.	4	2	...	...	7cs;k	...	...	...	...	...	Central Physical Obs.
Tashkend	28.47	723.2	29.99	761.8	71.2	21.8	54	Calm.	0	0	...	...	0	...	...	...	...	...	Teich, A. M.
Tiflis	28.71	729.2	30.07	763.6	79.7	26.5	45	SE.	4	2	...	...	0	...	...	...	...	...	Physical Observatory.
Vladivostock	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Warsaw	29.53	750.1	29.95	760.7	61.0	16.1	48	W.	25	11	...	...	3k	...	...	...	...	...	Astronomical Obs.
Wilna	29.30	744.2	29.72	754.8	54.3	12.4	76	SW.	31	14	...	...	9	...	...	...	...	Heavy cl'ds	Astronomical Obs.
Yeniseisk	29.51	749.5	29.78	756.5	68.0	20.0	35	SE.	2	1	...	...	5	...	...	...	...	...	Marks.

NOTE.—The originals give the amount, and generally the kind of cloudiness, without distinguishing between upper and lower clouds; occasionally, the weather by Vienna symbols; they omit the rainfall. The elevation of Tiflis is 409 m., or 1,342 ft.; Tashkend, 455 m., or 1,493 ft.; Irkutsk, 461.5 m., or 1,514.1 ft.; Nertchinsk, 660 ? m., or 2,165 ? ft.

*N. 53° 47′, E. 48° 34′.

SPANISH SERIES.

[Furnished by the co-operation of Antonio Aguilar, Director of the Royal Observatory at Madrid, and the respective observers.]

Barcelona, Met. Observat'y	30.01	762.2	30.11	764.9	71.2	21.8	63	SW.	4.9	2.17	....	......	4k	......	......	0	0	½ clear	Antonio Rave, Director.
Bilboa, Met. Observatory...	30.14	765.5	30.19	766.9	69.3	20.7	60	NW.	1.9	0.83	....	3	6	NW.	......	0	0	Almost cov'd	Prof. Man. de Naverane.
Burgos, Met. Observatory..	27.16	689.8	......	......	71.6	22.0	50	E.	15.1	6.74	....	......	2	......	......	0	0	Light clouds	Domingo Martin y Perez.
Madrid, Royal Observatory	27.87	707.9	29.98	761.6	50.4	10.2	36	SW.	16.4	7.33	....	0	2	......	......	0	0	Light clouds	The Staff.
Murcia, Met. Observatory..	29.99	761.8	30.14	765.5	77.0	25.0	63	S.	2.3	1.03	....	0	0	......	......	0	0	Clear	Olayo Diaz, Director.
Santiago, Met. Observatory	29.26	743.2	30.15	765.8	63.9	17.7	63	N.	4.3	1.9	....	......	7	......	......	0	0	Cloudy	R. Gil Villanueva, Dir.
SUBSERIES.																			
Havana, Cuba, W. I........	30.00	761.9	30.06	763.5	77.1	25.1	85	Calm.	0	0	....	10ck	0	SSW.	......	0.902	22.9	Cloudy	Benito Vines, S. J.
Manila, Philippine Islands.	29.77	756.3	29.83	757.6	85.7	29.8	76	SW.	6.6	3.0	....	......	3kn	......	E.	0	0	Clear	Federico Faura, S. J.
San Fernando, Naval Obs'y	30.07	763.7	30.17	766.2	73.6	23.1	64	WNW.	8.5	3.8	....	0	0	......	......	0	0	....	Capt. C. Puiazon, R. N., Director.
San Juan de Porto Rico, W. I	30.02	762.6	30.11	764.9	79.5	26.4	94	E.	4.1	1.85	....	6kn	7kn	E.	E.	0.679	17.25	Cloudy	Enrique Gades, Chief Engineer.

NOTE.—The originals give the weather in general terms as published; wind-velocity, except for subseries, in kilometers per hour; rainfall for San Juan is measured at 4 p. m., instead of 8.19 a. m., and for San Fernando at midnight following; at Barcelona, Bilbao, Burgos, Murcia, and Santiago the barometer is reduced to freezing, but not to sea-level. The elevation of Burgos is 860 m., or 2,822 ft.; Madrid, 655.5 m., or 2,150.5 ft.

SWEDISH SERIES.

[Furnished by the co-operation of Prof. R. Rubenson, Director of the Royal Swedish Meteorological Institute, of F. Malmberg, Director of the Nautical Meteorological Bureau, Stockholm, and of Prof. H. H. Hildebransson, Director of the Meteorological Observatory of the Upsala University.]

Haparanda	29.43	747.6	29.47	748.6	43.2	6.2	....	N.	......	......	2	......	10	......	......	2.362	60.0	....	
Umea	29.48	748.8	29.53	750.1	45.0	7.2	77	SSW.	......	......	4	......	10	......	......	0.063	1.6	....	
Hernosand	29.46	748.2	29.51	749.5	52.9	11.6	86	SSW.	......	......	2	......	5	......	......	0.232	5.9	....	
Stockholm	29.32	744.8	29.50	749.3	57.6	14.2	55	WSW.	......	......	2	......	10	......	......	0.051	1.3	....	
Wisby	29.45	748.1	29.51	749.6	48.2	9.0	87	WNW.	......	......	2	......	10	......	......	0.055	1.4	....	
SUBSERIES.																			
Upsala	29.36	745.8	29.51	749.6	58.5	14.7	55	W.	5.1	2.3	....	......	9	......	W.	0.002	0.05	....	Nils Ekholm.

NOTE.—The originals give the wind-force by the scale 0 to 6, except Upsala; occasionally, the weather by Vienna symbols or in general terms; no distinction between the amount of upper and lower clouds. The rainfall is measured at 8 a. m., local time, and apparently on the following day.

SWEDISH NAVAL SERIES.															Sea or swell.				
Vessels.															Height scale 0-9	Direction from—			
Bark Australia	......	......	......	......	......	......	....	....	......	......	....	......	......	......	......	......	......	....	J. P. Pahlson.
H. M. corvette Balder.	......	......	......	......	......	......	....	....	......	......	....	......	......	......	......	......	......	....	Capt. A. C. Schonmeyr.
Saga, N. 37° 07′, W. 15° 36′..	......	......	30.32	770.2	65.1	18.4	....	NE.	......	......	3	......	10	......	......	......	......	D. clouds.	M. von Krusenstierna.

NOTE.—The originals give wind-force and weather by Beaufort notation. Observations of bark Australia not strictly simultaneous.

Bulletin of international meteorological observations, taken simultaneously on June 8, 1880—Continued.

SWISS SERIES.

[Furnished by the co-operation of Prof. R. Wolf, Director of the Observatory at Zurich, and of Prof. E. Plantamour, Director of the Observatory at Geneva.]

Stations.	Barometer.				Temperature of the air.		Relative humidity.	Wind.				Clouds.				Rain-fall or melted snow in the past 24 hours.		Weather.	Observer.
	Corrected for instrumental error and temperature.		Reduced to sea-level.					Direction.	Velocity.		Force.	Amount.		Direction.					
												Upper.	Lower.	Upper.	Lower.				
	Inches.	Millimeters.	Inches.	Millimeters.	Fahrenheit.	Centigrade.	Per cent.	From—	Miles per hour.	Meters per second.	0—10.	0—10.	0—101.	From—	From—	Inches.	Millimeters.		
Geneva	28. 64	727. 5	30. 03	762. 8	66. 6	19. 2	46	SW.	......	......	3	......	2	......	......	0	0	Clear	The Observatory.
Zurich	28. 43	722. 1	30. 04	762. 9	63. 9	17. 7	69	W.	......	......	3	......	5	......	......	0	0	Lightly cl'dy	The Observatory.

NOTE.—At Geneva the corresponding departures from the normal values are: Barometer, + 1. 3 mm.; thermometer, — 0. 6 cent.; relative humidity, — 10 per cent.

NOTE.—The rainfall is measured at Zurich at 7 a. m., on the following day. The originals give the barometer reduced to freezing, but not to sea-level; the wind-force by the scale 0 to 4 for Zurich; the amount of cloudiness without distinguishing between upper and lower clouds; the weather in general terms. The elevation of Geneva is 408 meters, or 1,339 feet, and that of Zurich 470 meters, or 1,542 feet.

TURKISH SERIES.

[Furnished by the co-operation of A. Coumbary, Effendi, Director of the Central Observatory at Constantinople, and of Prof. C. V. A. van Dyck, Superintendent of the Lee Observatory at Beirut.

Stations.	Barometer.				Temperature of the air.		Relative humidity.	Wind.				Clouds.				Rain-fall or melted snow in the past 24 hours.		Weather.	Observer.
	Inches.	Millimeters.	Inches.	Millimeters.	Fahrenheit.	Centigrade.	Per cent.	From—	Miles per hour.	Meters per second.	0—10.	0—10.	0—101.	From—	From—	Inches.	Millimeters.		
Constantinople	......	......	30. 07	763. 6	81. 0	27. 2	54	NNE.	16	7. 0	....	......	0	......	......	0	0	....	The Observatory.
Fao, Persian Gulf	......	......	......	......	......	......	....	......	......	......	....	......	......	......	......	......	......	....	
Valona	......	......	30. 07	763. 6	77. 2	25. 1	....	SW.	......	......	2	......	2	......	......	0	0	Slightly cld'y	A. Bertrand.
SUBSERIES.																			
Beirut (Syria), Lee Obs'y	......	......	29. 87	758. 8	81. 3	27. 4	75	NE.	......	......	1	......	0	......	......	0	0	....	Prof. C. V. A. van Dyck.

NOTE.—The originals give the velocity at Constantinople in meters per second; at Fao and Valona the wind-force by the scale 0 to 7; at Beirut by the scale 0 to 12; the weather in general terms as published; for Valona the amount is inferred from the general weather terms. Valona does not state that the barometer is reduced to sea-level, but it is so assumed.

CANADIAN SERIES.

[Furnished by the co-operation of Charles Carpmael, A. M., F. R. A. S., Director of the Magnetic Observatory at Toronto and Superintendent of the Meteorological Office of the Dominion of Canada, and the respective observers.

Bathurst, N. B	......	......	......	......	53. 0	11. 7	....	Calm.	0	0	....	......	10n	......	......	0	0	Cloudy	Hon. J. Ferguson.
Chatham, N. B	30. 21	767. 3	30. 27	768. 8	52. 3	11. 3	90	NE.	5	2. 2	....	......	10s	......	......	Inap.	Inap.	Cloudy	G. A. Blair.
Charlottetown, P. E. Isl'd	30. 18	766. 6	30. 22	767. 6	51. 5	10. 8	98	E.	6	2. 7	....	......	10n	......	......	0	0	Cloudy	H. J. Cundall, C. E.
Cornwall, Ontario	29. 89	759. 2	30. 08	764. 0	60. 4	15. 8	70	W.	......	......	1	5cs	0	......	......	0	0	Fair	James Smith, M. A.
Dalhouse, N. B	30. 09	764. 3	30. 26	768. 6	51. 0	10. 6	94	E.	......	......	1	......	10s	......	......	0	0	Cloudy	H. A. Johnson.
Father Point, Quebec	30. 15	765. 8	30. 17	766. 3	60. 6	15. 9	68	S.	20	8. 9	....	......	10s	......	......	Inap.	Inap.	Threatening	J. McWilliams.
Fredericton, N. B	30. 19	766. 8	30. 26	768. 6	56. 0	13. 3	78	NE.	1	0. 4	....	......	10s	......	......	0	0	Clearing	Professor Harrison.
Fort Garry, Manitoba	28. 98	736. 1	29. 78	756. 4	60. 0	15. 6	88	SE.	5	2. 2	....	2cs	2s	SE.	......	0	0	Fair	James Stewart.
Granton, Ontario	28. 97	735. 8	30. 06	763. 5	53. 0	11. 7	80	N.	......	......	1	0	0	......	......	0	0	Clear.	James Grant.
Halifax, N. S	30. 10	764. 5	30. 23	767. 8	51. 3	10. 7	91	SE.	4	1. 8	....	......	10n	......	......	Inap.	Inap.	Cloudy	A. Allison.
Hamilton, Ontario	29. 70	754. 4	30. 08	764. 0	52. 9	11. 6	80	NE.	......	......	1	......	10s	......	......	0	0	Cloudy	George Dickson, B. A.
Heart's Content, N. F	......	......	......	......	......	......	....	......	......	......	....	......	......	......	......	......	......	......	E. Weedon.
Kingston, Ontario	29. 71	754. 6	30. 04	763. 0	55. 9	13. 3	81	E.	1	0. 4	....	10cs	0	Calm.	......	0	0	Cloudy	S. Woods, M. A.
Little Glace Bay, N. S	30. 21	767. 3	30. 25	768. 3	45. 0	7. 2	96	E.	3	1. 3	....	......	Fog.	......	......	0	0	Foggy	C. H. Rigby.
Montreal, Quebec	29. 90	759. 4	30. 10	764. 5	59. 0	15. 0	62	SW.	5	2. 2	....	......	10s	......	......	0. 02	0. 5	Cloudy	C. H. McLeod, C. E.
Moose Factory, Ontario	29. 87	758. 7	29. 90	759. 4	43. 0	6. 1	91	SW.	......	......	1	......	10n	......	......	0. 49	12. 4	Clearing	J. R. Nason.
Norwood, Ontario	......	......	......	......	......	......	....	......	......	......	....	......	......	......	......	......	......	......	Rev. T. F. Fotheringham, M. A.
Parry Sound, Ontario	29. 37	746. 0	30. 07	763. 8	47. 0	8. 3	77	W.	12	5. 4	....	0	0	......	......	0. 06	1. 5	Clear	Rev. R. Mosley.
Peterboro, Ontario	29. 33	745. 0	30. 07	763. 8	58. 7	14. 8	76	W.	......	......	1	4k	0	......	......	0	0	Fair	J. F. Jeffers, M. A.
Port Dover, Ontario	29. 38	746. 2	30. 06	763. 5	60. 1	15. 6	94	Calm.	0	0	....	10k	0	W.	......	0	0	Fair	H. Morgan.
Port Stanley, Ontario	29. 42	747. 3	30. 05	763. 3	60. 1	15. 6	77	W.	1	0. 4	....	2ck	0	W.	......	0	0	Clear	M. Payne.
Quebec, Quebec	29. 80	756. 9	30. 12	765. 0	59. 0	15. 0	88	E.	......	......	1	0	2s	......	......	0. 18	4. 6	Fair	Captain Ashe, R. N.
Rockliff, Ontario	29. 55	750. 6	30. 01	762. 2	48. 1	8. 9	70	Calm.	0	0	....	......	8s	......	......	0	0	Cloudy	W. H. McIntyre.
St. John, N. B	30. 07	763. 8	30. 24	768. 1	50. 0	10. 0	85	SW.	3	1. 3	....	......	10s	......	......	0	0	Cloudy	G. Murdock, C. E.
Saugeen, Ontario	29. 36	745. 7	30. 08	764. 0	51. 1	10. 6	71	SW.	7	3. 1	....	......	10ks	......	......	0	0	Cloudy	K. Stewart.
Stratford, Ontario	28. 79	731. 3	30. 07	763. 8	49. 9	9. 9	79	E.	3	1. 3	...	0	0	......	......	0	0	Clear	C. J. MacGregor, M. A.
Sydney, C. B	30. 22	767. 6	30. 26	768. 6	47. 0	8. 3	100	N.	1	0. 4	....	......	10n	......	......	0. 01	0. 3	Foggy	T. C. Hill, C. E.
Toronto, Ontario	29. 72	754. 9	30. 10	764. 5	56. 8	13. 8	65	N.	5	2. 2	....	4cs	0	W.	......	0	0	Fair	Magnetic Observatory.
Windsor, N. S	......	......	......	......	......	......	....	......	......	......	....	......	......	......	......	......	......	......	Prof. Jno. E. Oram, M. A.
Woodstock, Ontario	29. 02	737. 1	30. 08	764. 0	54. 7	12. 6	78	N.	7	3. 1	....	1k	0	......	......	0	0	Clear	Professor Wolverton.
Yarmouth, N. S	30. 14	765. 5	30. 21	767. 3	53. 6	12. 0	79	NE.	2	0. 9	....	6ck	0	NW.	......	0	0	Fair	Lieut. F. E. Wilmot, R. N.
SUBSERIES.																			
St. Johns, Newfoundland	30. 15	765. 8	30. 40	772. 1	45	7. 2	100	E.	......	......	....	......	Fog.	......	......	0. 24	6. 1	Fog & mist.	John Delany.
St. Pierre, N. F., l'Hopital Maritime.	......	......	30. 20	767. 1	46. 4	8. 0	....	S.	......	......	1	......	......	......	......	0. 24	6. 1	......	The Commandant.

NOTE—The originals give the wind-force at St. Pierre on the scale 0 to 7. The elevation of Granton is 1,015 feet, or 309 meters; Stratford, 1,182 feet, or 360 meters.

Bulletin of international meteorological observations, taken simultaneously on June 8, 1880—Continued.

UNITED STATES SERIES.

(By authority of the Secretary of War.)

[Furnished by the co-operation of R. C. Drum, Adjutant-General, and Acting Chief Signal Officer, United States Army.]

Stations.	Barometer.				Temperature of the air.		Relative humidity.	Wind.				Clouds.				Rainfall or melted snow in the past 24 hours.		Weather.	Observer.
	Corrected for instrumental error and temperature.		Reduced to sea-level.					Direction.	Velocity.		Force.	Amount.		Direction.					
												Upper.	Lower.	Upper.	Lower.				
	Inches.	Millimeters.	Inches.	Millimeters.	Fahrenheit.	Centigrade.	Per cent.	From—	Miles per hour.	Meters per second.	0—10.	0—10.	0—10.	From—	From—	Inches.	Millimeters.		
Albany, N. Y	30.05	763.3	30.13	765.3	67	19.4	46	NW.	4	1.8	....	8c	Haze	Calm.	Calm.	0.01	0.3	Fair	
Alpena, Mich	29.39	746.5	30.04	763.0	47	8.3	70	W.	9	4.0	....	0	0	......	......	0	0	Clear	
Atka, Aleutian Is., Alaska	......	......	......	......	......	......	....	......	......	......	....	......	......	......	......	......	......	......	
Atlanta, Ga	28.86	733.0	29.96	761.0	71	21.7	85	SW.	5	2.2	....	8k	2s	Calm.	Calm.	0.42	10.7	Cloudy	
Atlantic City, N. J	30.03	762.7	30.04	763.0	65	18.3	78	NE.	3	1.3	....	......	10s	......	NE.	0	0	Cloudy	
Augusta, Ga	29.85	758.2	30.05	763.3	73	22.8	85	S.	......	......	1	......	10s	......	Calm.	Inap.	Inap.	Cloudy	
Baltimore, Md	30.03	762.7	30.08	764.0	71	21.7	49	NE.	8	3.6	....	2k	0	W.	......	0	0	Clear	
Barnegat, N. J	30.02	762.5	30.04	763.0	63	17.2	89	NE.	12	5.4	....	......	10s	......	NE.	0	0	Cloudy	
Bismarck, Dak	27.77	705.4	29.63	752.6	60	15.6	88	SE.	16	7.2	....	......	10s	......	SE.	0	0	Cloudy	
Boerne, Tex	28.44	722.4	29.70	754.4	74	23.3	90	S.	12	5.4	....	5k	8ks	S.	S.	0	0	Cloudy	
Boise City, Idaho	27.12	688.8	30.08	764.0	46	7.8	62	Calm.	0	0	....	......	10s	......	W.	0.09	2.3	Cloudy	
Boston, Mass	29.99	761.7	30.15	765.8	52	11.1	93	NE.	16	7.2	....	......	Fog.	......	Calm.	0.05	1.3	Foggy	
Brackettville, Tex	28.72	729.5	29.71	754.6	77	25.0	82	E.	10	4.5	....	......	10ks	......	E.	0	0	Cloudy	
Breckenridge, Minn	28.79	731.3	29.75	755.6	60	15.6	86	SE.	20	8.9	....	5k	0	SW.	......	0	0	Fair	
Brownsville, Tex	29.83	757.7	29.88	758.9	82	27.8	79	S.	8	3.6	....	2ck	0	Calm.	......	0	0	Clear	
Buffalo, N. Y	29.37	746.0	30.06	763.5	59	15.0	76	SW.	5	2.2	....	8k	0	SW.	......	0	0	Fair	
Burkes, Ariz	......	......	......	......	65	18.3	22	Calm.	......	......	0	0	0	......	......	0	0	Clear	
Burlington, Vt	29.83	757.7	30.12	765.0	62	16.7	56	N.	1	0.4	....	8cs	0	W.	......	0.07	1.8	Fair	
Cairo, Ill	29.63	752.6	30.01	762.2	73	22.8	72	S.	6	2.7	....	......	10ks	......	W.	0	0	Cloudy	
Campo, Cal	27.33	694.2	29.90	759.4	40	4.4	82	SW.	3	1.3	....	0	0	......	......	0	0	Clear	
Cape Hatteras, N. C	29.99	761.7	30.00	762.0	77	25.0	82	W.	7	3.1	....	Haze.	0	Calm.	......	0.03	0.8	Clear	
Cape Henry, Va	29.96	761.0	29.98	761.5	73	22.8	81	W.	4	1.8	...	8cs	0	SW.	......	0.02	0.5	Fair	
Cape Lookout, N. C	30.00	762.0	30.01	762.2	75	23.9	90	NW.	8	3.6	....	5c;k	0	Calm. NW.	......	0.02	0.5	Fair	

Cape May, N. J	29.99	761.7	30.02	762.5	69	20.6	75	NE.	22	9.8	....	......	10s	......	NE.	0	0	Cloudy
Castroville, Tex	29.10	739.1	29.77	756.1	80	26.7	78	SE.	11	4.9	....	......	10s	......	S.	0	0	Cloudy
Cedar Keys, Fla	30.04	763.0	30.07	763.8	81	27.2	74	W.	7	3.1	....	1k	2ks	Calm.	W.	0.39	9.9	Fair
Charleston, S. C	29.97	761.2	30.02	762.5	76	24.4	77	N.	4	1.8	....	0	0	......	......	0.52	13.2	Clear
Charlotte, N. C	29.16	740.7	29.94	760.5	69	20.6	95	SE.	2	0.9	....	......	10s	......	SE.	2.14	54.4	Cloudy
Chattanooga, Tenn	29.23	742.4	30.00	762.0	69	20.6	80	W.	1	0.4	....	2cs	Sm'e	Calm.	Calm.	0	0	Fair
Cheyenne, Wyo	23.77	603.8	29.73	755.1	52	11.1	35	NW.	6	2.7	....	0	0	......	......	0	0	Clear
Chicago, Ill	29.31	744.5	29.98	761.5	65	18.3	68	S.	1	0.4	....	......	10ks	......	W.	0.02	0.5	Cloudy
Chincoteague, Va	29.98	761.5	30.00	762.0	71	21.7	78	NE.	20	8.9	....	5c	Haze	NE.	Calm.	Inap.	Inap.	Fair
Cincinnati, Ohio	29.40	746.7	30.02	762.5	68	20.0	56	SE.	1	0.4	....	0	0	......	......	0	0	Clear
Cleveland, Ohio	29.35	745.5	30.06	763.5	62	16.7	67	S.	3	1.3	....	2ck	0	W.	......	0	0	Clear
Coleman City, Tex	28.06	712.7	29.63	752.6	76	24.4	73	S.	12	5.4	....	0	0	......	......	0	0	Clear
Columbus, Ohio	29.22	742.2	30.03	762.7	68	20.0	70	NE.	6	2.7	....	Sm'e	0	Calm.	......	0	0	Clear
Concho, Tex	27.92	709.2	29.50	749.3	77	25.0	69	S.	16	7.2	....	2ck	0	SW.	......	0	0	Fair
Corsicana, Tex	29.44	747.8	29.88	758.9	77	25.0	82	S.	16	7.2	....	0	8ks	......	Calm.	0	0	Cloudy
Davenport, Iowa	29.32	744.7	29.93	760.2	64	17.8	83	E.	7	3.1	....	1k	0	S.	......	0.02	0.5	Clear
Dayton, Wash	......	......	......	......	46	7.8	69	S.	......	......	4	......	10s	......	SW.	0.35	8.9	Cloudy
Deadwood, Dak	24.99	634.7	......	......	62	16.7	42	SW.	12	5.4	....	8cs	0	SW.	......	0	0	Fair
Decatur, Tex	28.69	728.7	29.79	756.7	77	25.0	82	SE.	16	7.2	....	2ck	5s	Calm.	S.	0	0	Clear
Delaware Breakwater, Del	30.03	762.7	30.05	763.3	66	18.9	89	NE.	16	7.2	....	......	10s	......	NE.	0	0	Cloudy
Denison, Tex	29.12	739.6	29.87	758.7	75	23.9	86	SE.	3	1.3	....	2ck	5ks	S.	S.	Inap.	Inap.	Cloudy
Denver, Colo	24.51	622.5	29.73	755.1	59	15.0	33	SW.	3	1.3	....	0	0	......	......	0	0	Clear
Des Moines, Iowa	29.01	736.8	29,87	758.7	58	14.4	76	E.	5	2.2	....	0	0	......	......	0.04	1.0	Clear
Detroit, Mich	29.38	746.2	30.04	763.0	56	13.3	75	NE.	4	1.8	....	5cs	0	Calm.	......	0	0	Fair
Dodge City, Kans	27.04	686.8	29.17	740.9	68	20.0	84	SE.	14	6.3	....	0	5s	......	E.	0	0	Fair
Dubuque, Iowa	29.28	743.7	29.96	761.0	62	16.7	72	E.	4	1.8	....	5k	Haze	S.	Calm.	Inap.	Inap.	Fair
Duluth, Minn	29.31	744.5	29.98	761.5	52	11.1	73	NE.	5	2.2	....	0	0	......	......	0	0	Clear
Eagle Pass, Tex	29.04	737.6	29.72	754.9	83	28.3	64	SE.	12	5.4	....	0	0	......	......	0	0	Clear
Eastport, Me	30.16	766.1	30.23	767.8	45	7.2	92	E.	4	1.8	....	......	10s	......	Calm.	0	0	Cloudy
Edinburg, Tex	......	......	......	......	82	27.8	91	SE.	......	......	1	5k	2s	SE.	S.	0	0	Fair
El Paso, Tex,	......	......	......	......	......	......	...	......	......	......	....	......	......	......	......	......	......	......
Erie, Pa	29.34	745.2	30.04	763.0	66	18.9	54	SW.	2	0.9	....	0	5ks	......	W.	0	0	Fair
Escanaba, Mich	29.39	746.5	30.04	763.0	53	11.7	73	W.	3	1.3	....	0	0	......	......	0	0	Clear
Florence, Ariz	28.33	719.6	29.93	760.2	69	20.6	56	SE.	2	0.9	....	0	0	......	......	0	0	Clear
Fort Apache, N. Mex	25.00	635.0	30.45	773.4	42	5.6	50	NE.	4	1.8	....	0	0	......	......	0	0	Clear
Fort Assiniboine, Mont	......	......	......	......	......	......	...	......	......	......	....	......	......	......	......	......	......	......
Fort Buford, Dak	27.50	698.5	29.23	742.4	59	15.0	87	SE.	1	0.4	....	......	10s	......	SW.	0.73	18.5	Cloudy
Fort Custer, Mont	26.41	670.8	......	......	52	11.1	93	NW.	4	1.8	....	......	10n	......	Calm.	0.24	6.1	Light rain
Fort Davis, Tex	25.15	638.8	30.11	764.8	73	22.8	55	W.	5	2.2	....	0	0	......	......	0	0	Clear
Fort Elliott, Tex	26.66	677.2	28.74	730.0	71	21.7	58	SE.	14	6.3	....	0	0	......	......	0	0	Clear
Fort Gibson, Indian Ter	29.30	744.2	29.81	757.2	68	20.0	95	NE.	4	1.8	....	......	10s	......	W.	1 .24	31.5	Cloudy
Fort Grant, Ariz	25.16	639.0	29.96	761.0	69	20.6	8	E.	7	3.1	....	0	0	......	......	0	0	Clear
Fort Griffin, Tex	28.52	724.4	29.72	754.9	77	25.0	66	S.	12	5.4	....	0	0	......	......	0	0	Clear
Fort Keogh, Mont	26.86	682.2	......	......	55	12.8	93	Calm.	0	0	....	......	10n	......	NW.	0.09	2.3	Light rain
Fort McKavett, Tex	27.60	701.0	29.41	747.0	74	23.3	76	S.	10	4.5	....	1ck	0	S.	......	0	0	Clear
Fort St. Michael, Alaska	......	......	......	......	......	......	...	......	......	......	....	......	......	......	......	......	......	......
Fort Shaw, Mont	......	......	......	......	......	......	...	......	......	......	....	......	......	......	......	......	......	......
Fort Sill, Indian Ter	28.55	725.2	29.59	751.6	76	24.4	86	SE.	22	9.8	....	0	0	......	......	0	0	Clear
Fort Stevenson, Dak	27.75	704.8	......	......	59	15.0	76	S.	14	6.3	....	8k	0	S.	......	0.16	4.1	Cloudy
Fort Verde, Ariz	......	......	......	......	58	14.4	48	NW.	......	......	1	0	0	......	......	0	0	Clear
Fort Yates, Dak	......	......	......	......	......	......	...	......	......	......	....	......	......	......	......	......	......	......

Bulletin of international meteorological observations, taken simultaneously on June 8, 1880—Continued.

UNITED STATES SERIES—Continued.

Stations.	Barometer.				Temperature of the air.		Relative humidity.	Wind.				Clouds.				Rainfall or melted snow in the past 24 hours.		Weather.	Observer.
	Corrected for instrumental error and temperature.		Reduced to sea-level.					Direction.	Velocity.		Force.	Amount.		Direction.					
												Upper.	Lower.	Upper.	Lower.				
	Inches.	Millimeters.	Inches.	Millimeters.	Fahrenheit.	Centigrade.	Per cent.	From—	Miles per hour.	Meters per second.	0—10.	0—10.	0—10.	From—	From—	Inches.	Millimeters.		
Fredericksburg, Tex	......	......	......	......	......	......	......	......	......	......	....	......	......	......	......	......	......	......	
Galveston, Tex	29.90	759.4	29.94	760.5	83	28.3	71	S.	12	5.4	....	1ck	1ks	NW.	S.	0	0	Clear	
Grand Haven, Mich	29.38	746.2	30.02	762.5	58	14.4	70	E.	8	3.6	....	0	0	......	......	0	0	Clear	
Helena, Mont	......	......	......	......	46	7.8	62	SW.	7	3.1	....	......	8ks	......	Calm.	Inap.	Inap.	Cloudy	
Henrietta, Tex	......	......	......	......	......	......	......	......	......	......	....	......	......	......	......	......	......	......	
Indianapolis, Ind	29.23	742.4	29.98	761.5	69	20.6	65	E.	4	1.8	....	5k	0	W.	......	0	0	Fair	
Indianola, Tex	29.90	759.4	29.93	760.2	84	28.9	71	S.	18	8.0	....	1k	0	Calm.	......	0	0	Fair	
Jacksboro, Tex	28.66	728.0	29.72	754.9	75	23.9	77	SE.	12	5.4	....	0	0	......	......	0	0	Clear	
Jacksonville, Fla	30.04	763.0	30.06	763.5	79	26.1	78	SW.	8	3.6	....	5k	0	SW.	......	0.23	5.8	Fair	
Keokuk, Iowa	29.27	743.4	29.86	758.4	66	18.9	79	E.	5	2.2	....	0	2s	......	Calm.	0	0	Clear	
Key West, Fla	30.04	763.0	30.07	763.8	81	27.2	78	SE.	8	3.6	....	2k	0	SE.	......	0	0	Fair	
Kittyhawk, N. C	29.89	759.2	29.91	759.7	69	20.6	95	N.	13	5.8	....	8c	0	W.	......	0.04	1.0	Cloudy	
Knoxville, Tenn	29.04	737.6	30.01	762.2	68	20.0	74	Calm.	0	0	....	0	0	......	......	0	0	Clear	
LaCrosse, Wis	29.21	741.9	29.94	760.5	57	13.9	81	NE.	1	0.4	....	......	10s	......	Calm.	0	0	Cloudy	
La Mesilla, N. Mex	26.02	660.9	30.17	766.3	58	14.4	42	Calm.	0	0	....	0	0	......	......	0	0	Clear	
Laredo, Tex	29.40	746.7	29.72	754.9	81	27.2	70	SE.	10	4.5	....	1c	0	Calm.	......	0	0	Clear	
Leavenworth, Kans	28.96	735.6	29.77	756.1	64	17.8	73	SE.	2	0.9	....	4cs	2s	W.	S.	0.19	4.8	Fair	
Lewiston, Idaho	29.14	740.1	29.78	756.4	52	11.1	53	W.	2	0.9	....	......	10ks	......	Calm.	0.16	4.1	Cloudy	
Little Rock, Ark	29.59	751.6	29.90	759.4	71	21.7	85	SE.	6	2.7	....	......	10s	......	Calm.	0	0	Cloudy	
Los Angeles, Cal	29.54	750.3	29.88	758.9	61	16.1	82	SE.	4	1.8	....	......	10s	......	Calm.	0	0	Cloudy	
Louisville, Ky	29.45	748.0	29.98	761.5	71	21.7	66	N.	4	1.8	....	0	2s;s'm	......	Calm.	0	0	Clear	
Lynchburg, Va	29.38	746.2	30.03	762.7	73	22.8	59	W.	2	0.9	....	0	0	......	......	0	0	Clear	
Madison, Wis	29.02	737.1	29.98	761.5	59	15.0	88	NW.	2	0.9	....	10cs	0	W.	......	0	0	Cloudy	
Marquette, Mich	29.31	744.5	30.01	762.2	55	12.8	56	SW.	12	5.4	....	0	0	......	......	0	0	Clear	
Mason, Tex	28.24	717.3	29.90	759.4	77	25.0	77	S.	10	4.5	....	2k	0	S.	......	0	0	Fair	
Memphis, Tenn	29.62	752.3	29.94	760.5	73	22.8	72	SE.	4	1.8	....	......	10s	......	SE.	0	0	Cloudy	
Milwaukee, Wis	29.28	743.7	30.01	762.2	50	10.0	72	N.	10	4.5	....	3c;ck	1s	W.	Calm.	0	0	Fair	
Mobile, Ala	30.00	762.0	30.04	763.0	78	25.6	91	Calm.	0	0	....	2c	5s	Calm.	W.	1.09	27.7	Fair	

Montgomery, Ala	29.82	757.4	30.04	763.0	73	22.8	92	S.	3	1.3	....	......	10s	......	Calm.	0.08	2.0	Cloudy
Morgantown, W. Va	29.06	738.6	30.02	762.5	68	20.0	70	Calm.	0	0	....	0	0	......	......	0	0	Clear
Mount Washington, N. H	23.96	608.6	30.32	770.1	49	9.4	85	SW.	8	3.6	....	8c	10s	Calm.	SW.	0.40	10.2	Fair
Nashville, Tenn	29.49	749.0	30.00	762.0	69	20.6	80	NW.	2	0.9	....	......	10ks	......	NW.	0.02	0.5	Cloudy
New Haven, Conn	29.97	761.2	30.08	764.0	61	16.1	88	NE.	15	6.7	....	......	10s	......	NE.	0	0	Cloudy
New London, Conn	30.03	762.7	30.08	764.0	60	15.6	77	N.	10	4.5	....	......	9s	......	N.	0	0	Cloudy
New Orleans, La	29.97	761.2	30.03	762.7	80	26.7	78	SW.	2	0.9	....	1c	Sm'e.	Calm.	Calm.	0.52	13.2	Clear
Newport, R. I	30.04	763.0	30.09	764.3	57	13.9	87	N.	12	5.4	....	......	10s	......	Calm.	0	0	Cloudy
New River, N. C	......	......	......	......	......	......	....	......	......	......	....	......	......	......	......	......	......	......
New York, N. Y	29.91	759.7	30.08	764.0	66	18.9	54	N.	14	6.3	....	8k	0	NE.	......	0	0	Fair
Norfolk, Va	29.93	760.2	29.98	761.5	76	24.4	77	NE.	4	1.8	....	1c	Haze.	Calm.	Calm.	0.53	13.5	Clear
North Platte, Nebr	26.77	680.0	29.20	741.7	62	16.7	91	SE.	16	7.2	....	......	Fog.	......	SE.	0	0	Foggy
Olympia, Wash	29.94	760.5	29.98	761.5	48.0	8.9	89	S.	4	1.8	....	......	10s	......	W.	0.16	4.1	Cloudy
Omaha, Nebr	28.66	728.0	29.71	754.6	62	16.7	77	SE.	8	3.6	....	2c	2s	W.	Calm.	Inap.	Inap.	Fair
Oswego, N. Y	29.79	756.7	30.11	764.8	62	16.7	72	SE.	6	2.7	....	5c	2s	Calm.	Calm.	0	0	Fair
Pembina, Dak	28.90	734.0	29.71	754.6	55	12.8	81	S.	6	2.7	....	2c	0	Calm.	......	0	0	Clear
Pensacola, Fla	30.01	762.2	30.04	763.0	78	25.6	86	SW.	5	2.2	....	4k	5ks	W.	W.	0.09	2.3	Cloudy
Philadelphia, Pa	30.02	762.5	30.07	763.8	65	18.3	63	NE.	15	6.7	....	5cs	Haze.	Calm.	Calm.	0	0	Fair
Phœnix, Ariz	28.65	727.7	30.35	770.9	79	26.1	27	E.	6	2.7	....	0	0	......	......	0	0	Clear
Pike's Peak, Colo	17.73	450.3	29.94	760.5	31	— 0.6	38	SW.	44	19.7	....	1cs	0	Calm.	......	0	0	Clear
Pilot Point, Tex	29.10	739.1	29.91	759.7	76	24.4	86	SE.	12	5.4	....	10k	0	S.	......	0	0	Cloudy
Pioche, Nev	23.93	607.8	29.70	754.4	56	13.3	24	NW.	4	1.8	....	0	0	......	......	0	0	Clear
Pittsburgh, Pa	29.26	743.2	30.04	763.0	65	18.3	73	NW.	3	1.3	....	5c	Haze.	N.	......	0	0	Fair
Port Huron, Mich	29.40	746.7	30.06	763.5	54	12.2	61	NE.	10	4.5	....	0	0	......	......	0	0	Clear
Portland, Me	30.14	765.5	30.20	767.1	50	10.0	86	E.	11	4.9	....	......	10s	......	Calm.	0.66	16.8	Cloudy
Portland, Oreg	29.99	761.7	30.06	763.5	49.5	9.7	85	SE.	5	2.2	....	......	10s	......	W.	0.04	1.0	Cloudy
Portsmouth, N. C	......	......	......	......	74	23.3	86	NW.	10	4.5	....	8k	0	NW.	......	1.34	34.0	Cloudy
Prescott, Ariz	24.70	627.4	30.06	763.5	67	19.4	13	S.	12	5.4	....	0	0	......	......	0	0	Clear
Punta Rassa, Fla	30.04	763.0	30.06	763.5	81	27.2	78	SE.	8	3.6	....	6c; k	0	WNW.	......	0	0	Fair
Red Bluff, Cal	29.60	751.8	29.96	761.0	57.5	14.2	56	NW.	5	2.2	....	0	0	......	......	0	0	Clear
Rio Grande City, Tex	29.68	753.9	29.89	759.2	82	27.8	75	SE.	15	6.7	....	5c	2ks	NW.	SE.	0	0	Fair
Rochester, N, Y	29.43	747.5	30.03	762.7	61	16.1	66	SW.	3	1.3	....	5c	0	W.	......	0	0	Fair
Roseburg, Oreg	29.56	750.8	30.14	765.5	48.5	9.2	89	W.	3	1.3	...	......	10n	......	W.	0.06	1.5	Light rain
Sacramento, Cal	29.85	758.2	29.93	760.2	55	12.8	84	SE.	4	1.8	....	0	0	......	......	0	0	Clear
Saint Louis, Mo	29.39	746.5	29.94	760.5	68	20.0	79	S.	6	2.7	....	......	10ks	......	Calm.	Inap.	Inap.	Cloudy
Saint Paul, Minn	29.07	738.4	29.88	758.9	57	13.9	87	E.	7	3.1	....	......	10s	......	Calm.	0	0	Cloudy
Salt Lake City, Utah	25.53	648.4	29.86	758.4	58	14.4	42	Calm.	0	0	....	5k	1ks	W.	W.	Inap.	Inap.	Fair
San Antonio, Tex	29.21	741.9	29.88	758.9	80	26.7	78	S.	8	3.6	....	......	8s	......	S.	0	0	Cloudy
San Diego, Cal	29.85	758.2	29.92	760.0	60	15.6	88	SE.	7	3.1	....	......	Fog.	......	SE.	0	0	Foggy
Sandusky, Ohio	29.39	746.5	30.04	763.0	66	18.9	59	S.	3	1.3	....	5c	5ks	W.	Calm.	0	0	Cloudy
Sandy Hook, N. J	30.03	762.7	30.06	763.5	63	17.2	72	NE.	28	12.5	....	......	10s	......	NE.	0	0	Cloudy
San Francisco, Cal	29.95	760.7	30.01	762.2	52	11.1	86	SW.	4	1.8	....	0	Fog.	......	Calm.	0	0	Clear
Santa Fé, N. Mex	23.31	592.1	29.85	758.2	52	11.1	18	NE.	1	0.4	....	0	1ks	......	Calm.	0	0	Clear
Savannah, Ga	29.95	760.7	30.04	763.0	80	26.7	74	S.	1	0.4	....	1cs	Sm'e.	Calm.	Calm.	0.11	2.8	Clear
Shreveport, La	29.74	755.4	29.95	760.7	79	26.1	82	SW.	3	1.3	....	0	8s	......	Calm.	0	0	Fair
Silver City, N. Mex	......	......	......	......	......	......	....	......	......	......	....	......	......	......	......	......	......	......
Smithville, N. C	29.99	761.7	30.03	762.7	78	25.6	82	SW.	4	1.8	....	8k	1ks	SW.	Calm.	0.35	8.9	Cloudy
Socorro, N. Mex	......	......	......	......	......	......	....	......	......	......	....	......	......	......	......	......	......	......
Springfield, Ill	29.31	744.5	[illegible].96	761.0	66.5	19.2	74	SE.	7	3.1	....	0	5ks	......	SW.	0.01	0.3	Fair
Springfield, Mass	30.00	762.0	30.15	765.3	59	15.0	76	NE.	6	2.7	....	......	10s	......	NE.	0.01	0.3	Cloudy
Stockton, Tex	26.80	680.7	29.80	756.9	76	24.4	56	S.	7	3.1	....	0	0	......	......	0	0	Clear
Thatcher's Island, Mass	30.14	765.5	30.19	766.8	53	11.7	100	NE.	22	9.8	....	......	10n	......	NE.	0.50	12.7	Light rain

Bulletin of international meteorological observations, taken simultaneously on June 8, 1880—Continued.

UNITED STATES SERIES—Continued.

Stations.	Barometer.				Temperature of the air.		Relative humidity.	Wind.				Clouds.				Rain fall or melted snow in the past 24 hours.		Weather.	Observer.
	Corrected for instrumental error and temperature.		Reduced to sea-level.					Direction.	Velocity.		Force.	Amount.		Direction.					
												Upper.	Lower.	Upper.	Lower.				
	Inches.	Millimeters.	Inches.	Millimeters.	Fahrenheit.	Centigrade.	Per cent.	From—	Miles per hour.	Meters per second.	0—10.	0—10.	0—10.	From—	From—	Inches.	Millimeters.		
Toledo, Ohio	29.37	746.0	30.04	763.0	63	17.2	72	SE.	3	1.3	....	2k	5s	S.	SW.	0	0	Threatening	
Tucson, Ariz	27.42	696.5	29.97	761.2	77	25.0	18	SE.	3	1.3	....	0	0	......	......	0	0	Clear	
Umatilla, Oreg	29.64	752.8	30.12	765.0	52	11.1	54	SW.	22	9.8	....	0	5s	......	SW.	0.03	0.8	Fair	
Uvalde, Tex	28.82	734.6	29.69	754.1	79	26.1	78	SE.	4	1.8	....	......	10s	......	S.	0	0	Cloudy	
Vicksburg, Miss	29.75	755.6	30.00	762.0	77	25.0	86	S.	4	1.8	....	5cs	0	W.	......	0	0	Fair	
Virginia City, Mont	24.04	610.6	29.52	749.8	37	2.8	100	W.	8	3.6	...	......	10n	......	Calm.	0.53	13.5	Light rain	
Visalia, Cal	29.51	749.5	29.88	758.9	60	15.6	71	NW.	5	2.2	....	0	0	......	......	0	0	Clear	
Washington, D. C	29.97	761.2	30.08	764.0	70	21.1	57	NE.	8	3.6	....	5k	0	NW.	......	0	0	Fair	
Wickenburg, Ariz	......	......	......	......	64	17.8	30	NW.	......	......	1	0	0	......	......	0	0	Clear	
Wilmington, N. C	29.93	760.2	30.01	762.2	74	23.3	86	SW.	1	0.4	....	8k	0	Calm.	......	1.50	38.1	Fair	
Winnemucca, Nev	25.56	649.2	29.92	760.0	43	6.1	67	SW.	8	3.6	....	2ck	0	SW.	......	0	0	Clear	
Wood's Holl, Mass	30.05	763.3	30.09	764.3	56	13.3	94	NE.	10	4.5	....	......	Fog.	......	NE.	0	0	Foggy	
Yankton, Dak	28.51	724.1	29.76	755.9	58	14.4	94	SE.	8	3.6	....	10k	0	SW.	......	0.14	3.6	Cloudy	
Yuma, Ariz	29.55	750.6	29.69	754.1	68	20.0	51	Calm.	0	0	....	0	0	......	......	0	0	Clear	
SUBSERIES.																			
Bogota, U. S. Colombia	22.06	560.3	......	......	57.2	14.0	71	Calm.	0	0	....	5k	0	......	......	0.13	3.3	Cloudy	Thomas Herran.
§ Havana, Cuba, W. I	30.03	762.7	30.08	764.0	77	25.0	82	Calm.	0	0	....	8ck;cs	......	Calm.	......	0.65	16.5	Cloudy	Charles Hasselbrink.
‡ Kingston, Jamaica, W. I	30.03	762.7	30.04	763.0	82	27.8	76	Calm.	0	0	....	8c	2cs	......	Calm.	0	0	Fair	Maxwell Hall.
Navassa, W. I	29.88	758.9	29.96	761.0	81	27.2	83	E.	1	0.4	....	8	8s	SE.	E.	0	0	Cloudy	F. M. Everett.
Paramaribo, D. Guiana, S. A	30.06	763.5	30.06	763.5	78	25.6	86	SE.	......	......	2	......	10n	SE.	......	0.500	12.70	Raining	C. J. Hering,
Puerto Berrio, U. S. Col'bia‖	29.47	748.5	30.02	762.5	78	25.6	89	N.	......	......	2	......	10ks	......	......	0.21	5.3	......	Francisco J. Cisneros.
§ Rivas, Nicaragua	......	......	......	......	77	25	....	ESE.	......	......	....	6c	1d	SE.	ESE.	0.04	1.	Fair	Earl Flint.
Santiago de Cuba, W. I	30.05	763.3	30.08	764.0	81	27.2	82	Calm.	0	0	....	8cs	0	......	......	0	0	......	Robert Mason.
St. Thomas, W. I	......	......	......	......	......	......	....	S.	......	......	....	......	......	......	......	......	......	......	G. O. Gellich.
York Factory, B. A	30.02	762.5	30.07	763.8	52.0	11.1	83	S.	7	3.1	....	2c	0	S.	......	0	0	Fair	J. Fortsecue & W. Wood.

NOTE.—The originals give the amount of cloudiness by the scale 0 to 4, except Bogota, Paramaribo, and York Factory. The elevations of the barometers are, at Atlanta, 1,131.3 feet, or 344.8 meters; Bismarck, 1,704.3 feet, or 519.5 meters; Boerne, 1,333 (?) feet, or 406 (?) meters; Bogota, 8,717.9 feet, or 2,657.2 meters; Boise City, 2,877 (?) feet, or 877 (?) meters; Brackettville, 1,026 (?) feet, or 313 (?) meters; Campo, 2,500 (?) feet, or 762 (?) meters; Cheyenne, 6,057.3 feet, or 1,846.2 meters; Coleman City, 1,727 (?) feet, or 526 (?)meters; Concho, 1,750 (?) feet, or 533 (?) meters; Deadwood, (?); Decatur, 1,160 (?) feet, or 354 (?) meters; Denver, 5,269 feet, or 1,606 meters; Dodge City, 2,486 feet, or 757 meters; Florence, 1,550 (?) feet, or 472 (?) meters; Fort Custer, (?); Fort Davis, 5.203 (?) feet, or 1,586 (?) meters; Fort Elliot, 2,500 (?) feet, or 762 (?) meters; Fort Grant, 4,823 (?) feet, or 1,470 (?) meters; Fort Griffin, 1,270 (?) feet, or 387 (?) meters; Fort McKavett, 2,050 (?) feet, or 625 (?) meters; Fort Sill, 1,100 (?) feet, or 335 (?) meters; Fredericksburg, 1,614 (?) feet, or 492 (?) meters; Jacksboro', 1,119.2 (?) feet, or 341.1 (?) meters; Mason, 1,800 (?) feet, or 549 (?) meters; Mount Washington, 6,285 feet, or 1,916 meters; North Platte, 2,838.2 feet, or 865.1 meters; Omaha, 1,077.4 feet, or 328.4 meters; Phœnix, 1,800 (?) feet, or 549 (?) meters; Pike's Peak, 14,150.7 feet, or 4,313.1 meters; Pioche, 5,778.6 (?) feet, or 1,761.3 (?) meters; Prescott, 5,700 (?) feet, or 1,737 (?) meters; Salt Lake City, 4,362.2 feet, or 1,329.5 meters; Santa Fé, 6,851 (?) feet, or 2,088 (?) meters; Silver City, 6,896 (?) feet, or 2,102 (?) meters; Socorro, 4,064 feet, or 1,239 meters; Stockton, 3,100 (?) feet, or 945 (?) meters; Tucson, 2,542 (?) feet, or 775 (?) meters; Virginia City, 5,480 (?) feet, or 1,670 (?) meters; Wickenburg, 2,050 (?) feet, or 625 (?) meters; Winnemucca, 4,335.3 feet, or 1,321.4 meters; Yankton, 1,275 feet, or 389 meters. The following constants are added to the barometer readings as approximate reductions for altitude above sea-level: Bismarck, 1.856 inches, or 47.14 millimeters; Boise City, 2.96 inches, or 75.2 millimeters; Campo, 2.57 inches, or 65.3 millimeters; Cheyenne, 5.94 inches, or 150.9 millimeters; Denver, 5.22 inches, or 132.6 millimeters; Florence, 1.60 inches, or 40.6 millimeters; Fort Davis, 4.96 inches, or 126.0 millimeters; Fort Grant, 4.800 inches, or 121.9 millimeters; Fort Verde, 3.488 inches, or 88.6 millimeters; La Mesilla, 4.15 inches, or 105.4 millimeters; Mount Washington, 6.36 inches, or 161.5 millimeters; Pike's Peak, 12.21 inches, or 310.1 millimeters; Pioche, 5.77 inches, or 146.6 millimeters; Prescott, 5.36 inches, or 136.1 millimeters; Salt Lake City, 4.33 inches, or 110.0 millimeters; Santa Fé, 6.54 inches, or 166.1 millimeters; Stockton, 3.00 inches, or 76.2 millimeters; Tucson, 2.59 inches, or 65.8 millimeters; Wickenburg, 2.09 inches, or 53.1 millimeters; Winnemucca, 4.36 inches, or 110.7 millimeters; Virginia City, 5.48 inches, or 139.2 millimeters. || The correction of the barometer for temperature is uncertain, but is assumed to be the same as for brass scales.

Bulletin of international meteorological observations, taken simultaneously on June 8, 1880—Continued.

UNITED STATES NAVAL SERIES.

[By authority of the Secretary of the Navy. Furnished by the co-operation of the Navy Department, through Commodore William D. Whiting, U. S. N., Chief of Bureau of Navigation.]

Stations and vessels.	Barometer reduced to sea-level.		Temperature of the air.		Relative humidity.	Wind.				Clouds.				Rainfall or melted snow in the past 24 hours.		Sea-swell.		Weather.	Observer.
						Direction.	Velocity.		Force.	Amount.		Direction.							
										Upper.	Lower.	Upper.	Lower.						
	Inches.	Millimeters.	Fahrenheit.	Centigrade.	Per cent.	From—	Miles per hour.	Meters per second.	0—10.	0—10.	0—10.	From—	From—	Inches.	Millimeters.	Character.	Direction from—		
§ Navy Yard (Pensacola, Fla.)	29.96	761.0	79	26.1	86	NW.	8	3.6	....	....	8n	....	SE.	......	......	....	....	Cloudy..	
§ Navy Yard (Portsmouth, N. H.)	30.15	765.8	52	11.1	66	NE.	13	5.8	....	....	10	....	....	0.4	10.	....	....	Foggy ..	
Naval Hospital (Yokohama, Japan)	29.39	754.1	72	22.2	58	NE.	....	....	1	4c	Haze	....	W.	0	0	....	....	Clearing	
§ Adams (N. 2° 02′, W. 82° 18′)	29.96	761.0	77	25.0	91	S.	....	....	2	....	2	....	S.	......	......	....	....	Fair	
§ Alaska (Callao, Peru*)	29.94	760.5	63	17.2	94	NW.	....	....	4	....	10	....	NW.	......	......	Long .	SW.	Cloudy..	
§ Alert (Yokohama, Japan)	29.55	750.6	75	23.9	56	N.	....	....	1	....	10	....	Calm.	0	0	Smooth	....	Cloudy..	
§ Alliance (N. 41° 30′, W. 57° 15′)	30.03	762.7	62	16.7	94	ENE.	....	....	5	....	2	....	N.	Light	Light	Smooth	N.	Fair	
§ Ashuelot (Nankin, China)	29.77	756.1	75	23.9	64	SE.	....	....	1	....	0	....	....	......	......	None..	....	Clear ...	
§ Colorado (New York, N. Y.)	30.07	763.8	65	18.3	84	N.	3	1.3	....	....	8	....	NE.	0	0	....	....	Cloudy..	
§ Constitution (off Robin's Island Reef Light, New York Harbor.)	30.04	763.0	64	17.8	68	NNE.	19	8.5	....	....	8	....	NE.	......	......	....	....	Hazy ...	
§ Franklin (off Navy Yard, Norfolk, Va.)	29.98	761.5	74	23.3	86	NNW.	5	2.2	....	....	2	....	N.	0.44	11.2	....	....	Fair	
§ Independence (Mare Island Navy Yard, Cal.)	29.98	761.5	72	22.2	95	SW.	2.4	1.1	....	....	0	....	....	0	0	....	....	Clear ...	
§ Jamestown (Sitka, Alaska*)	29.86	758.4	45	7.2	92	WSW.	....	....	1	....	10	....	....	......	......	Smooth	....	Cloudy..	
§ Kearsarge (N. 38° 43′, W. 73° 18′)	30.00	762.0	64	17.8	94	N.	....	....	4	....	10	....	....	......	......	Smooth	....	Foggy ..	
§ Lackawana (La Union, San Salvador.†)	30.07	763.8	80	26.7	87	WSW.	....	....	1–2	....	8	....	WSW.	......	......	....	....	Fair	
§ Marion (Port Stanley, Falkland Islands.)	29.56	750.8	37	2.8	100	SW.	....	....	2	....	8	....	....	......	......	Smooth	....	Drizzling	
§ Michigan (Erie, Pa.)	30.00	762.0	66	18.9	74	S.	....	....	1	....	8	....	NW.	......	......	....	....	Cloudy..	
§ Minnesota (Navy Yard, Brooklyn, N. Y.*)	30.05	763.3	63	17.2	83	NE.	....	....	3–5	....	10	....	E.	......	......	....	....	Cloudy..	
§ Monocacy (Chefoo, China)	29.73	755.1	68	20.0	74	NW.	....	....	0–1	....	2	....	NW.	......	......	....	....	Hazy ...	

§ New Hampshire (Port Royal, S. C.)	30.03	762.7	75	23.9	86	S.	9	4.0	....	....	8	....	Calm.	0.35	8.9	....	....	Fair ....
Nipsic (Leghorn, Italy)	30.08	764.0	72	22.2	67	W.	....	....	1	....	2	....	....	......	......	....	....	D. clouds
§ Onward (Callao Bay, Peru†)	29.97	761.2	64	17.8	83	NNW.	....	....	4	....	10	....	NW.	......	......	Long..	W.	Cloudy..
§ Palos (Shanghai, China)	29.80	756.9	78	25.6	69	SE.	....	....	1	....	2	....	S; E.	......	......	....	....	Fair ....
§ Passaic (Washington, D. C.)	30.03	762.7	68	20.0	74	NE.	....	....	1	....	5	....	NE.	0	0	....	....	Fair ....
§ Pensacola (San Francisco, Cal.)	29.92	760.0	56	13.3	87	Calm.	....	....	0	....	0	....	....	......	......	Smooth	....	Blue sky
§ Portsmouth (N. 34° 32′, W. 51° 50′)	30.14	765.5	68	20.0	90	SSW.	....	....	6	....	5	....	SW.	......	......	Long..	NW.	Fair ....
§ Powhatan (New York, N. Y.)	30.06	763.5	65	18.3	73	NNE.	....	....	3	....	10	....	NE.	......	......	....	....	Cloudy..
§ Quinnebang (Antwerp, Belgium)	29.85	758.2	58	14.4	70	WSW.	....	....	4	....	8	....	WSW.	......	......	....	....	Cloudy..
§ Richmond (Nagasaki, Japan)	29.83	757.7	70	21.1	90	SW.	....	....	1	....	5	....	Calm.	0	0	....	....	Fair ....
Rio Bravo (Brownsville, Tex.†)	30.03	762.7	80	26.7	91	SE.	3	1.3	....	....	5	....	Calm.	0	0	....	....	Fair ....
§ Saratoga (Gibraltar, Mediterranean)	30.18	766.6	69	20.6	75	Calm.	....	....	0	....	0	....	....	0	0	Smooth	....	Clear ...
§ Shenandoah (Montevideo, Uruguay)	29.97	761.2	54	12.2	67	WSW.	....	....	6	....	2	....	Calm.	......	......	Long..	SW.	Fair ....
§ St. Louis (League Island, Pa.)	30.02	762.5	66	18.9	89	NE.	10	4.5	....	....	2	....	SW.	0	0	....	....	Clear ...
Swatara (Saigon, Siam†)	29.81	757.2	79	26.1	91	W.	....	....	1	....	10	....	W.	......	......	Smooth	....	Cloudy..
§ Tennessee (New York, N. Y.)	30.08	764.0	70	21.1	53	NNE.	....	....	2	....	8	....	N; E.	......	......	Smooth	....	Cloudy..
§ Ticonderoga (N. 34° 17′, E. 133° 28′)	29.78	756.4	71	21.7	90	SW.	....	....	2	....	8	....	WNW.	......	......	Smooth	....	Cloudy..
§ Trenton (Marseilles, France)	30.09	764.3	66	18.9	64	W.	....	....	2	....	0	....	....	0	0	None..	....	Clear ...
§ Vandalia (Newport, R. I.)	30.09	764.3	56	13.3	94	NNE.	....	....	5	....	10	....	Calm.	......	......	....	....	Misty...
§ Wabash (Boston, Mass.)	30.16	766.1	52	11.1	??	NE.	7	3.1	....	....	10	....	....	0.04	1.0	....	....	Cloudy..
§ Wachusett (S. 52° 13′, W. 76° 49′)	29.99	761.7	43	6.1	92	SW.	....	....	3	....	5	....	WSW.	......	......	Long..	W.	Fair ....
Wyoming (Villafranca, France)	30.06	763.5	68	20.0	65	ESE.	....	....	1	....	2	....	SE.	......	......	Smooth	SE.	Clear ...

NOTE.—With some exceptions, the originals give the barometer as read off; wind and weather by the Beaufort scales; no distinction between upper and lower clouds. The elevation of naval hospital at Yokohama is 115 feet, or 35 meters, for which the constant reduction is 0.125 inches, or 3.18 millimeters.

*The error of barometer is not known.

†Aneroid.

Bulletin of international meteorological observations, taken simultaneously on June 8, 1880—Continued.

UNITED STATES MARINE SERVICE.

REPORTED TO THE OFFICE OF THE CHIEF SIGNAL OFFICER OF THE ARMY.

ALLAN LINE MARINE SERIES.

[Furnished by the co-operation of A. Schumacher & Co., agents, Baltimore, Md.]

Names of vessels and captains.	Barometer reduced to sea-level.		Temperature of the air.		Relative humidity.	Wind.				Clouds.				Rainfall or melted snow in the past 24 hours.		Sea-swell.		Weather.	Observer.
						Direction.	Velocity.		Force.	Amount.		Direction.							
										Upper.	Lower.	Upper.	Lower.						
	Inches.	Millimeters.	Fahrenheit.	Centigrade.	Per cent.	From—	Miles per hour.	Meters per second.	0—10.	0—10.	0—10.	From—	From—	Inches.	Millimeters.	Character.	Direction from—		
Steamship Caspian, M. Trocks	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	......	W. E. Jago.
Steamship Circassian	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	......	R. Carruthers.
Steamship Hibernian, F. Archer, Halifax, N. S.	30.16	766.1	53	11.7	....	ESE.	....	....	2	....	10	....	ESE.	......	......	......	......	Cloudy......	
Steamship Moravian, J. Graham	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	......	John France.
Steamship Peruvian	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	......	
Steamship Sardinian, J. E. Dutton	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	......	A. Christie and F. W. Erskine.
Steamship Sarmatian, A. D. Air	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	......	A. D. Air.

AMERICAN STEAMSHIP COMPANY MARINE SERIES.

[Furnished by the co-operation of H. D. Welsh, president; Peter Wright & Sons, general agents, Philadelphia, Pa.]

Names of vessels and captains.	Barometer, Inches.	Barometer, Millimeters.	Fahrenheit.	Centigrade.	Per cent.	Wind from—	Miles per hour.	Meters per second.	Force 0—10.	Clouds upper 0—10.	Clouds lower 0—10.	Clouds upper from—	Clouds lower from—	Rainfall, Inches.	Rainfall, Millimeters.	Sea-swell, Character.	Sea-swell, Direction from—	Weather.	Observer.
Steamship Illinois, I. W. Shackford	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	......	
Steamship Indiana, R. W. Sargent, N. 50° 28′, W. 19° 11′.	30.06	763.5	55	12.8	68	NNW.	....	....	7	....	7	....	NNW	Moderate.	Moderate.	Moderate.	NNW.	Fair........	C. M. Rowe and G. Worth, jr.
Steamship Ohio, Henry Morrison, N. 41° 13′. W. 45° 38′.	30.19	766.8	70	21.1	90	SW.	....	....	1	....	5	....	SW.	1 hour.	1 hour.	Small.	SE.	Fair........	Wm. Shackford.
Steamship Pennsylvania, George H. Dodge.	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	......	Geo. H. Dodge.

CALIFORNIA AND MEXICAN STEAMSHIP COMPANY MARINE SERIES.

[Furnished by the co-operation of J. Birmingham, agent, San Francisco, Cal.]

§ Steamship Newbern, W. Metzer, N. 24° 58′, W. 112° 40′.†	29.94	760.5	62	16.7	94	W.	....	....	2	....	10	....	W.	....	....	Gentle.	NW.	Cloudy......	

CUNARD LINE MARINE SERIES.

[Furnished by the co-operation of Ch. G. Francklyn, agent, New York.]

Steamship Algeria, W. Watson....	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	....	
Steamship Scythia, W. H. O. Hains, N. 40° 32′, W. 72° 22′.*	29.83	757.7	64	17.8	78	ENE.	....	....	3	....	Haze	....	NE.	0	0	Light.	NE.	Hazy........	H. Buckland.

NORTH GERMAN LLOYD OF BREMEN MARINE SERIES.

[Furnished by the co-operation of A. Schumacher & Co., agents, Baltimore, Md.]

Steamship Amerika, C. Pohle......	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	....	
Steamship Braunschweig, C. Undutsch, N. 49° 37′, W. 6° 49′.	29.92	760.0	55	12.8	68	NW.	....	....	5	....	2	....	NW.	½ hour.	½ hour.	Moderate.	NW.	Fair........	C. Undutsch.
Steamship Leipzig, F. Pfeiffer	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	....	S. Risius.
Steamship Ohio, G. Meyer	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	....	
Steamship Strassburg, O. Heimbruch.	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	....	

NOTE.—The steamship Amerika gives sea-swell in general terms; the steamship Braunschweig in general terms, or occasionally by the scale 0 to 9; the steamship Leipzig by the scale 0 to 12.

OCCIDENTAL AND ORIENTAL STEAMSHIP COMPANY MARINE SERIES.

[Furnished by the co-operation of Leland Stanford, president; D. D. Stubbs, secretary, San Francisco, Cal.]

§ Steamship Belgic, L. Meyer, N. 37° 59′, E. 156° 46′.†	29.79	756.7	61	16.1	94	E.	....	....	6	....	10	....	E.	....	....	Heavy.	E.	Overcast	D. A. Joyce.
§ Steamship Gaelic, W. H. Kidley, N. 37° 25′, E. 154° 28′.†	29.81	757.2	69	20.6	90	W.	....	....	4	....	10n	....	SW.	Consid	erable.	Smooth	SW.	Raining.....	J. A. Thompson.
Steamship Oceanic, Metcalf........	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	....	

NOTE.—With some exceptions, the originals give the barometer as read off; wind and weather by the Beaufort scales; no distinction between upper and lower clouds.

* The error of the barometer is not known.

† Aneroid.

Bulletin of international meteorological observations, taken simultaneously on June 8, 1880—Continued.

UNITED STATES MARINE SERIES—Continued.

OREGON RAILWAY AND NAVIGATION COMPANY MARINE SERIES.

[Furnished by the co-operation of K. van Oterendorp, agent, San Francisco, Cal.]

Names of vessels and captains.	Barometer reduced to sea-level.		Temperature of the air.		Relative humidity.	Wind.				Clouds.				Rainfall or melted snow in the past 24 hours.		Sea-swell.		Weather.	Observer.
						Direction.	Velocity.		Force.	Amount.		Direction.							
										Upper.	Lower.	Upper.	Lower.						
	Inches.	Millimeters.	Fahrenheit.	Centigrade.	Per cent.	From—	Miles per hour.	Meters per second.	0—10.	0—10.	0—10.	From—	From—	Inches.	Millimeters.	Character.	Direction from—		
§ Steamship George W. Elder, J. M. Lachlan.	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	......	J. M. Lachlan.
Steamship Oregon	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	......	

PACIFIC COAST STEAMSHIP COMPANY MARINE SERIES.

[Furnished by the co-operation of Goodall, Perkins & Co., agents, San Francisco, Cal.]

§ Steamship Ancon, E. Alexander, N. 35° 34′, W. 121° 13′.	29.97	761.2	51	10.6	....	NW.	....	....	7	....	5	....	NW.	......	......	Heavy.	NW.	......	
§ Steamship Idaho, E. Alexander	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	......	
Steamship Orizaba	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	......	
§ Steamship State of California, G. Debney, Portland, Oreg.†	29.97	761.2	45	7.2	....	SE.	....	....	2	....	5	....	SW.	......	......	......	......	Light rain ..	

PACIFIC MAIL STEAMSHIP COMPANY MARINE SERIES.

[Furnished by the co-operation of David S. Babcock, president; Williams, Dimond & Co., agents, San Francisco, Cal.]

§ Steamship Alaska, D. S. Austin, Acajutla, San Salvador.†	29.89	759.2	75	23.9	95	NNW.	....	....	2	....	8	....	N.	....	....	Moderate.	SW.	Cloudy......	F. A. Johnston.
§ Steamship Australia........	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	......	Banneman.
§ Steamship China, W. B. Seabury .	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	......	
§ Steamship City of Chester, J. M. Lacklan.	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	......	J. M. Lacklan.
§ Steamship City of New York, W. B. Cobb, Sydney, N. S. W.†	30.12	765.0	54	12.2	87	Calm.	....	....	0	....	0	....		......	......	Smooth	SW.	Clear........	W. H. Hawes.
§ Steamship City of Panama, M. Connolly, Panama, Panama.†	29.99	761.7	78	25.6	91	NW.	....	....	2	....	8	....	NW.	0.5	13	Smooth	S.	Cloudy......	R. Thompson and J. Anderson.
§ Steamship City of Peking, G. G. Berry, N. 22° 49′, E. 116° 53′.†	29.72	754.9	81	27.2	87	ESE.	....	....	2	....	5	....	SW.	0	0	......	......	Fair........	
§ Steamship City of Sidney, H. C. Dearborn, Honolulu, Sandwich Islands.*†	30.00	762.0	73	22.8	....	ENE.	....	....	5	....	5	....	ENE.	0.12	3.0	Smooth	......	Squally	E. Le Sack.
§ Steamship City of Tokio, J. Maury.	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	......	F. S. Doane.
§ Steamship Colima, R. R. Searle, N. 28° 04′, W. 116° 18′.†	29.95	760.7	63	17.2	94	SE.	....	....	1	....	10	....	Calm.	0	0	Smooth	NW.	Cloudy......	
§ Steamship Dakota, D. E. Griffiths, Seattle, Wash.†	29.98	761.5	50	10.0	86	Calm.	....	....	0	....	5	....	W.	......	......	......	......	Hazy........	D. E. Griffiths.
§ Steamship Granada, J. M. Cavarly, N. 17° 02′, W. 100° 31′.†	30.02	762.5	80	26.7	81	NW.	....	....	3	....	5s	....	Calm.	0	0	Moderate.	SSE.	Fair........	
§ Steamship Idaho, E. Alexander, San Francisco, Cal.†	30.03	762.7	52	11.1	....	SW.	....	....	2	....	0	...	......	......	......	......	......	Clear........	E. Alexander.
§ Steamship Zealandia, R. C. Ghest, N. 36° 26′, W. 125° 54′.	30.02	762.5	55	12.8	....	SW.	....	....	6	....	10	....	SW.	......	......	Smooth	W.	Foggy	

RED STAR LINE MARINE SERIES.

[Furnished by the co-operation of James A. Wright, president; Peter Wright & Sons, agents, Philadelphia, Pa.]

Steamship Belgenland, S. Jackson.	......	......	......	......	......	....	....	....	....	....	....	....	......	......	......	......	......	......	J. Farmer and W. Apetan.
Steamship Nederland, S. Stokes ...	......	......	......	......	......	....	....	....	....	....	....	...	......	......	......	......	......	......	

WHITE STAR LINE MARINE SERIES.

[Furnished by the co-operation of Ismay, Imrie & Co., agents, Liverpool, and R. J. Cortis, agent, New York.]

Steamship Adriatic, J. W. Jennings.	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	......	H. N. Goulden.
Steamship Britannic, H. Perry, N. 41° 34′, W. 53° 28′.†	30.15	765.8	59	15.0	....	E.	....	....	5	....	8	....	NE.	......	......	Moderate.	E.	Misty	J. Jones.
Steamship Celtic, B. Gleadell	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	......	
Steamship Republic, P. J. Irving ..	......	......	......	......	....	......	....	....	....	....	....	....	......	......	......	......	......	......	G. W. Ryder.

* Instrumental error not known.

† Aneroid.

Bulletin of international meteorological observations, taken simultaneously on June 8, 1880—Continued.

UNITED STATES MARINE SERIES—Continued.

MISCELLANEOUS MARINE SERIES.

[Furnished by the co-operation of the observers named.]

Names of vessels and captains.	Barometer reduced to sea-level.		Temperature of the air.		Relative humidity.	Wind.				Clouds.				Rainfall or melted snow in the past 24 hours.		Sea-swell.		Weather.	Observers.
						Direction.	Velocity.		Force.	Amount.		Direction.							
										Upper.	Lower.	Upper.	Lower.						
	Inches.	Millimeters.	Fahrenheit.	Centigrade.	Per cent.	From—	Miles per hour.	Meters per second.	0—10.	0—10.	0—10.	From—	From—	Inches.	Millimeters.	Character.	Direction from—		
Schooner Abby K. Bentley, N. 33° 45′, W. 77° 21′.†	30.06	763.5	77	25.0	....	SW.	....	....	1	....	10	....	SW.	0.25	6.3	Short; rough.	S.	Gloomy	A. R. Mehaffey.
Schooner Addie Fuller, J. Jorgensen, Boston, Mass.	30.15	765.8	56	13.3	87	NE.	14	6.3	....	....	Mist.	....	....	....	....	....	....	....	J. Jorgensen.
Schooner Annie R. Lewis, L. L. Lewis, Arroyo, Porto Rico, West Indies.†	30.07	763.8	86	30.0	....	NE.	....	....	1	....	10	....	E.	Showers		Smooth	....	Cloudy	L. L. Lewis.
Barkantine Carrie Heckle, B. F. Woodbury, S. 9° 28′, W. 13° 40′.*†	30.18	766.6	76	24.4	....	SE.	....	....	4	....	10	....	SE.	....	....	Short.	S.	Fair	B. F. Woodbury.
Schooner Delia Hodgkins, Red Bay, Labrador.†	30.41	772.4	....	....	....	E.	....	....	1	....	10	....	E.	Light.	Light.	....	....	Foggy	S. S. Miner.
Brigantine George, W. H. Champlin, N. 40° 50′, W. 72° 00′.†	30.19	766.8	63	17.2	....	NE.	....	....	6	....	10	....	NE.	0	0	Moderate.	ENE.	Threatening.	
Iron Cross, W. Randall	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	W. Randall.
Ship Jumna, James S. Garvin, N. 44° 47′, W. 61° 19′.	30.19	766.8	44	6.7	100	ENE.	....	....	4	....	Fog.	....	....	0	0	Smooth	....	Dense fog	James S. Garvin.

NOTE.—With some exceptions, the originals give the barometer as read off; wind and weather by the Beaufort scales; no distinction between upper and lower clouds.

Collated at the office of the Chief Signal Officer of the Army, Washington, D. C.

The records which appear in this bulletin are copied from the regular exchanges of this office, made in each instance in compliance with a special request, and are published for the uses of the co-operating observers.

The barometric readings in the first two columns are reduced to freezing and their respective standards; those in the second two also to mean sea-level. For all naval and marine series the correction for instrumental error and the reduction to sea-level have been applied whenever they could be ascertained by means of reliable comparisons, made when the vessel was at or near land stations. When rain has fallen, but neither amount nor duration is recorded, the word "Blank" is published in the rainfall column. The "weather" is generally published as given: D. clouds, for detached clouds. When the distinction between the upper and lower strata of clouds is not reported, the *kinds* or *types*, viz, cirrus, cumulus, stratus, nimbus, scud, fracto, pallio, haze, fog, and smoke, as indicated, respectively, by the letters c, k, s, n, d, f, p, hz, fg, and sm'e, are generally published with the amount in the lower-cloud column. The distinction between the upper and lower strata is carefully made in the United States series and a portion of the Canadian series, and the types are indicated by the above letters and their combinations in the proper column.

R. C. DRUM,
Adjutant-General, and Acting Chief Signal Officer of the Army.

PAPER 28.

List of military posts from which meteorological reports have been received monthly at the office of the Chief Signal Officer during the year ending June 30, 1880.

Post.	State.	Post.	State.
Abraham Lincoln, Fort	Dakota.	Madison Barracks	New York.
Adams, Fort	Rhode Island.	McDermit, Fort	Nevada.
Alcatraz Island	California.	McDowell, Fort	Arizona.
Angel Island	Do.	McHenry, Fort	Maryland.
Apache, Fort	Arizona.	McKavett, Fort	Texas.
Assinniboine, Fort	Montana.	McPherson, Fort	Nebraska.
Barrancas, Fort	Florida.	Mojave, Fort	Arizona.
Benicia Barracks	California.	Monroe, Fort	Virginia.
Brady, Fort	Michigan.	Meade, Fort	Dakota.
Benton, Fort	Montana.	McPherson Barracks	Georgia.
Bidwell, Fort	California.	Niagara, Fort	New York.
Bliss, Fort	Texas.	Niobrara, Fort	Nebraska.
Boise, Fort	Idaho.	Pembina, Fort	Dakota.
Bowie, Fort	Arizona.	Plattsburg Barracks	New York.
Brown, Fort	Texas.	Point San José	California.
Buford, Fort	Dakota.	Porter, Fort	New York.
Bridger, Fort	Wyoming.	Preble, Fort	Maine.
Canby, Fort	Washington Ter.	Presidio, San Francisco	California.
Columbus, Fort	New York.	Pagosa Springs Cantonment	Colorado.
Colville, Fort	Washington Ter.	Randall, Fort	Dakota.
Concho, Fort	Texas.	Rice, Fort	Do.
Cœur d' Alene, Fort	Idaho.	Ringgold, Fort	Texas.
Davis, Fort	Texas.	Rock Island Arsenal	Illinois.
Douglas, Fort	Utah.	Sanders, Fort	New York.
Duncan, Fort	Texas.	Shaw, Fort	Montana.
Ellis, Fort	Montana.	Sheridan, Camp	Nebraska.
Elliott, Fort	Texas.	Sidney, Fort	Do.
Fetterman, Fort	Wyoming.	Sill, Fort	Indian Territory.
Fred Steele, Fort	Do.	Sisseton, Fort	Dakota.
Garland, Fort	Colorado.	Snelling, Fort	Minnesota.
Gaston, Fort	California.	Stevenson, Fort	Dakota.
Grant, Fort	Arizona.	Saint Augustine	Florida.
Griffin, Fort	Texas.	Sully, Fort	Dakota.
Hale, Fort	Dakota.	Stevens, Fort	Oregon.
Halleck, Fort	Nevada.	Totten, Fort	Dakota.
Hamilton, Fort	New York.	Townsend, Fort	Washington Ter.
Harney, Fort	Oregon.	Union, Fort	New Mexico.
Hartsuff, Fort	Nebraska.	Verde, Fort	Arizona.
Hays, Fort	Kansas.	Walla Walla, Fort	Washington Ter.
Hall, Fort	Idaho.	Wallace, Fort	Kansas.
Keogh, Fort	Montana.	Warren, Fort	Massachusetts.
Klamath, Fort	Oregon.	Wayne, Fort	Michigan.
Lapwai, Fort	Arizona.	West Point Military Academy	New York.
Leavenworth, Fort	Kansas.	Whipple Barracks	Arizona.
Logan, Fort	Montana.	Willet's Point	New York.
Lowell, Fort	Arizona.	Wingate, Fort	New Mexico.
Lyon, Fort	Colorado.	Washakee, Fort	Wyoming.
Lewis, Fort	Do.	Yuma, Fort	California.

PAPER 29.

List of voluntary observers who have forwarded monthly reports to the Chief Signal Officer during the year ending June 30, 1880.

Name of observer.	Post-office address.	State.
Abbott, Dr. E. K	Salinas City	California.
Adriance, Charles E	Hector	New York.
Allbree, George	Pittsburgh	Pennsylvania.
Allan, W. T.	Geneseo	Illinois.
Alden, Lyman P	State School, Coldwater	Michigan.
Allen, Lucius C	Springfield	Massachusetts.
Allison, Dr. John A	Statesville	North Carolina.
Altaffer, J. M	Independence	Kansas.
Amos, Franklin	Ringgold	Ohio.
Anderson, Rev. John	Clarksville	Texas.
Andrews, George W	Williamstown	Massachusetts.
Andrews, Lurman	Southington	Connecticut.
Andrew, Thomas B	Garrison's	New York.
Armstrong, Rev. G. C	Fayette	Mississippi.
Ashby, M. V	Afton	Iowa.

List of voluntary observers, &c.—Continued.

Name of observer.	Post-office address.	State.
Annis, Prof. F. J	State Agricultural College, Fort Collins	Colorado.
Aber, C. K	Williamstown	Massachusetts.
Bateman, J. H	Dover	Delaware.
Barringer, William	Bellefontaine	Ohio.
Blanchard, O. A	Elmira	Illinois.
Bryant, A. F	Clear Creek	Nebraska.
Bartlett, E. B	Vermillion	New York.
Baker, D. W. C	Austin	Texas.
Bayliss, Rachel H	Independence	Kansas.
Brainerd, H. G	Independence	Iowa.
Bradley, W. R	Georgetown	Colorado.
Blake, D. G	Calvistogu	California.
Ballard, Dr. F. A	Independence	Missouri.
Beebe, Levi	South Lee	Massachusetts.
Beans, Thomas J	Moorestown	New Jersey.
Breed, J. E	Embarrass	Wisconsin.
Beal, William	Murphey	North Carolina.
Bell, Joseph	Franklin	Pennsylvania.
Beall, Dr. and Mrs. R	Lenoir	North Carolina.
Brendell, Fred	Peoria	Illinois.
Beloit College	Beloit	Wisconsin.
Benedictine Fathers	Saint Meinrad	Indiana.
Brewster, James	Okalooska	Louisiana.
Bently, David	Princeton	California.
Beatty, Dr. George F	Paloa	Kansas.
Bien, Morris	Eureka	Nevada.
Briggs, John	Albany	Oregon.
Breedon, Jacob	Adrian	Michigan.
Bowman, Peter	Savannah	Ohio.
Boerner, Prof. Charles	Vevay	Indiana.
Blodgett, Charles	Howard	Nebraska.
Blood, Charles F	Waltham	Massachusetts.
Blood, Charles F	Windsor	Vermont.
Bower, Dr. William W	Mount Sterling	Illinois.
Brown, C. C	Cape Vincent	New York.
Boies, A. H	Hudson	Michigan.
Boone, C. A	Orlando	Florida.
Bullard, R	Litchfield	Michigan.
Bullock, Thomas	Coalville	Utah.
Byrant, A. F	Clear Creek	Nebraska.
Clarke, Dr. J. T	Mount Solon	Virginia.
Crane, George W	Bethel	Ohio.
Chase, Dr. D. H	Louisville	Illinois.
Clark, T. A	Weldon	North Carolina.
Chappelsmith, John	New Harmony	Indiana.
Caldwell, John W	Clarksville	Tennessee.
Carlovitz, John	Milton	Florida.
Clark, J. Morton	Arlington	Indiana.
Caulkins, John S	Thornville	Michigan.
Calkins, Dr. H. T	Petoskey	Do.
Castelhun, Carl	Newburyport	Massachusetts.
Calhoun, P. B	Austin	Tennessee.
Chandler, Dr. William I	South Orange	New Jersey.
Carr, William J	Fall River	Massachusetts.
Cheney, William	Minneapolis	Minnesota.
Child, Dr. A. L	Plattsmouth	Nebraska.
Child, H. P	Kansas City	Missouri.
Cline, P. P	Terrill	Texas.
Clinton Wire Cloth Company	Clinton	Massachusetts.
Crump, H. H	Bowling Green	Kentucky.
Cobb, N. T	Fayetteville	North Carolina.
Cook, E. R	Trenton	New Jersey.
Couch, E. D	Contoocookville	New Hampshire.
Colby, Alfred	Amoskeag	Do.
Cornell University	Ithaca	New York.
Colt, Henry H	Nora Springs	Iowa.
Cobb, Lee S	Nirvana	Michigan.
Collin, Prof. Alonzo	Mount Vernon	Iowa.
Crosier, Adam	Laconia	Indiana.
Cummings, James	Tarentum	Pennsylvania.
Cutting, Dr. Hiram A	Lunenburg	Vermont.
Cutter, J. L	Quitman	Georgia.
Curtis, George G	Fallston	Maryland.
Cutler, Rev. B. B	Schroon Lake	New York.
Dawson, William	Spiceland	Indiana.
Davis, Jacob	Rowe	Massachusetts.
Davies, Mrs. D. D	Forest Hill	North Carolina.
Daboll, Solon N	Olivet	Dakota.
Doak, Miss Julia A	Tusculum	Tennessee.
Draper, Daniel	Central Park, New York City	New York.
Day, Theodore	Dyberry	Pennsylvania.
Denning, H. D	Wellsboro'	Do.

List of voluntary observers, &c.—Continued.

Name of observer.	Post-office address.	State.
Dewhurst, Rev. E	Mystic	Connecticut.
Dean, Seth	Glenwood	Iowa.
Dickinson, J. P	Guttenburg	Do.
Diffendorffer, W. S	Lebanon	Missouri.
Doton, Hosea	Woodstock	Vermont.
Dunning, I. S	Vail	Iowa.
Dunn, William	Syracuse	Nebraska.
Ellis, Edwin	Ashland	Wisconsin.
Emmett, Thomas A	Boyd's Corners	New York.
Fallon, J	Lawrence	Massachusetts.
Farquhar, Allan	Sandy Springs	Maryland.
Failyer, G. H	Manhattan	Kansas.
Ferris, E. J	Little Mountain	Ohio.
Fernald, Prof. M. C	Orono	Maine.
Freeman, G. S	Genoa	Nebraska.
Freman, M. H	Monrovia, Liberia	Africa.
Friend, Charles W	Carson City	Nevada.
Friel, Joseph	Cloverport	Kentucky.
Foster, R. W	New York City	New York.
Fox, Fred. E	Mount Fair View	California.
Fortescue, Joseph	Lower Fort Garry	Manitoba.
Fowler, W. C	Milton	Pennsylvania.
Fuller, A. N	Hermosa	Colorado.
Foster, R. W	Springfield	Massachusetts.
Flint, Earl	Granada	Central America.
Gray, F. R	Yates Centre	Kansas.
Gardiner, R. H	Gardiner	Maine.
Grathwohl, John	Blooming Grove	Pennsylvania.
Green, H. A	Atco	New Jersey.
Gedding, Dr. W. H	Aiken	South Carolina.
Gleitsmann	Asheville	North Carolina.
Green, Dr. J. C	West Chester	Pennsylvania.
Gillingham, C	Accotink	Virginia.
Gillespie, Dr. S. W	Sterling	Illinois.
Gillingham, Milnor	Fallsington	Pennsylvania.
Gibboney, H. H	Tazewell	Virginia.
Gibbs, George A	Turks Island, Grand Turk	Bahamas.
Gowey, H. D	North Lewisburg	Ohio.
Golson, Lewis B	Milton	Florida.
Guffey, T. H	Milton	Pennsylvania.
Guerrero, I., and others	Mazatlan	Mexico.
Harper, George W	Cincinnati	Ohio.
Hammitt, John W	College Hill	Do.
Haworth, John	Philadelphia	Pennsylvania.
Haywood, John	Westerville	Ohio.
Harvard College Observatory	Cambridge	Massachusetts.
Harrington, Charles A	Dover Mines	Virginia.
Hardy, R. T	Troy	New York.
Harcourt, J	Wappinger's Falls	Do.
Heath, Dr. E. R	San Antonio	Brazil.
Hering, C. J	Paramaribo	South America
Hess, F	Fort Dodge	Iowa.
Helm, Thomas B	Logansport	Indiana.
Henning, Irving P	Lompoc	California.
Higgins, F. W	Detroit	Michigan.
Hinrichs, Prof. Gustavus	Iowa City	Iowa.
Hilton, J. T	Paterson	New Jersey.
Hills, Frank T	Auburn	New Hampshire.
Hoskinson, R. M	Port Blakely	Washington Territory.
Howard, S. A	Greensboro	North Carolina.
Hopkins, Dr. H. H	New Market	Maryland.
Hurlin, Rev. William	Antrim	New Hampshire.
Hunt, G. M	North Argyle	New York.
Hull, F. V	Okahumpka	Florida.
Hunt, P. L	Litchfield	Pennsylvania
Hunter, T. C	Wabash	Indiana.
Hunt, L. H	Schooley's Mountain	New Jersey.
Hyde, G. A., and Mrs	Cleveland	Ohio.
Ingram, Dr. J	Vineland	New Jersey.
Iowa Agricultural College	Ames	Iowa.
James, John W	Marengo	Illinois.
Jacobs, George A	Highlands	North Carolina.
Jennison, H. L	Starkey	New York.
Johnson, J. A	Emory Grove	Maryland.
Johnson, Rev. Samuel	Sidney Plains	New York.
Jones, Ira B	Neillsville	Wisconsin.
Kaucher, William	Oregon	Missouri.
Keeler, W. F	Mayport	Florida.
Kedzie, R. C	Lansing	Michigan.
Keese, G. P	Cooperstown	New York.
Keenan, Mrs. W. E. A	Brookhaven	Mississippi.
Kedzie, W. K	Oberlin	Ohio.

List of voluntary observers, &c.—Continued.

Name of observer.	Post-office address.	State.
Kendall, Henry T	Reading	Pennsylvania.
Kenmuir, J. P	Kansas City	Missouri.
Kellogg, J. H	Battle Creek	Michigan.
Kent, Joseph C	Phillipsburg	New Jersey.
Kridelbaugh, Dr. J. A	Clarinda	Iowa.
Kirkpatrick, J. A	Philadelphia	Pennsylvania.
Kimball, Perly R	Grafton	New Hampshire.
King, J. Stebbins	Decatur	Illinois.
Kohler, Edward	Egypt	Pennsylvania.
Lapham, A. Milton	Springfield	Missouri.
Lawrence, J. B	South Haven	New York.
Lewis, Miss Blanche L	McMinnville	Tennessee.
Lewis, James	Kanab	Utah.
Lincoln, J. R	Boonsboro	Iowa.
Lovewell, Prof. J. T	Washburn College, Topeka	Kansas.
Long, R. L	Kendall Green, Washington	District of Columbia.
Luëps, Misses C. and J	Manitowoc	Wisconsin.
Martin Horace	Corning	Missouri.
Marshall, Gregory	Cresco	Iowa.
MacSwain, L. S	Thomasville	Georgia.
Maxwell, Samuel A	Linden	Illinois.
Manning, Thomas	Boyd's Corners	New York.
Metcalf, John G	Mendon	Massachusetts.
Mead, S. B	Augusta	Illinois.
Meehan Thomas	Germantown	Pennsylvania.
McCready, Miss Lucy	Fort Madison	Iowa.
Meyer, William	Lake Charles	Louisiana.
Miller, Mr. and Mrs. L. O	West Liberty	Ohio.
Michigan State Board of Health	Lansing	Michigan.
McGill College	Montreal	Canada.
Moore, C. R	Johnsontown	Virginia.
Morris, Rev. John	Morristown	Dakota.
Mount Saint Mary's College	Emmittsburg	Maryland.
Moulton, M. M	Monticello	Iowa.
Morgan, William J	Somerville	New Jersey.
Moss, G. B	Belvidere	Illinois.
McConnell, E. M	New Castle	Pennsylvania.
McDonough School	Owings Mills	Maryland.
Morris, John W	Fancy Gap	Virginia.
McLouth, Prof. Lewis	Ypsilanti	Michigan.
Morrelle, Rev. Daniel	Wilmington	North Carolina.
Mueller, Dr. R	Saint Mary's Home	Indiana.
Munn, A. M	Kalamazoo	Michigan.
Muelles, A	Eureka	Nevada.
Nason, Rev. Elias	North Billerica	Massachusetts.
Naglewort, J. B	Austin	Nebraska.
Newcomb, G. S	Westborough	Massachusetts.
Neill, Thomas	Sandusky	Ohio.
Newbegin, Dr. John	Anna	Illinois.
New Jersey State Agricultural College.	New Brunswick	New Jersey.
Nixon, J. Sharpe	Chambersburg	Pennsylvania.
Nipher, Prof. F. E	Saint Louis	Missouri.
Nall, A. B	Linden	New Jersey.
Noble, A. C	Deckertown	Do.
Oehler, Arthur	Highlands	Illinois.
Owens, T. B	Gatesville	Texas.
Owsley, Dr. J. B	Jacksonburg	Ohio.
Oliphant, E	New Lisbon	New Jersey.
Partrick, J. M	North Volney	New York.
Parker, J. D	Mount Desert	Maine.
Parnell, George W	Poway	California.
Pearce, F	Eola	Oregon.
Phillips, W. R	Edgerton	Wisconsin.
Pitman, C. H	Farmington	New Hampshire.
Priest, Carlton R	Princeton	New Jersey.
Quarterman, E. A	Flushing	New York.
Quijano, F., and others	Mazatlan	Mexico.
Reinsch, August	Cedar Vale	Kansas.
Remington, C. V. S	Fall River	Massachusetts.
Reeves, James S	Niles	Michigan.
Richardson, C. F	Freehold	New Jersey.
Ring, John J	San Gorgonio	California.
Ripon College	Ripon	Wisconsin.
Robertson, Thomas D	Rockford	Illinois.
Rodman, Miss Susan	New Bedford	Massachusetts.
Robertson, R. S	Fort Wayne	Indiana.
Rotch, William	Fall River	Massachusetts.
Rogers, O. P	Marengo	Illinois.
Rogers, Jesse D	Nile	New York.
Rockford, Prof. C. G	Princeton	New Jersey.
Rogers, David D	Daytona	Florida.

List of voluntary observers, &c.—Continued.

Name of observer.	Post-office address.	State.
Rogers, J. B	Lima	New York.
Rockwell, J.	Ponca	Nebraska.
Robins, Charles E.	Summit	Colorado.
Runge, C	New Ulm	Texas.
Russell, George W	Wellsburg	West Virginia.
Ruley, Samuel M	Craig	Missouri.
Sanborn, J. T	Tabor	Iowa.
Saxby, J. I.	San Buenaventura	California.
Slade, Elisha	Somerset	Massachusetts.
Spaulding, John	Wautoma	Wisconsin.
Straight, Isaac	Walla-Walla	Washington Territory.
Swan, James G	Neah Bay	Do.
Smith, William Allen	Dover	New Jersey.
Seltz, Charles	De Soto	Nebraska.
Snell, S. C	Amherst	Massachusetts.
Slenker, Elmina D	Snowville	Virginia.
Stephenson, Dr. M. T	Gainesville	Georgia.
Streng, L. H.	Grand Rapids	Michigan.
Stern, Jacob F.	Logan	Iowa.
Scribner, H. F., jr	Stratford	Vermont.
Stringfield, William W	Waynesville	North Carolina.
Siler, Mrs. A.	Franklin	Do.
Shriver, E. T.	Cumberland	Maryland.
Shriver, Howard	Wytheville	Virginia.
Smith, E. Allen	Moriches	New York.
Smith, Rev. George N	Northport	Michigan.
Smith, C. J	Hudson	Ohio.
Spilman, J. J	Pierce City	Missouri.
Snow, Prof. F. H	Lawrence	Kansas.
Sommerville, W. B	Wilsonville	Alabama.
Scott, T. M	Melissa	Texas.
Scott, T. G.	Forsyth	Georgia.
Stoddard, Prof. O. N	Wooster	Ohio.
Sawyer, C. J	Williamstown	Massachusetts.
Sturtevant, E. T	Biscayne	Florida.
Stucky, Dr. C. F	Helvetia	West Virginia.
Smyth, B. B	Great Bend	Kansas.
Thralls, George R	Houston	Florida.
Thieme, T. F.	Fort Wayne	Indiana.
Teele, A. R	Milton	Massachusetts.
Trembly, Dr. J. B.	Oakland	California.
Tripp, Rev. L. S	Surrey	Maine.
Townsend, L. P	Hulmeville	Pennsylvania.
Trowbridge, D.	Waterburg	New York.
Turner, Ernest	Point Pleasant	Louisiana.
Tutwiler, H., LL. D	Green Springs	Alabama.
Truman, George S.	Genoa	Nebraska.
Valenti, Rev. A. X.	Woodstock	Maryland.
Van Meter, J. L	Lee's Summit	Missouri.
Van Inwegan, Charles F.	Port Jervis	New York.
Vermillion, W. W	Frankford	Missouri.
Walton, J. P.	Muscatine	Iowa.
Watters, Dr. James	Holton	Kansas.
Watkins, Joseph C.	Ashley	Missouri.
Washington Aqueduct	Receiving Reservoir	Maryland.
	Great Falls	Do.
	Distributing Reservoir	District of Columbia.
	Rock Creek	Do.
Walker, George	Girard	Kansas.
West, Silas	Cornish	Maine.
Wheaton, Mrs. D. B	Hinsdale	Illinois.
Wild, Rev. E. P	Newport	Vermont.
Wilbur, Benjamin F	West Waterville	Maine.
Williams, Milo G.	Urbana	Ohio.
Wing, Miss Minerva E	West Charlotte	Vermont.
Willis, O. R	White Plains	New York.
Winnepiseogee Lake Manufacturing Company.	Ashland	New Hampshire.
	Belmont	
	Bristol	
	Lake Village	
	Weir's Bridge	
	Wolfeborough	
	Woodstock	
Wilcox, C. M	Norwalk	Ohio.
Williams, C. Foster	Ashwood	Tennessee.
White, I. H	Cincinnati	Ohio.
Whiting, William H.	Geneva	Wisconsin.
Whittington, Granville	Mount Ida	Arkansas.
Whitney, C. E	Creswell	Kansas.
White, T. Baxter	Highlands	North Carolina.
Wolfe, John W.	Wellington	Kansas.

List of voluntary observers, &c.—Continued.

Name of observer.	Post-office address.	State.
Worth, J. M.	Fayetteville	North Carolina.
Woodward, Augustus J.	Gulf Hammock	Florida.
Wylie, William	Mount Forest	Canada.
Yetter, W. G.	Catawissa	Pennsylvania.
Young, George R.	Penn Yan	New York.
Young, John	Blackfeet Agency	Montana.

PAPER 30.

(Circular.)

THE WEATHER CASE, OR FARMERS' WEATHER INDICATOR.

DESCRIPTION.

Stand facing and look at the weather case. Now:

The right of the case is at your right hand; the left of the case is at your left hand.

The pointer or index at the top of the case (No. 1) slides on the brass arc; it is known as the "sunset barometer index," and indicates, when set, by the figures to which it points on the "main barometer scale," which is just below it, the reading of the barometer at the time of the sunset yesterday.

The "main barometer scale" (No. 2) exhibits all the barometric readings likely to be used with this instrument.

The pointer (No. 3) just below the "main barometer scale" is called the "reference index," and indicates by the figures to which it points on the main barometer scale, when the instrument is set, the mean or average reading of the barometer at the *place* at which the instrument is set and for each separate *month*. When the barometer reads above or below this reading at any place, such reading is said be "above the mean" or "below the mean" for that place in that month. This reference index is established in the exact central line of the face of the case.

The barometer and the main barometer scale are set to the reference index once for each month in the year, as follows:

The mean or average reading for the place and for the month, appearing on the scale marked on the barometer face, must be adjusted to coincide exactly with the reference index. To do this, the *mean barometer reading for the place and for the month* being first ascertained, the figures or divisions for that reading are found upon the scale of figures and divisions marked on the barometer face. The barometer is then revolved upon its horizontal axis by the hand-screw, to be found behind, or at the back of, the weather case, until these figures (*those for the proper reading for the month*) are adjusted to the lower point of the "reference index," as near to it as possible. This lower point is the point seen inside and at the top of the barometer case.

The main barometer scale (No. 2) is then turned by the thumb-screw A until the same proper mean reading for the month appearing upon that scale is adjusted to the upper point of the reference index.

The long brass hand over the glass face of the barometer is known as the "long pointer," and indicates, by the figures of the "main barometer scale" to which it points when set, the reading of the barometer when last set.

The black pointer on the face of the barometer under the glass face is known as the "short pointer," and indicates the existing pressure of the atmosphere at any time the instrument may be examined.

ILLUSTRATION.

For instance: Suppose for the month of February, and at the city of Washington, the mean or average barometer reading is 30.02, then the barometer face is turned by the hand-screw until the barometer reading 30.02, as near it as possible, is at the lower point of the reference index. The main barometer scale is turned by the thumb-screw, A, until the same reading (30.02) on that scale is at the upper point of the reference index, as near to it as possible. (See plate herewith.)

The barometer and the main barometer scale are now so arranged that when either the short pointer or long pointer, after being adjusted, is found to be pointing to the *right* of the reference index, it is at once and readily known that the barometer reading is above or higher than the mean barometer reading for the month.

When either the short pointer or long pointer, after being adjusted, is found to be pointing to the *left* of the reference index, it is readily known that the barometer reading is below or lower than the mean barometer reading for the month.

The instrument can in this way be easily observed: when so arranged it is described as "set to the reference index."

The reference index, when the instrument is thus set, indicates the mean or average reading of the barometer at the place at which the instrument is set and for each separate month.

As long as the barometer pointers at any time go towards the right the barometer is said to be "rising." As long as the barometer pointers go toward the left the barometer is said to be "falling."

When the barometer pointers go toward the right from the mean barometer reading at the reference index, the barometer is said to be "high and rising." When the barometer pointers go toward the left from the mean barometer reading at the reference index, the barometer is said to be "low and falling."

The barometer pointers may remain stationary. The barometer is, for such time, said to be "stationary."

Directions for procuring the mean barometer reading (actual) for each district for each month, with close approximation, can be had by application to this office.

A barometer reading ought always to be carefully taken and recorded at sunset each day, at each place, to enable a monthly mean for that place to be arrived at.

TO READ THE BAROMETER.

If the observer stands facing the barometer, the "short pointer" (black) moves toward the right as the pressure of the atmosphere (or weight of the air) increases, and to the left as the pressure of the atmosphere (or weight of the air) diminishes. The "long pointer" (brass) should be moved by the turning screw so as to coincide with, or exactly cover, the "short pointer" (black). The barometer is now set for reading, and the "barometer reading" is found by reading from the left to right on the "main barometer scale," from the lowest figures (or readings) on that scale to that exact division or mark upon that scale to which the "long pointer" points or which it covers. The inches and hundredths of inches are marked on the scale. The inches and hundredths are counted from left to right, or in the same direction as the hands of a watch move, and they are counted in the same way as the hours and minutes on a watch-face are counted. The inches and hundredths are written down, if they are to be written, in the same manner as dollars and cents are written, thus: one dollar and seventy-five cents; that is, one dollar seventy-five hundredths of a dollar would be written 1.75, or one and seventy-five hundredths; $29.35, twenty-nine dollars and thirty-five hundredths. The "long pointer" pointing on the "main barometer scale" to twenty-nine inches and thirty-five hundredths, the barometer reading would be twenty-nine inches and thirty-five hundredths of an inch, and would be written "29.35 inches," and so for other readings.

RAIN WINDS AND DRY WINDS.

There are for each place and each month two kinds of winds:

First. Winds which, blowing from certain directions, are at that place and in that month more likely than other winds to be followed by rain. These are called "rain winds."

Second. Winds which, blowing from certain directions, are at that place and in that month less likely than other winds to be followed by rain. These are called "dry winds."

The "rain winds" and the "dry winds" for each district and for each month are stated in the Farmers' Bulletin, or can be had by application to this office.

The wind direction for any day or time must be seen and taken at each place or station by a vane as well located as practicable.

The "wind disk" (No. 8) consists of a brass circle, on which slide freely two arcs—a red arc, called the "dry wind arc" (No. 9), and a blue arc, called the "rain wind arc" (No. 11). In the center of the disk is a pointer turning with a turning-screw, and called the "wind disk pointer" (No. 10). Around the disk are letters to show directions, as N. for north, E. for east, NE. for northeast, &c.

The wind disk is made ready for use as follows: If, for instance, the Farmers' Bulletin, or other report, states that, for any district or place, and for any month, "winds blowing from south and east, or from directions between those points, are found to be the winds most likely to be followed by rain; winds blowing from north or west, or from directions between those points, are found to be the winds least likely to be followed by rain;" or, in other words, "winds blowing from east or south, or from directions between those points, are rain winds; winds blowing from north or west, or from directions between those points, are dry winds;" then, if the instrument is to be used in that month and in that district or place, the rain wind arc No. 11 (the blue) is moved on the brass circle until one end of the arc is at the letter E., which stands for "east," and the other is at the letter S., which stands for "south;" the dry wind arc No. 9 (the red) is moved on the circle until one end of that arc is at the letter N., which stands for "north," and the other is at the letter W., which stands for "west." The arcs remain as they are thus placed for the whole of the month.

At the beginning of the next month, the rain-wind direction and dry-wind direction must be located for that month, and the arcs must be again moved on the circle in the same manner, until the rain-wind arc and the dry-wind arc touch, respectively, with their ends, the letters for the points named for the rain-winds and the dry-winds for that month. The arcs then remain so placed for that month; so for each month of the year.

Now, when the wind disk is thus ready, and on any day, the weather case is to be used. (1) The direction in which the wind is blowing is seen by a vane. It is noticed from what direction the wind is blowing, as from the north, south, east, &c. (2) The wind disk pointer (No. 10) is moved by the turning-screw to point to the compass letters on the disk, or between them, showing as nearly as practicable by those letters the same direction *i. e.*, that *from* which the wind is blowing when observed. If the pointer, so set, points at either of the ends of either arc, or any part of either arc, it shows, if it so points at the *red* arc, that the wind is at that time in the *dry*-wind direction or is a *dry*-wind; if it so points at the *blue* arc, that the wind is at that time in the *rain*-wind direction or is a *rain*-wind.

The hour is noted by a clock or watch and the time at which a rain-wind or a dry-wind commenced to blow or was first noticed is written down.

It must be also noticed if the wind shifts, as from blowing from a rain direction to blowing from a dry direction, or is blowing from such direction as not to be within either arc.

The length of time for which the wind has blown continuously from a rain direction or a dry direction is of importance, to be considered with other local signs and indications.

The pointer and scale (No. 5) on the right of and below the barometer are called the dry-wind time record, and the pointer (No. 7) is called the "record pointer," and indicates, when set, the length of time the wind has been blowing continuously from a "dry" direction, by the figures showing the number of hours on the scale to which it points.

The pointer and scale (No. 4) on the left of and below the barometer are called the rain-wind time record, and the record pointer (No. 6) indicates, when set, the length of time the wind has been blowing continuously from a "rain" direction, by the figures showing the number of hours on the scale to which it points.

The record pointer on the rain-wind time record (No. 6) is always turned by the thumb-screw, and set pointing at the figure 0 on the scale when the wind is not blowing in the rain-wind direction. In the same way the "record pointer" on the dry-wind time record (No. 7) is always set pointing at the figure 0 when the wind is not blowing in the dry direction.

When in actual use, the hour at which the *wind-disk pointer* has been set is carefully noted. When the weather case is next examined, the wind-vane is again noticed and the wind-disk pointer again *examined* or adjusted. If it still continues to point at any part of the same arc as before, the number of hours which have elapsed since the last setting and during which the wind-disk pointer has been so pointing is noticed, and the record pointer on either the rain-wind time record or dry-wind time record is turned to show *the number of hours* the wind has been thus noticed as blowing from the *rain* direction or from the *dry* direction, as the case may be. This proceeding is repeated every time the instrument is set. It can thus be seen at a glance whether the wind is, or not, blowing in a rain-wind or a dry-wind direction, and for how long it has been so blowing. Whenever, on noticing the wind-vane, it is seen that the wind has shifted, the wind-disk pointer is set accordingly. If it now points at neither arc or points to the different arc from that at which it pointed at its last setting, the time-record pointer on the rain-wind time record or dry-wind time record (whichever may have been in use at the last setting) is turned to point at the figure 0 (zero).

The wind-disk pointer and the time-record pointer ought to be set thrice daily, at least; early in the morning, at noon, and at sunset.

The sunset-disk (No. 12) consists of a circular disk one-half of which is colored red and one-half of which is colored blue. The disk turns upon a central turning-screw in such a manner that half of the disk shows through a semi-circular opening in the face of the weather case. The sunset-disk is set as follows: At the exact time of every sunset the western sky and the character of the sunset is carefully observed. The examination ought to be minute and careful, lasting for about fifteen minutes. If the sunset sky is clear or red, or markedly what is known as a "fair weather sunset"—a sunset such as is generally held to indicate a clear or fair day to follow on the next day—a day on which it will not rain—the sunset disk is turned by the turning screw until the semi-circular opening shows all red. The sunset disk, thus turned, is described as set for a "fair weather sunset."

If the sunset sky (the western) is cloudy or foul, or markedly what is known as a "foul weather sunset," a sunset such as is generally held to indicate foul weather to follow on the next day—a day on which it will rain—the sunset disk is turned by the turning-screw until the semi-circular opening shows all blue. The sunset disk thus turned is described as set for a "foul weather sunset." If the appearance of the western sky and the character of the sunset are neither markedly those of a "fair weather sunset" or of a "foul weather sunset," but such as to leave the observer in doubt how to style it, the sunset disk is turned to show half red and half blue, or "doubtful." The sunset disk, thus set, is described as set for a "doubtful weather sunset."

The term "fair weather sunset" expresses such condition of the sky, particularly the western, and such character of the sunset as is considered to indicate a fair day, a day on which it does not rain, for the day ensuing.

The term "foul weather sunset" indicates that the appearances are such as to presage a rainy day, a day on which rain falls, for the ensuing day.

The term "doubtful weather sunset" indicates that the conditions are such as to leave the mind of the observer in doubt as to what the sunset presages for the following day. The indication is considered to be for the period of time from the "sunset" of the day on which the character of the sunset is examined until the "sunset" of the following day.

DRY-BULB AND WET-BULB THERMOMETERS.

In the lower part of the weather case there are two thermometers, a dry-bulb thermometer (No. 13) on the left-hand side of the case, and a wet-bulb thermometer (No. 14) on the right-hand side.

The dry-bulb thermometer is like any other thermometer, and shows by its readings the temperature of the air.

The wet-bulb thermometer is one the bulb of which is kept constantly moist by the water passing up from the glass reservoir, through the wicking which covers the thermometer bulb.

The readings of the dry-bulb thermometer and those of the wet-bulb thermometer are more and more unlike, or further and further "*apart*," as it is called, in proportion as the air contains less and less moisture; that is, is becoming *dryer*.

The readings of the dry-bulb thermometer and those of the wet-bulb thermometer become more and more *alike*, are nearer and nearer together, in proportion as the air contains more and more *moisture*. That is, is becoming saturated or *wet*.

By the side of the dry-bulb thermometer (No. 13) is the dry-bulb pointer which slides on the brass slide (No. 15). By the side of the wet-bulb thermometer is the wet-bulb pointer which slides on the brass slide (No. 16). In the center of the case is the "dry and wet bulb scale," marked on the paper on which is the central brass slide-bar (No. 19), and on this slide move the dry-bulb keeper (No. 17) and the wet-bulb keeper (No. 18). To set the thermometers, examine first the dry-bulb thermometer and move the "dry-bulb pointer" (No. 15) on the slide until the outside point is exactly level with the top of the mercury in the thermometers—as near to it as practicable. Examine next the wet-bulb thermometer, and move the wet-bulb pointer (No. 16) on the slide until the outside pointer is exactly level with the top of the mercury in the wet-bulb thermometer, or as near to it as practicable; then turn to the dry and wet bulb scale, and on the "central brass slide-bar" (No. 19) move one of the keepers until it touches as nearly as possible—is on an exact level with the inside pointer of the "dry-bulb pointer;" then move the other keeper until it touches, as nearly as practicable—is on an exact level with the inside pointer of the "wet-bulb pointer." The thermometers are now set and the difference between their readings can be known by counting on the "dry and wet bulb scale" the number of degrees between the keepers.

When the thermometers are examined and set again, following the same plan, it will be easily seen whether the "keepers" are, when set, *further apart* than they were at the previous setting, or whether they are, when set, *nearer together* than at the previous setting.

If they are further apart the thermometers are said to be "separating." If they are nearer together the thermometers are said to be "approaching." Other things being equal, the thermometers show, when they are "separating," that the air is becoming more dry—one sign of approaching fair weather. The thermometers show, when they are "approaching," that the air is becoming more moist or damp—one sign of approaching rain.

The reservoir at the bottom of the weather case ought to be kept half filled always with pure water. The wicking must be kept clean and changed occasionally—say, once in each month.

USES OF THE WEATHER CASE.

The weather case is not intended to be used independently of the official weather reports. It is to be used always in connection with them. The weather case is for the purpose of supplementing the official reports by showing the local instrumental indications, and giving other information. It is intended especially for use at farmers' post-offices and places reached with difficulty by the printed reports. It will supplement often whatever knowledge there be of local signs, with the indications of the instruments. Its careful use, taken either with the furnished reports or even without them (if they chance to fail), will often enable the character of the coming weather on the coming day to be so judged as to determine what kind of work or undertaking it is wise to plan for or to omit. The case gives the local instrumental indications, and will frequently aid in making fair forecasts for the next day.

It is well to limit the forecasting to the attempt to tell only whether it will or will not *rain* on the next day. Days on which it does not rain at all are rated "fair," though the sky may be covered with clouds. Days on which there is rain enough to injure crops in the harvesting are rated "foul."

It must never be forgotten that the weather case is only to aid, sometimes, in making up one's mind as to what the weather of the next day will be. While it will often be very useful, there will be many instances in which everything will be left in doubt

LOCATION.

The weather case should be hung or stand in a fair light, where it will be always shaded, preferably on the northern side or part of the house, where it will not be exposed to artificial heat, and where there will be a free circulation of the air. It will be easier to find good locations in summer than in winter. As the readings of the instrument are examined for their general indications only, the great care as to the location will not be so needed for general use as if the readings were for exact record. For particular uses, the case may be particularly sheltered.

TO USE THE WEATHER CASE AT SUNSET.

(1) Read the description. See that the figures or divisions on the barometer face, and also those on the main barometer scale indicating the mean or average barometer reading for the *place* and for the *month*, are set to the reference index as directed on page 1.

(2) Set the rain-wind segment (or arc) and the dry-wind segment (or arc) at the proper places on the wind-disk circle for the place and month.

At sunset turn the "long barometer pointer" until it covers the "short barometer pointer." Note whether on the "main barometer scale" the long pointer is then at a reading *above* or *below* (greater or less than) the mean barometer reading for the place and for the month. Move the "sunset barometer index" until it points to the same reading on the "main barometer scale" with the "long barometer pointer."

Note the direction of the wind and set the wind-disk pointer.

Set the sunset-disk.

Set the dry and wet bulb thermometers.

Endeavor to apply the "indications" printed on the face of the case, to determine what is to be the character of the next day. Read these "indications" carefully, and see how many of the instruments or disks *agree* in showing one or another kind of weather as to be expected.

Study the character of the clouds. The scud cloud is one of the prominent signs of coming rain. Learn to apply the local signs of weather changes, the more the better.

Examine the case frequently during the day.

It can always be found whether the "pointer" is moving toward the right or left—that is, whether the barometer is rising or falling—by turning the long pointer so as to cover exactly the black barometer pointer; if then, on next examination, the black pointer is found to have moved toward the right, the barometer is rising. If the black pointer has moved toward the left, the barometer is falling.

At sunset of the next day set the case again; note whether the barometer has risen since the "sunset barometer index" was set at the last sunset, whether the wind is in the rain or dry direction, and for how many hours it has been in either, approximately. Study and record the character of the sunset and what it foretells. Set the wet and dry bulb thermometer, and note from the "keepers" whether the thermometers are approaching or separating.

Endeavor to make a forecast whether it WILL OR NOT rain for the ensuing day, as well as a more general forecast.

For instance, if, with a "fair weather sunset," there is a "high and rising barometer," "winds in dry direction," and "thermometers separating," the chances for a fair day for the next ensuing are increased; four indications of pleasant weather coincide. If, with a "foul weather sunset," the barometer is "falling" (the pointer moving toward the left), the winds are in the rain-wind direction and "thermometers approaching"; four indications of rainy or unpleasant weather coincide. So, three indications may coincide, as, with "thermometers approaching" there may be "fair weather sunset"—barometer pointer moving toward the right or high barometer—wind steady in the dry direction. The indications may be divided. In such cases weight must be given the different indications as experience may show their correctness. The purpose of the case is to be one aid only in making up a forecast.

The greater the number of the "indications," as stated on the face of the case, which are found, when the instrument is set, to coincide in indicating dry or clear weather or rainy or stormy weather, the more likely the success of the forecast.

Continue this practice at sunset from day to day. Skill will be found to increase with the knowledge and the use of the instruments and the habit of close observation of local signs which such use makes necessary.

In instances where the printed synopses and indications are had regularly, or where official weather charts, bulletins, &c., can be consulted, the weather case must be used with careful study of those papers. Locate the areas of high and low barometer on the map, and in reference to any location, as nearly as is practicable from the descriptions or date. Areas of cloudiness, rain-areas, areas of unusual temperatures, &c., may be similarly located. When any such areas are found to the westward of and at all near any place, it is rare that the effects of them fail to be shown at such place by weather conditions similar to those within the areas noticed, and in a short time, as of hours or days. As the movements of the areas—easterly—have a certain regularity, it is soon learned to tell nearly *when* the effect of any area noticed as approaching will commence to be felt. The instrumental signs of the weather case will show the changes commencing, and it may be judged whether or when the weather conditions noticed in the approaching area are likely to prevail. Some elementary knowledge of meteorology is needed; but much can be done by a careful watching solely. The instruments of the weather case will show the changes anticipated when they begin to be felt, and before they have arrived, in their full force.

If the area noticed has been large or small, with weather conditions decided or variable, it can, from these facts, be judged often if the "coming weather," of whatever kind it may be, will be steady for a day or for days, or more rapidly changing. The case makes practicable other and many studies.

ALBERT J. MYER.
Brig. Gen. (Brevet Assg'd), Chief Signal Officer, U. S. A.

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL OFFICER,
Washington, D. C., July 21, 1878.

PAPER 31.

(This bulletin must not be disturbed nor the blanks removed therefrom.)

DAILY WEATHER REPORT.

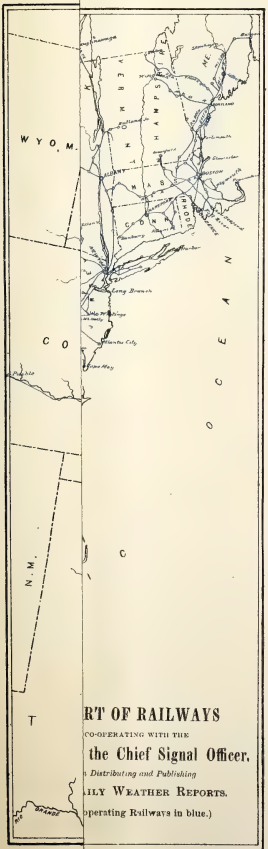
——, ——, 188—.

The following report was telegraphed from the United States Signal Office, Washington, D. C., to the Pennsylvania Railroad:

OFFICE OF THE CHIEF SIGNAL OFFICER, WASHINGTON, D. C.,
——, 188—, 1 a. m.

Issued by order of the Secretary of War:

R. C. DRUM.
Adjutant-General, and Acting Chief Signal Officer of the Army



RT OF RAILWAYS

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ILY WEATHER REPORTS.

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Washington, D. C., July 21, 1878.

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Issued by order of the Secretary of War:

R. C. DRUM.
Adjutant-General, and Acting Chief Signal Officer of the Army

RAILWAY BULLETIN SERVICE.

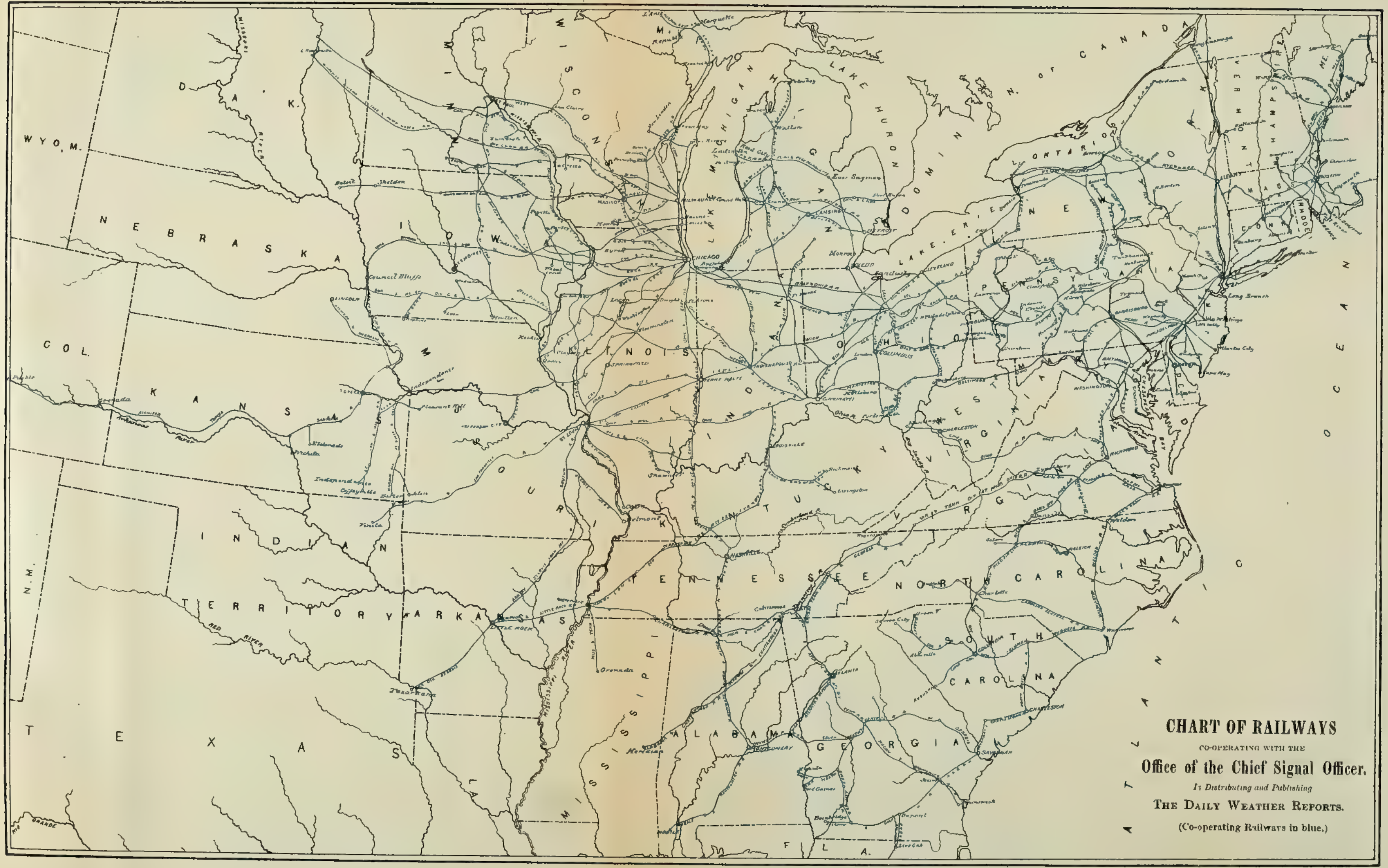

CHART OF RAILWAYS

CO-OPERATING WITH THE

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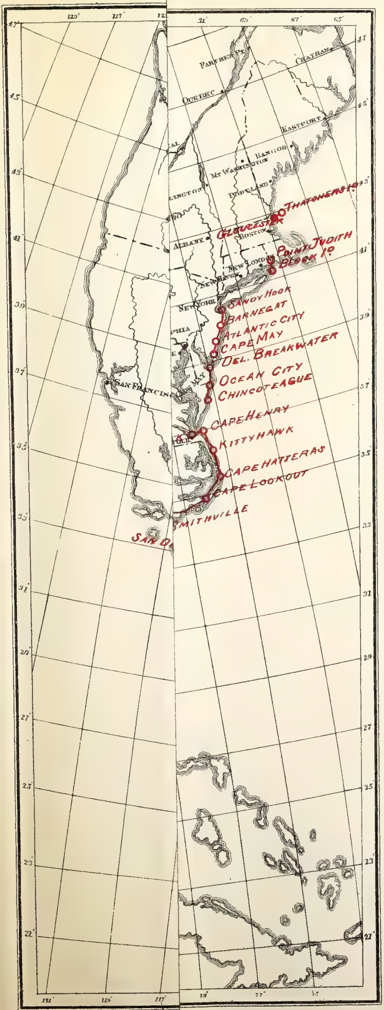
THE DAILY WEATHER REPORTS.

(Co-operating Railways in blue.)


Farther Pt.
Quebec
Chatham
Eastport
Bangor
Mt Washington
Portland
Thatchers Id.
Gloucester
Boston
Albany
New London
Point Judith
Block Id.
New Haven
New York
Sandy Hook
Barnegat
Atlantic City
Cape May
Del. Breakwater
Ocean City
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Kittyhawk
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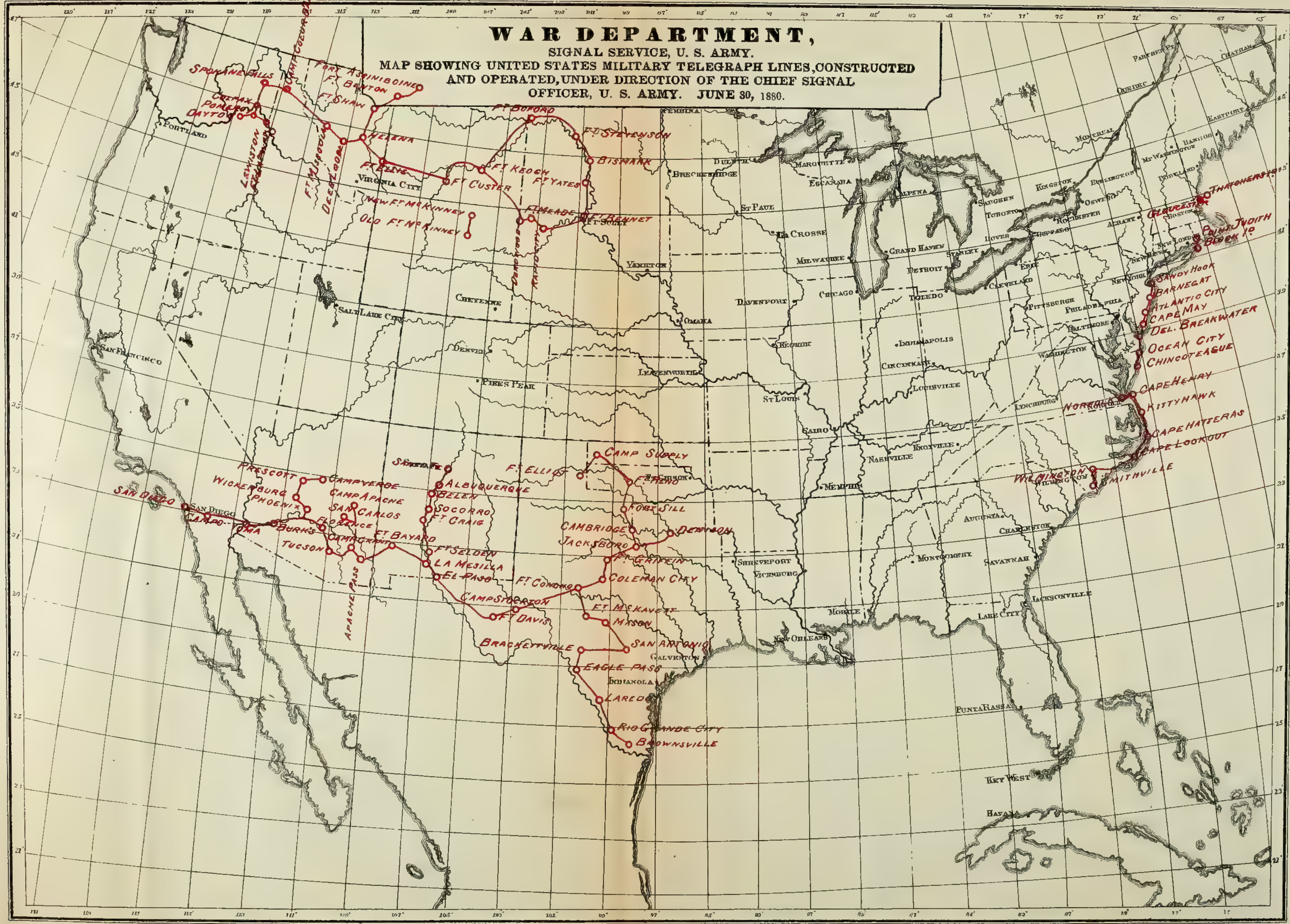
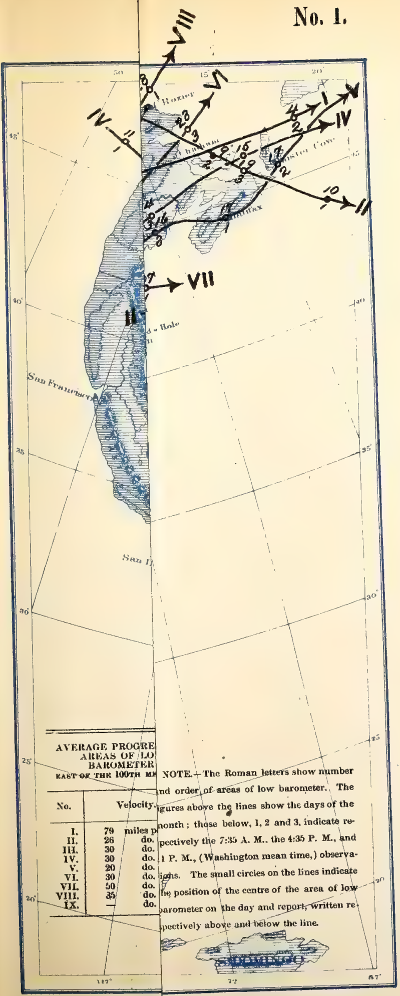


WAR DEPARTMENT,

SIGNAL SERVICE, U. S. ARMY.
MAP SHOWING UNITED STATES MILITARY TELEGRAPH LINES, CONSTRUCTED AND OPERATED, UNDER DIRECTION OF THE CHIEF SIGNAL OFFICER, U. S. ARMY. JUNE 30, 1880.

No. 1.



AVERAGE PROGRE
AREAS OF LO
BAROMETER
EAST OF THE 100TH ME

No.	Velocity.	
I.	79	miles p
II.	26	do.
III.	30	do.
IV.	30	do.
V.	20	do.
VI.	30	do.
VII.	50	do.
VIII.	35	do.
IX.	—	do.

NOTE.—The Roman letters show number nd order of areas of low barometer. The igures above the lines show the days of the nonth; those below, 1, 2 and 3, indicate repectively the 7:35 A. M., the 4:35 P. M., and 1 P. M., (Washington mean time,) observaions. The small circles on the lines indicate he position of the centre of the area of low barometer on the day and report, written repectively above and below the line.

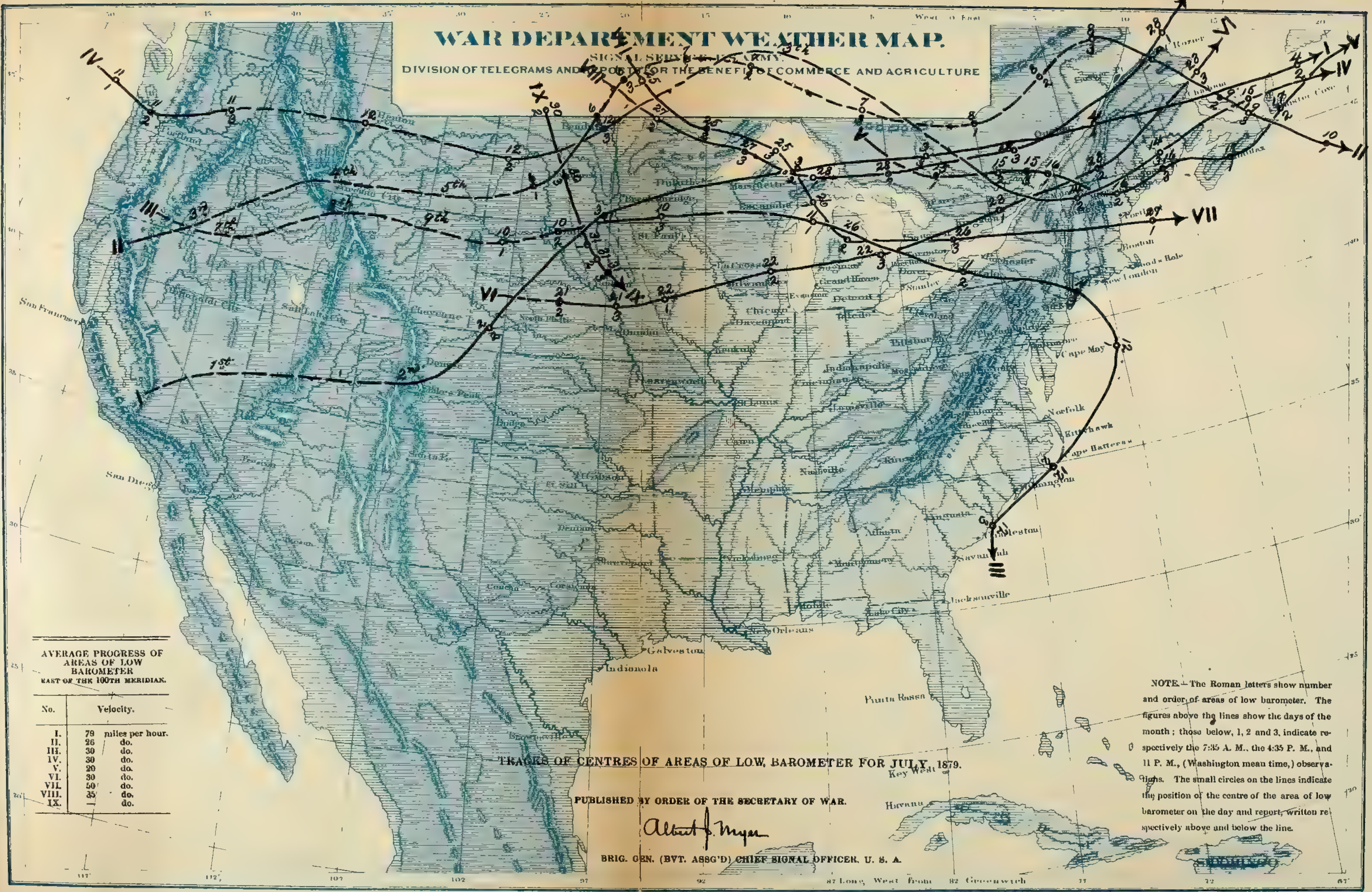
No. 1.

THE PREPARATION OF CHARTS OF THIS SERIES COMMENCED NOVEMBER 8, 1870.

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.



AVERAGE PROGRESS OF AREAS OF LOW BAROMETER

EAST OF THE 100TH MERIDIAN.

No.	Velocity.	
I.	79	miles per hour.
II.	26	do.
III.	30	do.
IV.	30	do.
V.	20	do.
VI.	30	do.
VII.	50	do.
VIII.	35	do.
IX.	—	do.

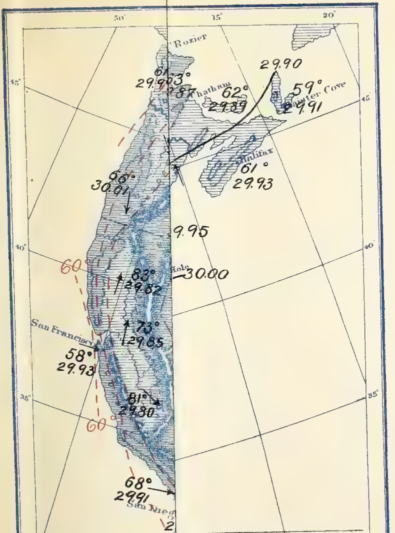
TRACKS OF CENTRES OF AREAS OF LOW BAROMETER FOR JULY, 1879.

NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7:35 A. M., the 4:35 P. M., and 11 P. M., (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above and below the line.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.



TEMPERATURES OF JULY, 1879

STATIONS.	Temper at bott Max.	
Alpena	76	
Augusta	92	
Baltimore	80 5	
Buffalo	76	
Burlington, Vt.	73	
Charleston	90	
Chicago	77	
Cleveland	78	
Detroit	76	
Duluth	65.5	
Eastport	49	
Escanaba	74.5	
Galveston	88	
Grand Haven	82	
Jacksonville	90	
Key West	91	
Marquette	67	
Milwaukee	70	
Mobile	83	
New London	83.3	
New York	76	
Norfolk	84	
Portland, Maine	57	
Punta Rassa	91	
*San Francisco	59	
Sandusky	82	
St. Marks	80	
Savannah	88	
Toledo	87	
Wilmington	87	
Wood's Holl	73	

* Observations for only part o

PERATURES FOR JULY.

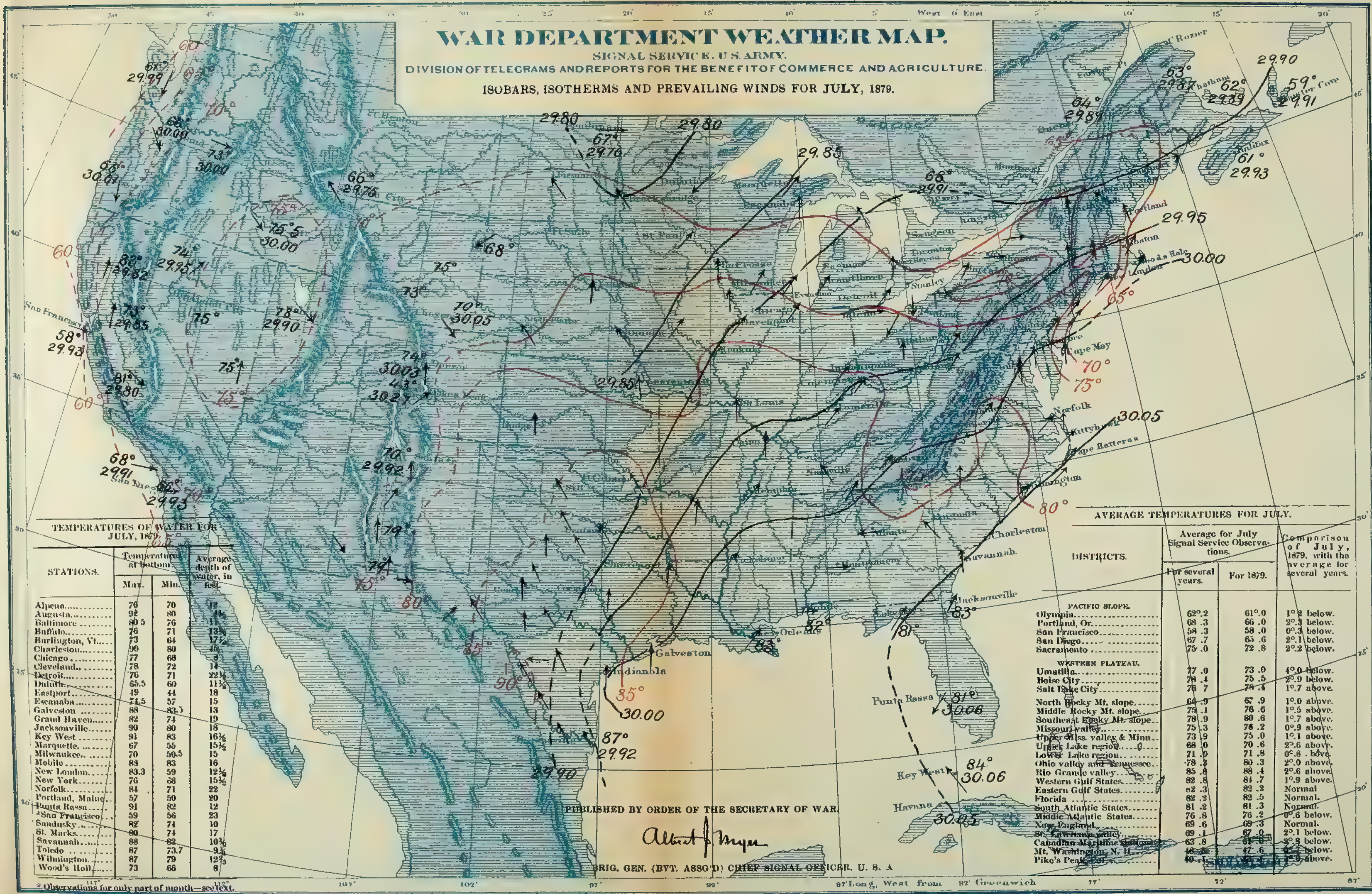
Average for July ignal Service Observations.		Comparison of July, 1879, with the average for several years.
or several years.	For 1879.	
62°.2	61°.0	1° 2 below.
68 .3	66 .0	2°.3 below.
58 .3	58 .0	0°.3 below.
67 .7	65 .6	2°.1 below.
75 .0	72 .8	2°.2 below.
77 .0	73 .0	4°.0 below.
78 .4	75 .5	2°.9 below.
76 7	78 .4	1°.7 above.
66 .9	67 .9	1°.0 above.
75 .1	76 .6	1°.5 above.
78 .9	80 .6	1°.7 above.
75 .3	76 .2	0°.9 above.
73 .9	75 .0	1°.1 above.
68 .0	70 .6	2°.6 above.
71 .0	71 .8	0°.8 above.
78 .3	80 .3	2°.0 above.
85 .8	88 .4	2°.6 above.
82 .8	84 .7	1°.9 above.
82 .3	82 .2	Normal.
82 .2	82 .5	Normal.
81 .2	81 .3	Normal.
76 .8	76 .2	0°.6 below.
69 .6	69 .3	Normal.
69 .1	67 .0	2°.1 below.
63 .8	61 .0	2°.8 below.
48 .3	47 .6	0°.7 below.
40 .1	[illegible]	2°.0 above.

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

ISOBARS, ISOTHERMS AND PREVAILING WINDS FOR JULY, 1879.



TEMPERATURES OF WATER FOR JULY, 1879.

STATIONS.	Temperature at bottom.		Average depth of water, in feet.
	Max.	Min.	
Alpena	76	70	12
Augusta	92	80	4½
Baltimore	80 5	76	11
Buffalo	76	71	13½
Burlington, Vt.	73	64	17½
Charleston	90	80	4½
Chicago	77	68	8
Cleveland	78	72	14
Detroit	76	71	22½
Duluth	65.5	60	11½
Eastport	49	44	18
Escanaba	74.5	57	15
Galveston	88	83.5	13
Grand Haven	82	74	19
Jacksonville	90	80	18
Key West	91	83	16½
Marquette	67	55	15½
Milwaukee	70	50.5	15
Mobile	83	83	16
New London	83.3	59	12½
New York	76	68	15½
Norfolk	84	71	22
Portland, Maine	57	50	20
Punta Rassa	91	82	12
*San Francisco	59	56	23
Sandusky	82	74	10
St. Marks	90	74	17
Savannah	88	82	10½
Toledo	87	73.7	9¼
Wilmington	87	79	12⅔
Wood's Holl	73	66	8

* Observations for only part of month—see text.

AVERAGE TEMPERATURES FOR JULY.

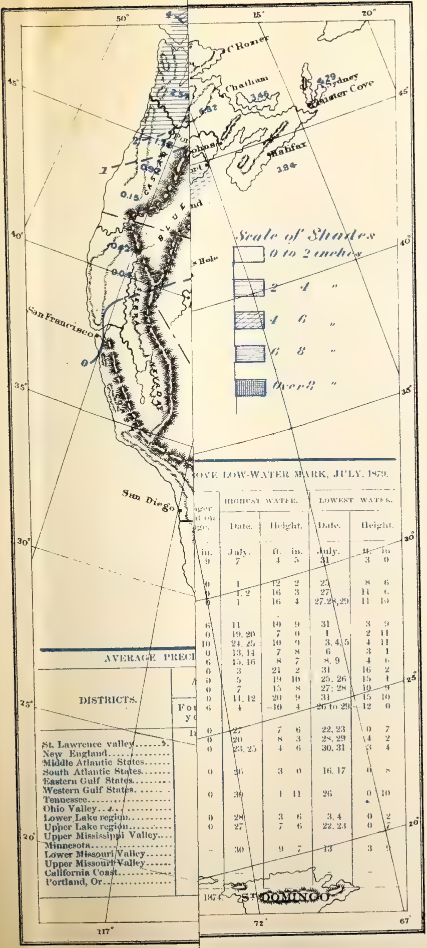
DISTRICTS.	Average for July Signal Service Observations.		Comparison of July, 1879, with the average for several years.
	For several years.	For 1879.	
PACIFIC SLOPE.			
Olympia	62°.2	61°.0	1°.2 below.
Portland, Or.	68 .3	66 .0	2°.3 below.
San Francisco	58 .3	58 .0	0°.3 below.
San Diego	67 .7	65 .6	2°.1 below.
Sacramento	75 .0	72 .8	2°.2 below.
WESTERN PLATEAU.			
Umatilla	77 .0	73 .0	4°.0 below.
Boise City	78 .4	75 .5	2°.9 below.
Salt Lake City	76 .7	78 .4	1°.7 above.
North Rocky Mt. slope	66 .9	67 .9	1°.0 above.
Middle Rocky Mt. slope	75 .1	76 .6	1°.5 above.
Southeast Rocky Mt. slope	78 .9	80 .6	1°.7 above.
Missouri valley	75 .3	76 .2	0°.9 above.
Upper Miss. valley & Minn.	73 .9	75 .0	1°.1 above.
Upper Lake region	68 .0	70 .6	2°.6 above.
Lower Lake region	71 .0	71 .8	0°.8 above.
Ohio valley and Tennessee	78 .3	80 .3	2°.0 above.
Rio Grande valley	85 .8	88 .4	2°.6 above.
Western Gulf States	82 .8	84 .7	1°.9 above.
Eastern Gulf States	82 .3	82 .2	Normal
Florida	82 .2	82 .5	Normal.
South Atlantic States	81 .2	81 .3	Normal.
Middle Atlantic States	76 .8	76 .2	0°.6 below.
New England	69 .6	69 .3	Normal.
St. Lawrence valley	69 .1	67 .0	2°.1 below.
Canadian Maritime stations	63 .8	61 .0	2°.8 below.
Mt. Washington, N. H.	[illegible]	47 .6	[illegible] below.
Pike's Peak, Col.	40 .1	[illegible]	[illegible] above.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

No. III.



Scale of Shades
- 0 to 2 inches
- 2 4 "
- 4 6 "
- 6 8 "
- Over 8 "

OVE LOW-WATER MARK, JULY, 1879.

nger t on ge.	HIGHEST WATER.			LOWEST WATER.		
	Date.	Height.		Date.	Height.	
in.	July.	ft.	in.	July.	ft.	in.
9	7	4	5	31	3	0
0	1	12	2	23	8	6
0	1, 2	16	3	27	11	6
0	1	16	4	27, 28, 29	11	10
6	11	10	9	31	3	9
0	19, 20	7	0	1	2	11
10	24, 25	10	9	3, 4, 5	4	11
0	13, 14	7	8	6	3	1
6	15, 16	8	7	8, 9	4	6
0	3	21	2	31	16	2
0	5	19	10	25, 26	15	1
0	7	15	8	27; 28	10	9
0	11, 12	20	9	31	15	10
6	4	–10	4	26 to 29	–12	0
0	27	7	6	22, 23	0	7
0	20	8	3	28, 29	4	2
0	23, 25	4	6	30, 31	3	4
0	26	3	0	16, 17	0	8
0	30	1	11	26	0	10
0	28	3	6	3, 4	0	2
0	27	7	6	22, 23	0	7
–	30	9	7	13	3	9
	—				–	

AVERAGE PRECI

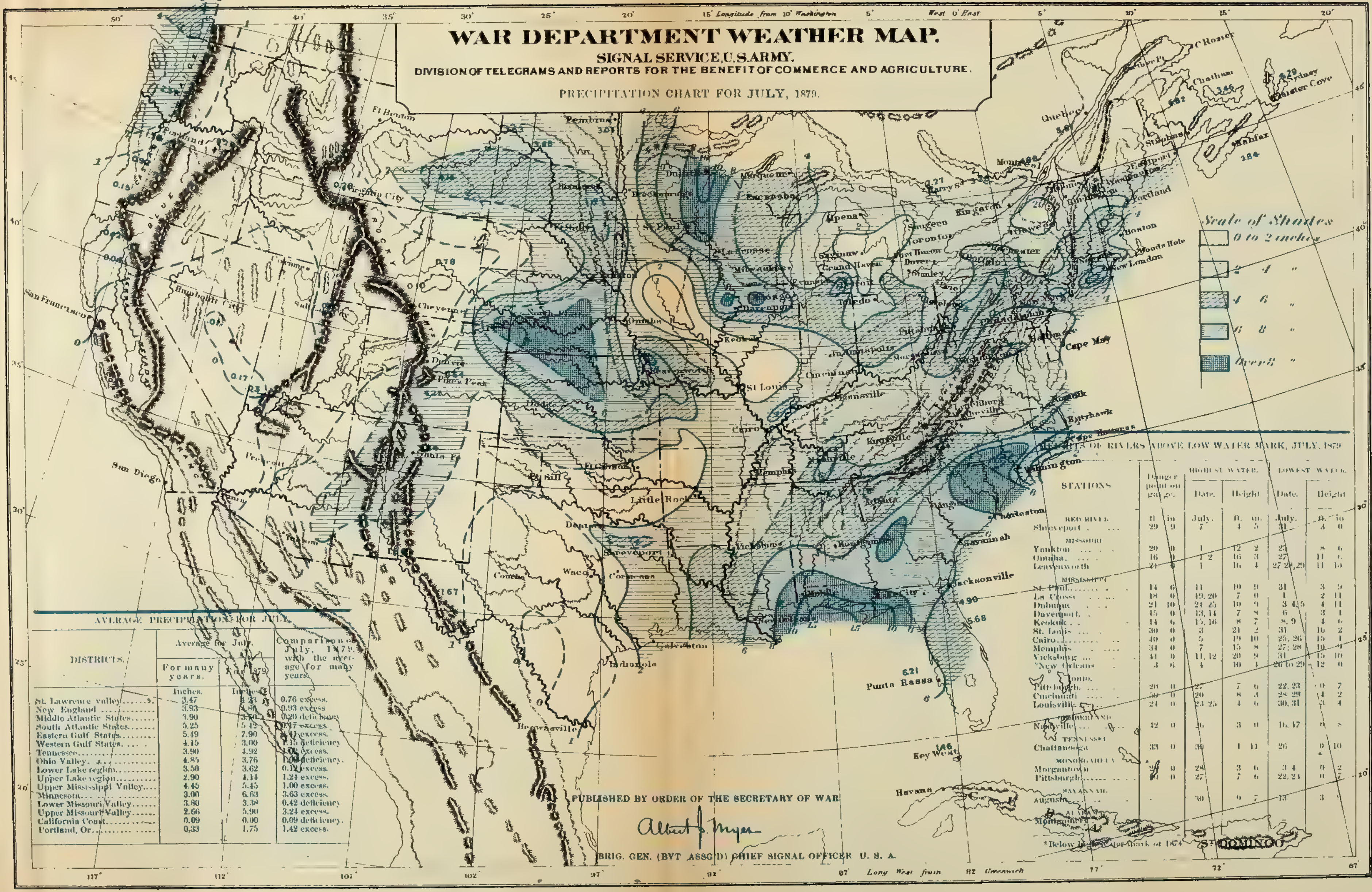
DISTRICTS.	For y
	In
St. Lawrence valley	
New England	
Middle Atlantic States	
South Atlantic States	
Eastern Gulf States	
Western Gulf States	
Tennessee	
Ohio Valley	
Lower Lake region	
Upper Lake region	
Upper Mississippi Valley	
Minnesota	
Lower Missouri Valley	
Upper Missouri Valley	
California Coast	
Portland, Or.	

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

PRECIPITATION CHART FOR JULY, 1879.



AVERAGE PRECIPITATION FOR JULY.

DISTRICTS.	Average for July.		Comparison of July, 1879, with the average for many years.
	For many years.	For 1879.	
	Inches.	Inches.	
St. Lawrence valley	3.47	4.23	0.76 excess.
New England	3.93	4.86	0.93 excess
Middle Atlantic States	3.90	3.70	0.20 deficiency
South Atlantic States	5.25	5.42	0.17 excess.
Eastern Gulf States	5.49	7.90	2.41 excess.
Western Gulf States	4.15	3.00	1.15 deficiency
Tennessee	3.90	4.92	1.02 excess.
Ohio Valley	4.85	3.76	1.09 deficiency.
Lower Lake region	3.50	3.62	0.12 excess.
Upper Lake region	2.90	4.14	1.24 excess.
Upper Mississippi Valley	4.45	5.45	1.00 excess.
Minnesota	3.00	6.63	3.63 excess.
Lower Missouri Valley	3.80	3.38	0.42 deficiency
Upper Missouri Valley	2.66	5.90	3.24 excess.
California Coast	0.09	0.00	0.09 deficiency.
Portland, Or.	0.33	1.75	1.42 excess.

HEIGHTS OF RIVERS ABOVE LOW-WATER MARK, JULY, 1879.

STATIONS	Danger point on gauge.		Highest Water.			Lowest Water.		
			Date.	Height		Date.	Height	
RED RIVER.	ft.	in.	July.	ft.	in.	July.	ft.	in.
Shreveport	29	9	7	4	5	31	3	0
MISSOURI.								
Yankton	20	0	1	12	2	23	8	6
Omaha	16	0	1 2	16	3	27	11	6
Leavenworth	24	0	1	16	4	27 28, 29	11	10
MISSISSIPPI.								
St. Paul	14	6	11	10	9	31	3	9
La Crosse	18	0	19, 20	7	0	1	2	11
Dubuque	21	10	24 25	10	9	3 4, 5	4	11
Davenport	15	0	13, 14	7	8	6	3	1
Keokuk	14	6	15, 16	8	7	8, 9	4	6
St. Louis	30	0	3	21	2	31	16	2
Cairo	40	0	5	19	10	25, 26	15	1
Memphis	34	0	7	15	8	27; 28	10	9
Vicksburg	41	0	11, 12	20	9	31	15	10
*New Orleans	3	6	4	10	4	26 to 29	12	0
OHIO.								
Pittsburgh	20	0	27	7	6	22, 23	0	7
Cincinnati	50	0	20	8	3	28 29	4	2
Louisville	24	0	23 25	4	6	30, 31	3	4
CUMBERLAND.								
Nashville	42	0	26	3	0	16, 17	0	8
TENNESSEE.								
Chattanooga	33	0	30	1	11	26	0	10
MONONGAHELA.								
Morgantown	24	0	28	3	6	3 4	0	2
Pittsburgh	20	0	27	7	6	22, 23	0	7
SAVANNAH.								
Augusta	-		30	9	7	13	3	
ALABAMA.								
Montgomery								

*Below high-water mark of 1874

PUBLISHED BY ORDER OF THE SECRETARY OF WAR

Albert J. Myer

BRIG. GEN. (BVT ASSG'D) CHIEF SIGNAL OFFICER U. S. A.

PAPER 32.

(Form 29.)

WAR DEPARTMENT, SIGNAL SERVICE, UNITED STATES ARMY.

DAILY WEATHER REPORT.

(Published by co-operation of the Pennsylvania Railroad.)

Report of bulletins received and posted by station operator at ——, county of ——, State of ——, during the fortnight ending Saturday ——, 188 .

Day and date	Number of copies received daily.	Time of receipt.	Time at which displayed in frame or on bulletin board.	Remarks.
Sunday				
Monday				
Tuesday				
Wednesday				
Thursday				
Friday				
Saturday				
Sunday				
Monday				
Tuesday				
Wednesday				
Thursday				
Friday				
Saturday				

(Signature.)

—— ——,
Operator.

NOTE.—Under the head of remarks will be noted all delays in the prompt receipt of the dispatch, with cause of delay, when known. One copy of this form will be mailed at the close of each fortnight to the Chief Signal Officer, U. S. A., Washington, D. C.

(Indorsed:) Form 29. Report of railway bulletins for the fortnight ending —— 188—, station ——. Rec'd O. S. C. O. ——, 188—.

PAPER 33.

MONTHLY WEATHER REVIEW, JULY, 1879.

INTRODUCTION.

In preparing this Review the following data, received up to August 13th, have been used, viz: The regular tri-daily weather charts, containing the data of simultaneous observations taken at 124 Signal Service stations and 12 Canadian stations, as telegraphed to this office; monthly journals and means, 137, and 140, respectively, from the former; reports from 37 sunset stations; 223 monthly registers from voluntary observers; 43 monthly registers from United States Army post surgeons; marine records; international simultaneous observations; monthly reports from voluntary observers in, and the local weather service of, the State of Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

Upon chart No. II is shown by the isobaric lines the general distribution of atmospheric pressure, as reduced to sea-level, for the month.

The local barometric ranges have varied as follows: Pacific Coast, 0.50 at Roseburg to 0.22 at San Diego; Western Plateau, 0.41 at Virginia City to 0.24 at Boise City; Rocky Mountains, 0.33 at Denver to 0.26 at Santa Fé; summit of Pike's Peak, 0.30; Gulf

States, 0.41 at Montgomery to 0.22 at Punta Rassa and Key West; Atlantic States, 0.78 at New York city to 0.43 at Jacksonville; summit of Mount Washington, 0.63; Ohio Valley and Tennessee, 0.62 at Pittsburg to 0.38 at Cairo; Lake Region, 0.79 at Rochester to 0.60 at Chicago; Northwest and Eastern Rocky Mountain Slope, 0.69 at Pembina to 0.40 at Deadwood and Leavenworth.

Areas of high barometer.—Of these, three have been sufficiently marked to merit a description.

No. I.—This area, central in New York on the morning of the 1st, moved almost due south, and passed off the North Carolina coast the evening of the 2d. Maxima abnormal barometric pressures of +0.31 at Albany morning of the 1st, and of +0.32 at Cape Henry the morning of the 2d, were reported. Generally clear weather, with no precipitation, prevailed during its passage through the Middle Atlantic States and New England. This area caused the minimum temperatures for the South Atlantic and a portion of the Middle Atlantic States. A minimum temperature of 38° was reported from Rockliffe the morning of the 1st, and light frost at Hector, Starkey, and Niles, N. Y., and Springfield, Massachusetts. Brisk northerly winds prevailing on the North Carolina coast the morning of the 1st, Cautionary signals were displayed. They were lowered that afternoon, having been justified by a maximum velocity of 28 miles NE. at Cape Lookout. Maximum velocities of 25 miles on the 1st and 26 miles on the 2d were reported from Cape May.

No. II.—From its influence on the barometers in the Northwest on the 3d, it is evident that this area was then central in Saskatchewan, and by the morning of the 4th had reached Manitoba, Bismarck barometer 0.14 abnormally high. Moving nearly due east, accompanied by light to fresh northerly winds and generally clear weather, it reached Ontario the morning of the 5th; Rockliffe barometer, 30.34 At that time clear weather, with fresh NE. winds, generally prevailed on the Lower Lakes and in New England; cloudy weather with brisk to high north winds on Middle Atlantic, and brisk westerly winds on North Carolina coast; maximum velocities had been reported of 25 miles W. at Hatteras, N. 26 at Barnegat, and 40 NE. at Sandy Hook. At noon Cautionary signals were hoisted from Cape Lookout along the Atlantic coast north to include Wood's Holl. Moving SE., by afternoon of the 5th the center had passed off the New England coast, at which time brisk to high NE. winds prevailed on the New Jersey and North Carolina coasts, with rain in connection with a small area of depression existing in the South Atlantic States. The signals from Wood's Holl south to include Norfolk were lowered the afternoon of the 5th, and from Cape Henry south, to include all displayed, on the afternoon of the 6th. They were all justified, maxima velocities of 32 SW. at Wood's Holl and 32 NE. at Cape Henry and Cape Lookout being reported. The pressure remained nearly stationary south of the New England and east of the Middle Atlantic States with no change until the morning of the 7th. The passage of this area was marked by the minimum temperatures generally for New England and the Middle Atlantic States and a considerable portion of the Lake region. A minimum temperature of 33° was reported from Sidney, C. B., the morning of the 6th, during the night of which date a sharp frost was reported for the Magdalen Islands, and a light frost, 5th and 6th, at Hector, N. Y.

No. III.—This area was central in Northeastern Minnesota the morning of the 18th; Duluth barometer 0.25 above the normal. Moving thence nearly east, it skirted the northern edge of Lake Huron, and by the morning of the 19th had reached eastern Quebec, and that afternoon was in the lower Saint Lawrence Valley; Quebec barometer 0.31 abnormally high. Its direction then changed to nearly due south, and on the morning of the 20th it was central in Massachusetts; Albany barometer 0.30 and Boston 0.28 above the normal. It passed south that afternoon, and remained central over the Atlantic Ocean off the Middle Atlantic coast, with almost stationary pressure, until the afternoon of the 21st. Its passage was marked by cool northerly winds and generally clear weather over the Lake region, New England and Middle Atlantic States. No signals were displayed. Several instances of brisk to high winds, ranging from SW. 27 at Eastport to NE. 32 at Cape Lookout, were reported from the 18th to the 21st, and an easterly gale in the Bay of Saint Lawrence.

No. IV.—This area traversed the British possessions north of the Lake region during the 23d and 24th, causing fresh to brisk north to east winds—maximum velocity Sandusky 30 miles E., reported at midnight of the 24th—with generally clear weather south of its center. On the morning of the 25th the pressure was central in lower Saint Lawrence Valley; Quebec barometer 0.23 above the normal—with clear weather and gentle N. to E. winds in New England, fresh to brisk easterly winds in the Middle Atlantic States. Signals were then ordered for the Jersey coast; and at noon, increasing winds with 27 miles S. at Kittyhawk being reported, signals were displayed on the Carolina coast, and in connection with advancing low area No. VII, remained displayed until the morning of the 27th. The signals were fully verified by south and southwest winds on the Carolina coast, ranging from S. 29 miles at Cape Henry to S. 35 at Macon, and on the Jersey coast from S. 28 at Atlantic City to SW. 37 at Sandy Hook. The high pressure moved rapidly from Quebec southeastward, and on the afternoon of the 25th passed off the New England coast.

Areas of low barometer.—Upon chart No. I are shown the tracks of nine areas which have been sufficiently marked and extensive to enable their course to be accurately charted. A continuation of area No. IX described in the June Review is charted as central the morning of the 1st in Manitoba—Pembina barometer 0.32 below the normal—by afternoon it had passed beyond our stations. Its passage was marked the afternoon of the 30th of June by a violent local storm at Bismarck, unroofing houses and wrecking a large steamboat; Fort Garry reported a high northwest wind on the morning of the 1st of July, and 1.45 inches rain-fall in eight hours.

No. I.—This area appears to have developed in California during the 1st, from the depression remaining from area No. IX described in the June Review. Moving eastward it was central in Colorado the morning of the 2d, whence its course was northeastward being central the morning of the 3d in Eastern Dakota. The depression increased from a minimum of 0.18 below the barometric normal at North Platte the morning of the 2d to 0.36 below at Saint Paul the morning of the 3d. The passage of the area on the 2d was marked by local storms of the most violent character. At Elkhorn, Dak., a tornado at 5.30 p. m., traveling in circular course from SW. to SE., totally destroyed three buildings and injured one person. In Plymouth County, at Le Mars, Iowa, about 7 p. m., 2d, violent storm, shaped like an hour glass, destroyed a number of buildings and killed three persons. In Goodhue County, Minn., at Belle Creek, buildings demolished; traveling northeastward through Vasa it demolished a church and orphanage, killing nine persons and injuring thirty others. At Lake Emily, five persons killed and many buildings destroyed. At Red Wing, very violent storm damaged many buildings, and crossed the Mississippi River into Pierce County, Wis., where many buildings were destroyed at Maiden Rock and Trenton. At Warren a flood followed, by which four persons perished. Saint Paul, Minn., on morning of 3d, reported 3.70 inches rain in preceding 8½ hours and 4.93 inches in preceding 15 hours. In Steele County, Minn., a succession of violent thunderstorms occurred. At Yankton, Dak., the barometer in seventeen hours fell abnormally 0.37 and at Saint Paul 0.39. On the morning of 3d, the area moving rapidly eastward, signals were displayed on Lake Michigan; reports missing from the Northwest, cloudy weather, with brisk southerly winds, prevailing on Lakes Michigan and Huron. By afternoon the center was over Lake Superior; Marquette barometer 0.33 below normal. Signals were then lowered, having been justified by velocities of NW. 27 miles at Escanaba and NE. 38 at Milwaukee; at Alpena, a velocity of 24 miles was reported. At Sandusky W. 28 miles on the 2d, and at Marquette NW. 28 miles on the 3d, were reported. The center moved eastward through Ontario, and on the morning of the 4th was central in lower Saint Lawrence Valley; Quebec barometer 0.44 below the normal. At that time, brisk northerly winds, with cloudy weather, on the Lower Lakes, and gentle to brisk SW. winds, with partly cloudy weather, in New England and the Middle Atlantic States, were reported. Signals were then displayed for Lake Ontario, the Carolina coast, at Newport and Wood's Holl. At the afternoon report the storm had passed into the Gulf of Saint Lawrence and the signals were lowered. The signals on Lake Ontario were not justified. The Carolina signals were all justified; maximum velocity at Cape Hatteras SW. 28 miles; at Newport and Wood's Holl the signals were justified by SW. 25 and SW. 32, but were somewhat late at Wood's Holl, where SW. and W. winds from 26 to 28 miles had prevailed from the 2d to morning of the 4th. By the afternoon of the 4th the storm center had passed into the Gulf of Saint Lawrence—Sydney barometer 0.52 below the normal—followed by cloudy weather and rain in New England, with brisk westerly winds, a maximum velocity of W. 27 miles being reported during the afternoon from Boston.

No. II.—This area first appeared in the valley of the Sacramento July 2d, where its course during the 3d, 4th, and 5th was a little north of east through Idaho and Montana, and was in Dakota the morning of the 6th; Bismarck barometer 0.28 below the normal. At that report high easterly winds, with cloudy weather, prevailed in the Northwest, with heavy rain-falls, 1.33 inches in less than eight hours at Pembina. The course of the center was thence northeast, and in the afternoon it was in Eastern Manitoba—all reports from the Northwest missing—the abnormal barometric isobar of —0.20 including Dakota, Minnesota and parts of Iowa and Wisconsin. A terrific hailstorm that morning prevailed in Meeker and Kandiyohi Counties, Minnesota, and during the afternoon a violent thunder-storm at Madison, Wis., with hail large enough to kill yearling pigs, and 1.83 inches rain-fall in seven hours. At La Crosse, Wis., severe thunder-storm, with 1.30 inches rain-fall in one and a half hours. Although the center had passed into Manitoba, the trough in the Upper Mississippi valley changed but little from the afternoon of the 6th to the morning of the 7th, at which time the rainfall at Madison was reported as 3.70 inches in twenty-four hours, and at La Crosse 4.70 inches for the same period. On the afternoon of the 6th fresh to brisk southerly winds, with cloudy weather and rains, prevailed on the Upper Lakes, with maximum velocity of SW. 41 miles reported from Milwaukee. At midnight a maximum velocity of SW. 44 miles was reported from Marquette. On the morning of the 7th reports from the Upper Mississippi valley and the Northwest were missing, and brisk southerly winds, with cloudy weather and light rains, were reported from the Lower Lakes, when signals for Lake Erie were ordered, which were lowered at midnight of the 7th, being justified, except at Port Huron and Buffalo, by winds ranging from SW. 28 at Sandusky and Toledo to S. 33 at Cleveland. At midnight of the 7th signals were displayed from Cape May northward along the Atlantic coast to include Eastport. By the morning of the 8th the area was probably central in northwestern Quebec. At that time Parry Sound barometer was 0.38 below the normal, and brisk S. and SW. winds were reported, with cloudy weather and rain, from New England and South Atlantic states to the Lake region. Velocities from S. 28 at Cape May to SE. 33 at Sandy Hook prevailed, while the brisk winds on the North Carolina coast (maximum velocity S. 25 miles at Cape Henry), were followed by signals from Cape Henry south to Macon. The area moving northeast all signals were lowered on the Atlantic coast the afternoon of the 8th, having been justified, except at Cape Henry and Eastport, by velocities ranging from SW. 25 at Macon to S. 38 miles at Wood's Holl. The storm central in northeastern Quebec at midnight of the 8th changed its course from northeast to southeast, and on the morning of the 9th was central in lower Saint Lawrence Valley; Father Point barometer 0.38 below the normal. At that time fresh to brisk north winds, with clear weather, were reported from New England, and cloudy weather, with heavy rain and fresh winds, from the Canadian Maritime Provinces, except a velocity of S. 30 miles from Father Point. Central the afternoon of the 9th in New Brunswick and at midnight in Nova Scotia, the area passed southeastward over the Atlantic Ocean. No high winds were reported on the morning of the 10th.

No. III.—This area appeared first in the Middle Plateau district on the 7th, and moving nearly east passed through Idaho and Wyoming on the 8th and 9th, and was central in western Dakota the morning of the 10th; Yankton barometer 0.29 below the normal. At that time heavy rains were reported from Minnesota and Wisconsin, with cloudy weather and variable winds over the whole Lake region. Moving nearly east, the center was in Minnesota at midnight of the 10th and over Lake Michigan the morning of the 11th, Milwaukee barometer 0.43 below the normal, when brisk N. to W. winds prevailed over Lakes Superior and Michigan, and southerly winds with cloudy weather and no precipitation on the Lower Lakes, except a heavy rain-fall of 2.06 inches reported for previous eight hours from Sandusky. Cautionary signals were then ordered for Lakes Michigan, Huron, and Erie. By the afternoon of the 11th it was central over Lake Ontario, which was covered by an average barometric pressure of 0.43 below the normal, while the abnormal isobar of —0.30 covered New England, Middle Atlantic States, and the Lower Lakes. The Lake signals were then lowered, having been justified for Lake Erie, maxima velocities of N. 45 miles at Cleveland and N. 67 at Sandusky being reported. The signals for Lakes Michigan and Huron were not justified by reports yet received. Severe and destructive local storms occurred during the day in Canada, Ohio, Michigan, Pennsylvania, and Maryland, which are mentioned under *Local Storms.* At this time cloudy weather and brisk southerly winds were reported from New England and the Middle Atlantic States, with a maximum velocity of 30 miles SW. wind at Cape Lookout. Cautionary signals were then displayed for the New Jersey coast from Lewes to Sandy Hook. At midnight of the 11th the area was central in Connecticut; New York barometer 0.48, abnormally low. At this time the signals from Lewes to Sandy Hook were lowered, having been fully justified by winds ranging in maximum velocity from SE. 26 miles at Barnegat to 30 S. at Cape May. Brisk to high SW. winds were, however, reported from the North Carolina coast, and a velocity of NW. 46 miles at Cape Henry. On the morning of the 12th the area was central off the New Jersey coast—Atlantic City barometer 0.47 below the normal—and brisk winds were reported, NE. in New England, NW. on the Jersey coast, and SW. on the North Carolina coast, with rain-fall in past eight hours from New England to Ohio Valley. The center thence moved west of south, and in the afternoon of the 12th was in North Carolina; Wilmington barometer 0.36 below the normal. At noon, however, high northerly winds, of maxima velocities ranging from N. 30 at Cape May to N. 35 at Barnegat, had been reported and cautionary signals displayed from Cape Henry south to include Macon. These signals were lowered that afternoon, having been fully justified by maxima velocities ranging from NE. 26 miles at Cape Henry to N. 35 at Macon. These signals were lowered somewhat soon, as the center, moving southwestward, was central at midnight of the 12th on the South Carolina coast, and NE. winds, with maxima velocities from 26 to 32 miles, were reported from the North Carolina coast. The area moved slowly off the South Carolina coast during the 13th. This area produced the maxima temperatures of the month for the Upper Mississippi, Tennessee, and Ohio Valleys and the South Atlantic States, in the last of which sections the highest temperatures ever known were experienced, reaching 104° at Charleston and Augusta and 105° at Savannah on the 12th, and 104° at Jacksonville on the 11th.

No. IV.—During the 10th the pressure fell from the Pacific coast to Utah and Western

Montana, with cloudy and threatening weather and light rains on the coasts of Oregon and Washington Territory. 11th, pressure fell rapidly over Oregon, Washington Territory, Idaho, and Western Montana, reaching the minimum (29.53 and 29.51 or 0.50 and 0.48 below the normals respectively) at Portland and Olympia at 4.35 p. m., and (29.50 or 0.30 below) at Virginia City at 11 p. m.; the observer at New Westminster, B. C., reported "at 6 p. m., barometer 29.43, wind WSW., heavy blue black clouds from W. moving rapidly—midnight, wind backed to S. and then SE., and blew a heavy gale in fierce gusts with very heavy rain until 9 a. m. 12th—nothing like this known here before in July;" about the same hour (6 p. m.) a "violent wind and rain storm" occurred at Umatilla, Or.; and a "severe local storm also passed over Dayton, Columbia County, Washington Territory, which struck Pomeroy, 10 miles from Dayton, ten minutes later." 12th, passed rapidly eastward over or to the north of Montana; light rains fell at the Rocky Mountain stations and in the Lower Missouri valley, and at 11 p. m. threatening weather was reported in the Red River of the North Valley. It was followed on the Pacific coast by cold weather, the minimum temperature of the month (40°) being reported at Roseburg, while the maxima temperatures of the month were reported at several stations over the Eastern Slope of the Rocky Mountains: Cheyenne, 95°; Deadwood, 92°; Bismarck, 95°; Pembina, 90°; Pilot Point and Coleman, Tex., 107°. 13th, was probably central north of Lake Superior; a severe thunderstorm with heavy rain occurred at Duluth during the early morning (5 to 10 a. m.), followed at noon by a brisk southwest wind, 28 miles at Duluth and SE. 31 at Milwaukee, for which signals were not ordered. High temperatures continued over the eastern section of the country, and the following maxima of the month were recorded: Denver, 98°; North Platte, 99°; Henrietta, Tex., 105°; Graham, 109°; Concho, 108°. Its course from the 13th to the afternoon of the 14th was too far north of our stations to be accurately traced; but at the latter report it was central in Vermont, marked by little energy; Burlington barometer 0.13 below normal. Thence moving NE. at midnight it was central in Maine, and the morning of the 15th in New Brunswick, its progress marked by no high winds and light precipitation. No signals were ordered and no dangerous winds reported.

No. V was north of the Lake region, in Ontario, the morning of the 15th; Parry Sound barometer 0.11 below the normal. Moving nearly east, it was central in eastern Ontario during the afternoon and midnight. At the latter report clear weather and fresh westerly winds prevailed on the Lower Lakes and fresh southerly winds with partly cloudy weather and rain areas in New England. Severe local storms, with hail and heavy winds, prevailed in various parts of Ontario during the day. On the 6th, in the morning, it was in the upper Saint Lawrence valley; Quebec barometer 0.251 below the normal, with falling barometer and fresh S. to W. winds, and clear weather with very high temperature reported from New England. During the day it moved southeast, and in the afternoon was central in Maine; Burlington barometer 0.33 and Eastport barometer 0.30 below the normal. At this time fresh to brisk easterly winds with cloudy weather prevailed in the lower Saint Lawrence valley and variable winds, with violent thunderstorms, in New England, with maxima velocities of 38 miles NW. at Boston and 40 NW. at Wood's Holl, and SW. winds from 26 to 28 miles from the North Carolina coast, with cloudy weather and rain. During the day the maxima temperatures for the month occurred at most stations from Virginia to Massachusetts, which were followed over New York and New England by a series of violent thunderstorms and cooler weather. The numerous cases of sunstroke will be found noted under *Temperature*, and the violent storms, by which many lives were lost and great damage done to property, under *Local Storms*. By midnight of the 16th the center had reached eastern Maine; Eastport barometer 0.38 below the normal, with fresh S. to W. winds, cloudy weather and heavy rain-fall in New England. Maxima velocities, from several stations, ranging from 25 to 32 miles, were reported from the New Jersey and North Carolina coasts. On the 17th the area in Nova Scotia in the morning and near Cape Breton at the afternoon report, passed northeastward over the Atlantic Ocean, attended by gales and terrific squalls, the depression having increased to 0.50 below the barometric normal at Halifax in the morning, and at Sydney in the afternoon.

No. VI.—This area, appearing in western Nebraska the afternoon of the 21st and moving nearly east, passed through Nebraska and Iowa with little energy, reaching Wisconsin the afternoon of the 22d; Milwaukee barometer 0.17 below the normal; by midnight it had reached Lake Huron, with cloudy weather and heavy rains on the Lower Lakes, fresh SW. to SE. winds, but one station, Sandusky, reporting a maximum velocity of SW. 25 miles on the Lakes, and Cape May S. 30 on the Atlantic coast. On the 23d it was central at the morning report in Ontario; Kingston barometer 0.32 below the normal; brisk SW. winds and cloudy weather in the Middle Atlantic States and New England, accompanied in the latter by heavy rains. In the afternoon central in Maine, brisk SW. winds were reported from Carolina to Massachusetts, with a maximum velocity of 28 SW. at Cape Lookout. The course of the area was northeast, and by midnight it had passed into the Gulf of Saint Lawrence. No signals were displayed during the passage of this area.

No. VII.—This area, whose presence was first shown by the barometers in the Northwest on the 24th, was central on the morning of the 25th in eastern Manitoba—Pembina barometer 0.33 below the normal—generally cloudy weather with southerly to westerly winds and light local rains being reported from the Upper Lakes and Northwest. Moving southeasterly, with increased pressure, it was central over Lake Superior midnight of that date. During the day southerly to westerly winds and cloudy weather had prevailed with moderate rain-fall over the Lake Region and Northwest. On the 26th, in the morning, the depression was central over Lake Michigan—Escanaba, barometer 0.26 below the normal—in the afternoon, in eastern Michigan. At midnight it reached southern Ontario. During the day, rainy weather, with brisk to high southerly winds on the New Jersey and North Carolina coasts, and rainy weather, with fresh easterly winds in New England, were reported, while clear weather and fresh southerly winds prevailed over the Lake Region. Signals displayed in connection with high area No. IV, on the 25th, from Macon north to Sandy Hook, inclusive, were continued up, and during the afternoon of the 26th signals were displayed at New York. On the morning of the 27th the pressure passed off the New England coast; Portland, barometer 0.28 below the normal. At this time fresh to high northerly winds, 30 miles NE. at Eastport, Me., with cloudy weather and heavy rain-falls, were reported from New England, and fresh to brisk west to southwest winds from the New Jersey and North Carolina coasts. All the signals on the Atlantic coast were then lowered, having been fully justified, as shown in connection with high area No. IV.

No. VIII.—This area appears to have sprung up from the remains of area No. VII, and at midnight of the 27th was central north of Lake Superior, at which time fresh westerly winds, with heavy rain-falls, were reported from that lake. On the morning of the 28th the central pressure had reached the eastern part of Lake Superior; Marquette barometer 0.22 below the normal. Moving eastward through Ontario, at midnight it was central at Quebec, and on the morning of the 29th passed into the Gulf of Saint Lawrence. The passage of the area was marked by little energy, and no dangerous winds in connection therewith were reported.

No. IX.—This area was central in western Manitoba on the afternoon of the 30th, and by midnight had reached central Dakota; Bismarck and Pembina barometers, respectively, 0.29 and 0.31 below the normal. Its course during the 31st was a little east of south, while its movement was sluggish and its pressure increasing, being 0.18 below the normal at Yankton on midnight of the 31st. No dangerous winds were reported in connection with this area.

INTERNATIONAL METEOROLOGY.

WORLD WEATHER CHARTS—*Meteorological charts of the Northern Hemisphere.*—It has been the plan of these charts that they should be based upon observations taken simultaneously, by day and at night, on land and at sea. The observations to be those of the barometer, thermometer, weather, &c., had everywhere on the globe at the same fixed instant of physical time; that is, for example, observations so arranged that those at Washington, St. Petersburg, Constantinople, &c., are taken, not at the same hours of local or clock time at those cities—for they would not then be taken at the same moment—but so arranged that the readers or observers are actually at the instruments at once, all reading and recording at one and at the same moment that the readings and records are being made at every other station, and so for all places. The atmosphere over any extent of the earth can thus be viewed as a whole, and at once before any movements in it are possible. The resulting charts give a true synopsis; in effect, a photograph of the atmosphere and its conditions at the instant. Such observations are known as SIMULTANEOUS OBSERVATIONS. They are characteristic of the work of this office. They were for the first time practically employed by it for purposes of prediction in 1870. Simultaneous observations as thus described are, upon the invitation of the United States, widely taken throughout the world. They are collated at this office, printed, and issued daily, forming "The International Bulletin of Meteorological Observations taken simultaneously." The international co-operation embraces observations taken by almost every civilized power north of the equator, and observations taken at sea.

Four charts, based upon international meteorological observations, taken simultaneously, are issued with this Review. No. IV is a daily chart for December 26, 1878; Nos. V and VI, monthly charts for December, 1877, and No. VII, for July, 1879. These charts have been specially prepared. The subject of the preparation of such World Charts is referred to in the annual report of the Chief Signal Officer for the year 1878 and in preceding reports. They embrace within their limits the Northern Hemisphere.

Chart No. IV is based on the *Bulletin of International Meteorological Observations*, taken at 7.35 a. m., Washington mean time, under date of December 26, 1878, and exhibits in graphic form the barometric pressure and temperatures over the Northern Hemisphere so had for that date and hour. Lines of equal barometric pressure and equal temperature are charted, and their values are expressed in French and English measures. Extended areas of high pressures and marked barometric depressions are respectively indicated as high, higher, highest, and low, lower, lowest. This map presents the data of the bulletin for the day charted for study. It is a map of the Northern Hemisphere and is charted daily.

Chart No. V is based on the daily *International Weather Charts* and *Daily Bulletin of International Meteorological Observations*, taken simultaneously, for December, 1877, and shows the mean isobars, mean isotherms, mean velocity, and prevailing direction of the the wind at 7.35 a. m, Washington mean time (0.43 p. m., Greenwich mean time), for that month, as deduced from the simultaneous observations received at this office. The values of the lines are given in French and English measures. Isolated means, when barometric, are expressed in English inches, and when thermometric, in degrees Fahrenheit. The chart is one of the Northern Hemisphere.

Chart No. VI, is based on the *Daily International Weather Charts* and *Daily Bulletin of International Meteorological Observations for December*, 1877, and shows the movements of the *centers of low barometer*, as charted from day to day, for that month, and also the lines of equal precipitation (rain and melted snow) as deduced from the United States Signal Service observations and those of co-operating international observers. Arabic numerals show the location of the center of low barometer at 7.35 a. m., Washington mean time (0.43 p. m., Greenwich mean time), on the day of the month having a similar number. Lines of equal rain-fall are given in both French and English measures. Isolated rain-falls, without the continuous lines, are expressed in English inches. The chart is one of the Northern Hemisphere.

Chart No. VII is based on *International Simultaneous Observations* received to date, on United States Signal Service observations, and on marine and other reports received from voluntary observers. It shows the movements of the centers of the most definitely marked areas of low barometer of recent date. The tracks in black have been charted in previous Reviews in connection with the storms of the United States, and the tracks as subsequently determined are charted in red. The subject of ocean storm tracks and the connection of them with storm-tracks on land is expressly considered in the preparation of these charts. A table of the wind velocities accompanying the storms, both on the European and American coasts, is printed upon the chart. The chart is one of the Northern Hemisphere.

In order to satisfy the many inquiries concerning the condition, scope, and progress of the labor connected with the international simultaneous observations, there is herewith published an extract from the Annual Report of the Chief Signal Officer to the Secretary of War, dated November 1, 1878, wherein are sufficiently set forth the origin of the work, its plan, the co-operation it has received from distinguished co-laborateurs, its progress, scope, and purposes, as follows:

The proposition adopted at the congress of persons charged with meteorological duties, assembled at Vienna in 1873, and to the effect that it is desirable, with a view to their exchange, that at least one uniform observation, of such character as to be suited for the preparation of synoptic charts, be taken and recorded daily and simultaneously at as many stations as practicable throughout the world, has continued to have practical effect.

By authority of the War Department, and with the courteous co-operation of scientific men and chiefs of meteorological services representing the different countries, a record of observations taken daily, simultaneously with the observations taken throughout the United States and the adjacent islands is exchanged semi-monthly. These reports are to cover the territorial extent of Algiers, Australasia, Austria, Belgium, Central America, China, Denmark, France, Germany, Great Britain, Greece, Greenland, Iceland, India, Italy, Japan, Mexico, Morocco, The Netherlands, Norway, Portugal, Russia, Spain, Sweden, Switzerland, Tunis, Turkey, British North America, the United States, the Azores, Malta, Mauritius, Sandwich Islands, South Africa, South America, and West Indies.

On July 1, 1875, the daily issue of a printed bulletin, exhibiting these international simultaneous reports, was commenced at this office and has been since maintained. A copy of this bulletin is furnished each co-operating observer. The results to be had from the reports thus collated are considered as to be of especial importance. The bulletin combines, for the first time of which there is record, the labors of the nations in a work of this kind for their mutual benefit. There is needed only the assistance to be had from the naval forces of the different powers (that of the navies of the United States and of Portugal being, as heretofore related, already given to extend the plan of report upon the seas) to bring more fully within the scope of study, observations practically extending round the northern hemisphere. This end is, to a great extent, already attained.

In this connection the office has to acknowledge the cordial and valuable co-operation of the meteorological services of the different countries, represented as follows:

Algiers, by General Teissier, Commandant Supérieur du Génie; Austria, by Prof. Dr. Julius Hann, director of the Imperial, Royal, and Central Meteorological Institute at Vienna; Belgium, by J. C. Houzeau, director of the Royal Observatory at Brussels; Costa Rica, by Señor Federico Maison, director of the Central Office of Statistics and Meteorology; Denmark, by Capt. N. Hoffmeyer, director of the Royal Danish Meteorological Institute at Copenhagen; France, by U. J. LeVerrier, director of the Paris Observatory, Prof. E. Mascart, director of the Central Meteorological Bureau of France, and the respective observers; Germany, by Prof. Dr. Geo. Neumayer, director of the German Naval Observatory, Hamburg; Great Britain, by Robert H. Scott, Esq., F. R. S., secretary of the Meteorological Council, London, Alexander Buchan, M. A., F. R. S. E., secretary of the Scottish Meteorological Society, Edinburgh, and the respective observers; Greece, by Prof. Dr. J. F. Julius Schmidt, director of the Royal Observatory at Athens; India, by H. F. Blanford, meteorological reporter to the Government of India; Italy, by the Minister of Agriculture, Industry, and Commerce, and the respective observers; Japan, by the Imperial Meteorological Observatory and the Imperial University of Tokei; Mexico, by Señor Mariano Barcena, director of the Central Meteorological Observatory in the city of Mexico, and the respective observers; Netherlands, by Prof. Buys Ballot, director of the Royal Meteorological Institute of the Netherlands at Utrecht; Norway, by Prof. H. Mohn, director of the Royal Norwegian Meteorological Institute at Christiana; Portugal, by J. C. de Brito Capello, director of the Meteorological Observatory of the Infante Don Louiz at Lisbon; Russia, by Prof. H. Wild, director of the Imperial Central Physical Observatory of Russia at St. Petersburg; Spain, by Antonio Aguilar, director of the Royal Observatory at Madrid, and the respective observers; Sweden, by Prof. R. Rubenson, director of the Royal Swedish Meteorological Institute at Stockholm, and Dr. H. H. Hildebrandsson, chief of the Meteorological Division of the Upsala Observatory; Switzerland, by Prof. R. Wolf, director of the Observatory at Zurich, and Prof. E. Plantamour, director of the Observatory at Geneva; Turkey, by A. Coumbary, Effendi, director of the Central Observatory at Constantinople, and Prof. C. V. A. Van Dyck, superintendent of the Lee Observatory at Beirut; Australasia, by Francis Abbott, director of the Meteorological Observatory, Hobart Town, Tasmania, and R. L. J. Ellery, director of the Meteorological Observatory at Melbourne, Victoria, Australia; Canada, by Prof. G. T. Kingston, director of the Magnetic Observatory at Toronto, and superintendent of the Meteorological Office of the Dominion of Canada, and the respective observers; United States Navy, by the Navy Department, through Rear-Admiral Daniel Ammen and Commodore W. D. Whiting, U. S. N., Chiefs of the Bureau of Navigation, and by individual observers at other points.

The office has to regret the death, since the date of the last annual report, of four co-laborers in the work, Urbain Jean Joseph Le Verrier, director of the Paris Observatory, Prof. Ernest Quetelet, director of the Royal Observatory at Brussels, Prof. Edward Heis, of Münster, and Prof. Pietro Angelo Secchi, of Rome.

A number of observations taken on vessels at sea to complement the synchronous reports of the service, and at the request of the Department, have been received on the form provided for that purpose. Their utility is evident in the study of storms approaching our coasts or which endanger vessels from our ports.

The co-operation of the Navy of the United States in the taking of observations, simultaneously with the system adopted at this office, wherever naval vessels of the United States may be, as assured by the general order of the Secretary of the Navy, dated December 25, 1876, has largely increased the data of this class. This co-operation has been skillfully rendered by the Navy Department and the United States Navy, through the Chief of the Bureau of Navigation.

The people of the United States are thus the first nation whose Army and Navy co-operate, as all armies and navies should, under official orders, in the taking of simultaneous observations, wherever the forces may be.

In view of the existence of the system of simultaneous reports to be made at sea by the vessels of the naval and commercial marines of the United States and other nations, and to provide for its extension, carefully tested barometers of the best make have, since the date of the last annual report, been prepared and located, as standards, at the ports of New York and San Francisco.

These barometers have been publicly located to afford means for comparison of the ships' barometers of the shipping of all nations. The instruments, while carefully guarded, are easily accessible. Public notice is given of the location, and a sergeant of the Signal Corps attends daily to give information and to take charge of any ships' barometer which may be brought for comparison.

The standard barometer for the use of shipping on the Atlantic Ocean is located at the Maritime Exchange, in New York City; the standard barometer for the use of shipping on the Pacific Ocean is located at the Merchants' Exchange, in the city of San Francisco.

The officers of the Signal Service at the different cities and ports of the United

States and upon the sea-coast offer every facility and aid in their power to the vessels of any nation.

With the plans for charting now adopted at this office, and with the reports now received here, it appears that the meteoric changes occurring over a great portion of the continents north of the equator can be charted with an accuracy sufficient to permit careful and valuable study. This charting, to be of the best attainable value, must be supplemented from the records of observations had on the seas. A ship at sea becomes one of the best of stations for a simultaneous system. The value of the record is enhanced by the change of the ship's location occurring within each of the twenty-four hours. There is no sea-going vessel but which carries human life, and each ought to carry, by compulsion, if need be, meteorological instruments. The smallest craft, in caring for its own safety, may use them enough to add to the value of the most extensive record. There is no nation without interest in the work proposed to be based upon exchanged simultaneous reports, and none has heretofore hesitated, when the subject has been properly presented, to aid in a duty which, so easily done as to require very little effort on the part of any one person, has for its object a good to mankind. The work cannot, from its nature, be for the selfish good of any section.

A number of the great steamship companies, foreign and domestic, operating the principal commercial sea-routes, have promised and will give their powerful influence and aid.

The office has the co-operation of the Pacific Mail Steamship Company, through its agents, Williams, Blanchard & Co.; the White Star Line, through its agents, Ismay Imrie & Co., Liverpool, and R. J. Curtis, New York; the Occidental and Oriental Steamship Company, through its president, George H. Bradbury; the North German Lloyd, through its agents, A. Schumacher & Co.; the American Steamship Company, through its president, H. D. Welsh; the Red Star Line, through its president, James A. Wright; and the Allan Line, through its agents, A. Schumacher & Co.

The United States bears, in the case of all maritime observers co-operating in this system, all expenses for forms, postages, &c., when so desired, and not infrequently, and when necessary, loan the required instruments.

The number of observations made daily on separate vessels at sea is one hundred.

Even if predictions are not directly practicable, research has already gone far enough to indicate the paths through which to learn what sequences will be found on our own western coast, consequent upon conditions reported as existing on or near the eastern coast of Asia or on the Pacific Ocean.

Similar studies will have reference to our own southern and eastern coasts and to the western coast of the European continent. The time cannot be far distant when vessels leaving any Atlantic port may be informed whether any notable disturbance exists at sea, and where it is likely to threaten the voyage.

The establishment of permanent ocean stations in lines traversing the oceans over or near the telegraphic cables, and in telegraphic communication with either continent, is not considered impracticable, and has been referred to in a preceding report.

There is reason to hope that such progress has been made as will eliminate from the study of practical international meteorology some of the difficulties hitherto encountered.

There are grounds to hope also that the atmospheric conditions and changes of condition can be charted with sufficient accuracy over any extent of the earth's surface. If the hope has fruition meteorological barriers will, as against study, practically cease to exist.

While the stations are crowded in some localities, each is useful—each serving to check the work of the others, and each aiding to close the gaps the failure of other stations might sometimes cause. The work is not likely to be abandoned by those in the different countries who have taken part in establishing it, and who share its benefits. If it served no other purpose than to maintain, as it does, the pleasant co-operation of those charged with the meteorological duties of the different countries, it would be of value. It is hoped that by systems of observations thus extensive, generalizations may be had to permit the announcement of meteoric changes for periods longer in advance than have been hitherto practicable.

The average number of daily simultaneous observations now made in foreign countries is 293. The total number of stations on land and on vessels at sea from which reports are entered in the bulletin regularly is 557. The co-operation of the different nations, secured by this plan of exchange, as above described, renders the additional cost to the United States, of the grand system of reports it makes possible, but little more than that of the cost of the preparation, paper, and binding of the International Bulletin and the accompanying charts, a cost which would have to be met in great part for the proper preservation of the records themselves, even if the bulletins were not distributed.

The Chief Signal Officer is gratified to announce in his report that the work of the collection of the reports of international simultaneous observations, carried on in foreign countries in co-operation with the United States, as well as within the Territories of the United States and upon the seas, thus above referred to, has, in the year just passed, so far progressed as to have attained one principal result for which it was set on foot. Only July 1, 1878, it became possible, for the first time in the history of this office, to commence the issue, on that date, of a daily international weather map, charted daily and issued daily, each chart based upon the data appearing in the International Bulletin of Simultaneous Reports of similar date. The charting extends around the world, and embraces for its area the whole Northern Hemisphere.

The daily issue of a chart of this kind, thus daily issued for the first time by the United States, is without a precedent in history. It exhibits the co-operation, for a single purpose, of the civilized powers of the world north of the equator.

The studies which such charts make possible, the improvement which will come as the work progresses, and the area of the chart is better filled with reports of observations carefully elaborated, are fully appreciated by scientific men.

The questions as to the translations of storms from continent to continent, and of the times and directions they may take in such movements; the movement of areas of high and of low barometer; the conditions of temperature, pressure, and wind-direction existing around the earth at a fixed instant of time—permitting thus the effects of day and night to be contrasted; the distribution and amount of rainfall, and other researches, many and valuable, only suggested by this enumeration, may be by such studies settled. It seems not impossible that in the future questions of climatology, and perhaps others bearing upon the prediction of weather changes far in advance of the time at which these changes may happen, or questions of the character of coming seasons even may be answered by the researches these charts will make practicable.

The very great aid, material furnished in this elaborated form gives to the search for generalization, or for data in the support of theories, was referred to in the last annual report. In frequent cases little more than collation is necessary.

As a means of better combining the work and the interests of the several nations; of certainly securing that co-operation at sea which will enable the lines of the charting to be drawn as fully and as well over oceans as over continents; and which will give the world ultimately a knowledge as practical of the movement of areas of disturbance in the midst of the seas as is now had of such movements on some continents, the undertaking is of much importance.

It is an advantage of the charting made from simultaneous reports that studies by normals, not possible in any other way, can be made. The normal pressure, temperature, &c., arrived at from observations taken at any one place, at the same and a fixed instant of time every day, becomes established as to that place and time with accuracy.

Many causes of error are eliminated.

The inter-comparison of these normals with the normals taken at other places simultaneously with the first, and under the similar conditions, viz: that the normals to be found at those places are to be from observations taken at a fixed time and on each day, gives results which are reliable, and differing from those to be had by the use of normal readings arrived at in any other manner. Normals for the year, for the season, and for the month may be determined by such procedure. The comparison of such normals will show in the case of abnormal changes in any district or section, for any season, whether and how they are compensated by compensating variations elsewhere. There are interesting studies as to what sequences there may be to follow such atmospheric variations occurring over any region or country—either in that region or country or elsewhere—and how and where the compensating variations occur, and with what concomitants or sequences of meteoric changes.

There is the hope to gain in this way, or by investigations which such study will suggest, information to benefit the commercial and agricultural interests of the world.

There is the further hope that as it is more fully realized by the different peoples, how close in the future the practice of such investigations draw, each member of the family of nations will find its own interest in the labors of this description, and cement more closely the bonds of union and join with energy in a work which has so begun to connect them. The undertaking, world-wide in extent, is capable of rendering a world-wide benefit.

Maps based upon a single simultaneous observation, taken daily, demonstrate what may be expected when more frequent observations are attainable, and the daily period of twenty-four hours may be exactly divided by the intervals at which such observations are taken.

It is by the study of the charts of the character of those herewith described and referred to, the practical solutions of the great questions of ocean and continental meteorology, and possibly some prevision of seasons, may be hoped to be arrived at.

On chart No. VII are shown the probable tracks of storm-centers over the oceans, deduced from data received at this office up to August 6th, and in the upper right-hand corner will be found an index to the same. In the upper left-hand corner is a table giving the approximate direction and probable maximum velocity of the wind (in miles per hour and meters per second) attending area No. III. Below is a brief notice of the areas, and also of some storms over the Southern Hemisphere:

North Atlantic Ocean.—No. I probably moved northeastward over the British Channel during the night of June 2d, thence to the North Sea and Gulf of Bothnia, and southward over Russia to the Black Sea. No. II may possibly be a continuation of area of low barometer No. XIV, shown on chart No. I, of the May, 1880, Review; it passed southeastward over Newfoundland on June 1st, and on the 2d and 3d rainy weather and variable winds prevailed thence to 40° W.; on the 4th and 5th a depression probably existed about as shown on chart, although reports from the Azores are not yet to hand. No. III is a continuation of low area No. III of chart No. I, June, 1880, Review; it passed over Newfoundland (barometer at St. John's about 29.04) on the 14th, and crossed the ocean, attended by rainy weather and high seas and followed by westerly gales and high NW. sea-swells; it passed northeastward over the British Isles on the 21st with very unsettled weather and moderate to fresh southerly gales. No. IV is a continuation of low area No. IV, of June, 1880, Review; on the 18th it was south of Newfoundland, but cannot at present be traced farther eastward. No. V probably originated during June 11th off Newfoundland, after which it moved eastward. No. VI is a continuation of low area No. V, of the June, 1880, Review; it probably passed eastward north of Newfoundland on the 23d; developed increased energy about 50° N., 30° W. on the 26th, and moved northeastward at some distance to the northwestward of the British Isles on the 27th and 28th. No. VII probably followed a path somewhat as shown on chart from the 22d to the 25th. *South Atlantic Ocean.*—Ship Altcar, at Queenstown, June 22d, from San Francisco, reports: "From lat. 30° S., long. 123° W. to Cape Horn, which was passed Apirl 16, 1879, had continuous gales from NE. by E. to S. and heavy cross-seas; lost sails, stove boats, bulwarks, &c.; decks constantly flooded; from April 22d constant gales, culminating on May 1st and 2d in a terrific gale and heavy sea, during which decks were constantly under water." At Montevideo, May 23d, 1879, N. gale; 24th, SSE. strong gale; June 24th and 25th schooner Syra driven ashore and lost during storm. *North Pacific Ocean.*—Three tracks are shown on chart: No. I produced strong SW. winds and moderate gales, with heavy rains, at Yokohama on April 24th and 25th, and brisk to high winds at Unalaska on the 27th and 28th. No. II produced heavy rainfall (2.75 inches in one hour) at Yokohama from 7 to 8 p. m. of May 7th. No. III probably passed eastward at some distance north of Yokohama on May 12th and 13th, and produced SE. to W. gales at Unalaska on the 14th and 15th. *South Pacific Ocean.*—April 11th to 14th, 1879, from 34° S., 166° E., to 34° S., 151° E., ESE. to SW. gales, heavy seas and bad weather; at Sydney, N. S. W., May 3d, SSW. gale, squally; 25th, 34° S., 170° E., NE. gale, rough sea, rain; 26th, 36° S., 175° E., ENE. strong gale, squally. *Indian Ocean.*—March 8th, 1879, 12° 41′ S., 113° 23′ E., heavy squall from WSW.; 11th, 14° S., 112° E., "had tail of a hurricane from NW., hove to for five hours." April 20, 31° S., 39° E., severe gale from NW. to SW. May 4th, 24° S., 54° E., hurricane. *Bay of Bengal.*—During the latter part of May the monsoon rains set in along the coast, and the track of an area of low pressure, which on May 20th was probably central over the bay, is given on chart No. VII.

TEMPERATURE OF THE AIR.

The isothermal lines on chart No. II show the general distribution of the temperature of the air for the month. By reference to the table of average temperatures given on the same chart it will be seen that it has been below the average in the Pacific States, over the Western Plateau, and in the lower Canadian Provinces. In the East Gulf and Atlantic States it has been about normal for the whole month, the high temperatures experienced during the middle of the month having been compensated by the moderate temperatures attending the continued rains of the latter part. In the South Atlantic States the means for Jacksonville, Savannah, Charleston, Augusta, and Lynchburg show a slight excess, which is, however, compensated for by those of the North Carolina coast. Elsewhere the temperature of the present month has been higher than the average, especially so from the Upper Lake region to the Rio Grande Valley. The following data, relative to sunstrokes, generally extracted from newspaper reports, together with the notes on drought given under "Precipitation," will serve to give a fair idea of the effects of the high temperatures: On the 8th, at Saint Louis, Mo., there were seven prostrations; 9th, eight prostrations and one fatal; 10th, warmest day of season, 100°, "two degrees higher than last summer," six prostrations, two fatal; Milwaukee, Wis., several prostrations, one fatal; Charleston, S. C., 101°, "two degrees higher than for last twenty years"; Nashville, Tenn, one fatal. 11th, New York City, 92°, several prostrations, none fatal; Saint Louis, Mo., six prostrations, one fatal; Cincinnati, Ohio, two fatal; Memphis, Tenn., one fatal; Charleston, S. C., "very hot," fifteen fatal. 12th, Charleston, "111° at 2 p. m., highest temperature for over 100 years," over one hundred prostrations, thirty fatal; Milwaukee, Wis., several prostrations; Memphis, Tenn., three prostrations. 13th, Portland, Mich., one fatal. 14th, St. Louis, Mo., one fatal; Fort Wayne, Ind., three prostrations, none fatal; Memphis, Tenn., three prostrations, one fatal. 15th, New York City, seventeen prostrations, one fatal; Atlanta, Ga., "heat almost intolerable for past ten days, sunstrokes have been reported in almost every city in the State"; Detroit, Mich., "heat intense," one fatal; Cincinnati, Ohio, several prostrations, one fatal; Vincennes, Ind., one prostration; Fort Wayne, Ind., two fatal; Osborn, Ohio, one probably fatal; Paris, Ky., several prostrations; Delaware, Ohio, one prostration; Akron, two fatal; Saint Louis, Mo., three prostrations; Sandusky, Ohio, one prostration; Nashville, Tenn., two "sunstrokes." 16th, Philadelphia, Pa., "heat very great," one or two fatal; Pittsburgh, Pa., "hottest day this year," three prostrations; Kittanning, Pa., one fatal; Cincinnati, Ohio, four prostrations, one fatal; St. Louis, Mo., six prostrations, one fatal; Baltimore, Md., seven prostrations, two fatal; New York City, N. Y., nineteen prostrations, four fatal; Boston, Mass., "two days of intense heat"; Chattanooga, Tenn., "one case of sunstroke." 31st, Cincinnati, Ohio, one prostration.

Maximum and minimum temperatures.—Upon charting the maxima temperatures of the month, it is found that the line of 90° runs through Maine, the Lower Lake region, Southern Michigan, northward over Lake Michigan, thence over Lake Superior to Manitoba, and afterwards includes Western Montana; the line of 100° includes Virginia, the South Atlantic and East Gulf states and Tennessee, except at the stations along the Gulf and North Carolina coasts—the highest maximum (105°) over this region occurred at Savannah on the afternoon of the 12th; a second 100° line runs northward from the Rio Grande along the coast of Texas, through Arkansas and Missouri to Illinois, westward to Kansas and southwestward through southern New Mexico; thence northwestward, including within its limits the southwestern half of Arizona, the interior of California and portions of Nevada and Idaho. Areas of 105° and above comprise part of Indian Territory, the whole interior of Texas, southern half of Arizona, and the San Joaquin and Sacramento Valleys. Extreme temperatures are reported as follows: Yuma, 116°; Burke's, 114°, at these stations maximum temperatures above 100° degrees daily, ranging at Yuma from 101° on the 2d, and at Burke's from 102° on the 2d, to 115° and 114° respectively on the 26th; Red Bluff, Cal., Phœnix and Florence, Ariz., 110°; Fort Gibson, Ind. T., 109°; and Denison and Griffin, Tex., 108°.

Upon charting the minimum temperatures it is found that the line of 70° and above includes only Southern Texas and the stations bordering the Gulf of Mexico. The line of 60° degrees and above comprises within its limits the South Atlantic states, Tennessee, and Ohio valley, Virginia, Maryland, Indian Territory, Missouri, and Kansas. Below 50° are the northern parts of New England and Upper Lakes, the Northwest, Oregon, elevated stations, and the Rocky Mountain Slope as far south as Santa Fé. The lowest temperatures reported from Signal Service stations were Pike's Peak and Campo, 30°; Mount Washington, 31°. The following list refers to the States and Territories in detail:

Maximum and minimum temperatures.—Maine, 47° at Eastport to 93° at Portland. *Vermont*, 42° at *Woodstock to 90° at Burlington, and 94° at West Charlotte. *Massachusetts*, 43° at *Waltham and 50° at Boston to 94° at Boston and 99° at Somerset. *Rhode Island*, 51° at *Fort Adams to 86° at Newport and 88° at *Fort Adams. *Connecticut*, 51° at New London and New Haven to 93° at New Haven. *New York*, 46° at *Cooperstown and 52° at Albany to 96° at Sandy Hook and 100° at *Starkey. *New Jersey*, 46° at Vineland and 53° at Barnegat to 96° at Barnegat and 100° at *Atco and *Linden. *Pennsylvania*, 50° at *Newcastle and *Wellsborough and 56° at Pittsburgh to 99° at Pittsburgh and 102° at *Milton. *Delaware*, 66° to 94° at *Dover. *Maryland*, 52° at *Woodstock to 99° at Baltimore, and 102° at *Fort McHenry. *District of Columbia*, 59° to 102° at Washington. *Virginia*, 57° at Fort Whipple to 102° at Norfolk and 104° at *Dover Mines. *West Virginia*, 57° to 98° at Morgantown. *North Carolina*, 56° at *White Sulphur Springs, 63° at Charlotte, Wilmington, and Smithville to 103° at Wilmington, and 107° at *Weldon. *South Carolina*, 71° to 105° at Charleston. *Georgia*, 61° at *Thomasville and 65° at Atlanta to 104° at Augusta and 105° at *Thomasville. *Florida*, 68° to 104° at Jacksonville. *Alabama*, 67° at *Wilsonville and 71° at Mobile to 101° at Montgomery and *Wilsonville. *Mississippi*, 68° at Vicksburg to 98° at Vicksburg and 102° at *Brookhaven. *Louisiana*, 67° to 100° at Shreveport. *Texas*, 59° at Fort Davis to 109° at Graham. *Ohio*, 53° at *Westerville to 98° at Cincinnati and 100° at *Jacksonburg. *Kentucky*, 63° to 98° at Louisville. *Tennessee*, 64° at Knoxville to 101° at Chattanooga and Nashville. *Arkansas*, 66° at *Mount Ida and 67° at Little Rock to 100° at *Mount Ida and Little Rock. *Michigan*, 48° at Alpena to 93° at Marquette and 96° at *Niles and *Thornville. *Indiana*, 55° at *Spiceland and 58° at Indianapolis to 96° at Indianapolis and 100° at *Vevay. *Illinois*, 58° to 101° at Springfield. *Missouri*, 55° at *Kansas City and 62° at St. Louis to 100° at St. Louis. *Kansas*, 61° at Leavenworth to 97° at Leavenworth and 105° at *Independence and *Wellington. *Wisconsin*, 50° at *Neillsville and 53° at Milwaukee to 93° at Madison. *Iowa*, 55° at Des Moines and *Muscatine to 98° at Keokuk and 102° at Boonesborough. *Nebraska*, 53° to 99° at North Platte. *Indian Territory*, 67° at Fort Sill and Fort Gibson to 109° at Fort Gibson. *Minnesota*, 49° at Duluth to 92° at Saint Paul. *Dakota*, 44° at Deadwood to 98° at Yankton and 102° at *Olivet. *Col-*

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*Those marked with a (*) are voluntary reports.

orado, 33° at *Summit to 98° at *Hermosa and Denver. *New Mexico*, 47° at Santa Fé to 104° at La Mesilla. *Wyoming*, 38° at *Fort Fred Steele and 42° at Cheyenne to 95° at Cheyenne and 101° at *Fort Fred Steele. *Montana*, 43° to 86° at Virginia City. *Utah*, 55° at Salt Lake City to 97° at Salt Lake City and 99° at *Kanab. *Nevada*, 39° at Winnemucca to 97° at Winnemucca and 102° at *Fort McDermitt. *Arizona*, 41° at Fort Apache to 116° at Florence, Yuma, and *Texas Hill. *Idaho*, 43° to 100° at Boise City. *California*, 30° at Campo and 51° at San Francisco to 110° at Red Bluff and 119° at Mammoth Tank. *Oregon*, 40° to 96° at Roseburg.

Ranges of temperature at signal service stations.—The *monthly ranges* will appear from an examination of the minimum and maximum just given. Greatest *daily ranges* vary in New England from 20° at Wood's Holl and Mount Washington to 32° at Thatcher's Island; Middle Atlantic States, 16° at Cape May to 34° at Norfolk; South Atlantic States, 14° at Cape Lookout to 29° at Augusta; Gulf States, 14° at Key West to 28° at Shreveport and Corsicana; Ohio Valley and Tennessee, 19° at Cairo to 32° at Pittsburgh; Lower Lake region, 24° at Erie to 31° at Oswego; Upper Lake region, 23° at Chicago, Grand Haven, and Milwaukee to 33° at Marquette; the Northwest, 23° at Davenport, La Crosse, and Omaha to 36° at Pembina and Fort Stevenson; Eastern Slope, 27° at Eagle Pass and San Antonio to 45° at Pilot Point; Rocky Mountain stations, 30° at Pike's Peak to 42° at Cheyenne; Western Plateau, 32° at Salt Lake City to 45° at Winnemucca; California, 17° at San Diego to 45° at Visalia; Oregon, 30° at Portland to 35° at Roseburg.

Frost.—1st, at Springfield, Mass., Niles, Starkey, N. Y. 5th, at Scott Valley, Cal., heavy, killing vegetation; Fall River, on low ground, and Westport, Mass. 6th, sharp frost in Magdalen Islands, Gulf of Saint Lawrence. Summit, Colo., nearly every night during month.

Ice.—5th, at Yreka, Cal.

PRECIPITATION.

General notes on precipitation of month.—The general distribution of rainfall for the month is illustrated as accurately as possible on Chart No. III by returns from about 500 stations. In the lower left-hand corner of the chart will be found a table giving the average precipitation for July by districts. In general, the rainfall for the first half of the month was deficient; serious droughts being reported in Texas, Nevada, Utah, and the Middle and South Atlantic States and Tennessee. The extensive precipitation of the latter part of the month somewhat remedied the condition of Tennessee and the Middle and South Atlantic States, but has not materially improved the condition of the other States, where numerous droughts were reported as prevailing at the end of the month. The excess of precipitation has been greatest in Oregon, Minnesota, Upper Missouri Valley, and Eastern Gulf States. Marked deficiencies are reported from the Western Gulf States and Ohio Valley, and trifling ones from the Middle Atlantic States, Lower Missouri Valley, and California. Moderate amounts in excess have fallen in other districts. The month is remarkable for the number of sudden and heavy rains reported.

Specially heavy rains.—1st, Leavenworth, Kans., 1.51 inches in 8 hours. 2d, Okalooska, La., 2.05 in 3 hours 30 minutes; Saint Paul, Minn., 4.93 in 8 hours 30 minutes. 3d, Fort Snelling, Minn., 6.60 in 25 hours; Mobile, Ala., 1.60 in 2 hours; Alpena, Mich., 1.47 in 2 hours. 4th, New Orleans, La., 1.37 in 3 hours 40 minutes. 6th, Chicago, Ill., 1.15 in 1 hour 45 minutes. 7th, Madison, Wis., 3.70 in 24 hours, of which 1.18 fell in 1 hour 45 minutes; La Crosse, Wis., 5.15 in 30 hours; Dubuque, Iowa, 2.85 in 8 hours; Logansport, Ind., 3.50 in 30 minutes; at Mound City, Mo., 10 inches is "reported" during a storm of about 36 hours; no authority given. 8th, Hinsdale, Ill., 3.75; Columbus, Ohio, 0.96 in 2 hours. 9th, Davenport, Iowa, 3.11 in 10 hours; Dubuque, Iowa, 2.52 in 6 hours 30 minutes; Monticello, Iowa, 5.60 in 24 hours; Sidney, Nebr., 2.18 in 2 hours 45 minutes. 10th, Breckenridge, Minn., 1.59 in 3 hours; Duluth, Minn., 1.32 in 4 hours; Urbana, Ohio, nearly 2.00 in 25 minutes; Hudson, Ohio, 3.00 on 10th and 11th; Cleveland, Ohio, 3.86 in 24 hours, of which 3.30 fell in 7 hours 35 minutes; greatest amount in same time for 25 years. 11th, Sandusky, Ohio, 2.30 in 9 hours; Toledo, Ohio, 0.73 in 1 hour 15 minutes; Norwalk, Ohio, 1.04 in 1 hour; Cleveland, Ohio, 3.30 in 6 hours 35 minutes, of which 1.24 fell in 1 hour 5 minutes. 12th, New London, Conn., 1.44 in 8 hours; New Haven, 3.00 in 8 hours. 14th, Smithville, N. C., 1.65 in 8 hours; Thomasville, Ga., 2.18 inches in 6 hours. 15th, Yankton, Dak., 3.11 in 3 hours 55 minutes. 16th, New London, Conn., 1.73 in 5 hours 40 minutes; New Haven, 1.69 in 2 hours; Newport, R. I., 1.20 in 6 hours 20 minutes; North Platte, 1.36 in 2 hours; Fort Barrancas, Fla., 3.09; Fort Independence, 1.24 in 15 minutes; Amherst, Mass., 2.00 in 20 minutes; Dodge City, Kans., 1.94 in 5 hours. 19th, Fort Gibson, I. T., 1.16 in 4 hours 22 minutes; New Orleans, La., 1.28 in 1 hour 35 minutes; Mobile, 1.43 in 2 hours 30 minutes; Anna, Ill., 2.06 in 2 hours 45 minutes. 21st, North Platte, 1.57 in 3 hours 30 minutes; Fort Barrancas, Fla., 1.80 and 2.43 on 23d; Litch-

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*** Those marked with a (*) are voluntary reports.**

field, Pa., 1 inch in 40 minutes; Columbus, Ohio, 0.67 in 30 minutes. 24th, Brookhaven, Miss., 1.90 inches; Mobile, Ala., 1.80 in 1 hour; Smithville, N. C., 4.98 in less than 14 hours; Nashville, Tenn., 5.04 in 24 hours, of which 3.30 fell in 4 hours 50 min- utes. 26th, Fort Preble, Me., 3.02 inches; Flushing, N. Y., 1.00 inch in hour; Trenton, N. J., 2.09 in 3 to 4 hours; Washington, D. C., 1.73 in 1 hour 15 minutes; Morgantown, 1.50 in 1 hour; Wilmington, N. C., 1.35 in 6 hours; Hulmeville, Pa., 3.50 in 1 hour 15 minutes, "heaviest ever known." 27th, Portland, Me., 1.80 in about 6 hours; Pittsburgh, Pa., 1.05 in 1 hour 15 minutes; Fort Barrancas, Fla., 2.37 inches. 28th, Shreveport, 1.21 in 5 hours; Fort Wallace, Kans., 1.60 in 1 hour; Fayetteville, N. C., 3.50 inches, followed by 6.50 on the 29th. 30th, Charlotte, N. C., 4.25 in 40 minutes; Fort Monroe, Va., 2.18 inches. 31st, New Orleans, La., 1.31 in 7 hours 30 minutes; Cape Henry, Va., 4.25 in less than 24 hours.

Largest monthly rainfalls.—Fort Barrancas, Fla., 18.32 inches; Fayetteville, N. C., 17.50; Mobile, Ala., 11.17; Duluth, Minn., 10.42; Mount Washington, N. H., 10.23; Smithville, N. C., 10.21; Sterling, Ill., 9.90; Saint Marks, Fla., 9.82; Fort Snelling, Minn., 9.71; New Haven, Conn., 9.50; Saint Joseph, Mo., 9.55; Saint Paul, Minn., 9.32; Sidney, Nebr., 8.78; Monticello, Iowa, 8.66; Charlotte, N. C., 8.61; Mount Ver- non, Iowa, 8.50; Nashville, Tenn., 8.47; North Platte, Nebr., 8.47; Forsyth, Ga., 8.23; Fort McPherson, Nebr., 8.14; Pittsburgh, Pa., 7.78.

Smallest monthly rainfalls.—Over an extensive area, embracing the largest parts of California, Nevada, Utah, and portion of the Rio Grande Valley, and included within lines marked 0.00 on Chart No. III, numerous reports show that no precipitation oc- curred. A trace or 0.01 inch was reported at San Francisco, Cal., Winnemucca, Nev., Burkes, Ariz., Boise City, Idaho, Fort McDermitt and Austin, Nev., and Brackettville and Uvalde, Texas; 0.02 at Willows, Cal.; 0.04 at Red Bluff, Cal., Fort McKavett and Edinburg, Tex.; 0.05 at Saint George, Utah; 0.07 at Salt Lake City, Utah; 0.10 at Saint Mary's, Wyo.; 0.12 at San Antonio, and 0.14 at Eagle Pass, Tex.

Rainy days.—The number of days on which rain or snow has fallen varies as follows: New England, 9 to 19; Middle Atlantic states, 8 to 14; South Atlantic states, 6 to 17; Gulf states, 6 to 22; Western Texas, 1 to 5; Tennessee and the Ohio Valley, 6 to 14; Lower Lakes, 7 to 16; Upper Lakes, 6 to 21; Upper Mississippi valley, 7 to 15: Missouri Valley, 10 to 15; Red River of the North valley, 6 to 18; Eastern Rocky Mountain Slope, 3 to 14; Rocky Mountains, 5 to 18; Pike's Peak, 20; Western Plateau, 1 to 6; California, 0 to 2; Oregon, 5 to 8.

Cloudy days.—The number of days on which cloudiness averaged eight-tenths is as follows: New England, 5 to 17; Middle Atlantic states, 4 to 9; South Atlantic states, 4 to 12; Gulf states, 2 to 15; Ohio valley and Tennessee, 4 to 7; Lower Lakes, 3 to 12; Upper Lakes, 1 to 12; Upper Mississippi Valley, 2 to 8; Missouri Valley, 3 to 8; Red River of the North valley, 5 to 6; Eastern Rocky Mountain slope, 0 to 11; Rocky Mountain stations, 0 to 7; Western Plateau, 0 to 2; California, 0 to 3; Oregon 3 to 10.

Hail.—The largest numbers of hail-storms reported from a single station are 12 from Pike's Peak and 7 from Fort Wallace, Kans. The only occasion on which hail seems to have been general to any extent appears to have been in connection with severe local storms of the 16th, when hail was reported from central New York eastward, to include the greater part of Massachusetts and parts of Rhode Island and Con- necticut. The largest hail in Ulster County, New York, where "ice fell in chunks," and at Lanesborough, Mass., where stones 7 inches in circumference fell, occurred in connection with these storms. Near Madison, Wis., on 6th, "size of man's fist, kill- ing yearling pigs, &c. No such storms have been reported from either the Gulf States, South Atlantic states, Tennessee, Southeastern Rocky Mountain Slope, or Pacific coast. In the Plateau districts it fell only at Fort Douglas, Utah, and El Paso, Tex. Only six stations report more than one storm.

Snow.—Red Bluff, Cal., reports a light snow-fall on a part of the Coast Range on the 31st. A few flakes fell at Portland, Me., on the 4th, followed by a shower of rain, temperature above 50°. 4th, on Salmon Mountain, Cal., elevation 6,200 feet.

Droughts.—The most extensive and serious droughts of the month are reported from Maryland, Virginia, Texas, Utah, and Nevada. In Maryland and Virginia droughts covering the greatest part of the latter and a considerable portion of the former State were reported to have seriously injured the crops, and in Virginia it was said to have been the worst known in twenty years. It terminated on the 26th, since which time copious rains have generally fallen. In the central part of Texas, from the Rio Grande to Red Rivers, serious droughts have prevailed during the entire month, which have nearly ruined the crops and killed much stock. In the section of country lying between the Rio Grande and Colorado Rivers the suffering has been the greatest; all the small streams have gone dry and water-holes dried up. In consequence, large numbers of cattle are reported dying in the valley of the Rio Grande, and the crops are utter failures. At Pioche, Nev., and Deep Creek, Utah, it was yet severe at the end of the month.

Floods and waterspouts.—**9th, heavy mountain floods reported near Socorro, N. M.; severe local flood at Monticello, Iowa. On the 15th, heavy thunder-storm, with water-**

spout near Buffalo Station, 30 miles south of Denver, Colo., several large buildings carried away, and the bed of the railroad was seriously damaged by washouts; very heavy rain caused flood at Yankton, carrying away railway bridges and tracks; 16th, local flood, doing considerable damage to low buildings and railroad tracks at Toledo, Ohio; 19th, cloud-burst ten miles south of Yreka, Cal.; 20th, serious washouts on Union Pacific Railroad reported near North Platte; 21st, Nora Springs, Iowa, waterspout; 26th, waterspout on divide north of Colorado Springs, carried away bridges and caused serious washouts on railway; serious flood near Pittsburgh swept away twenty-five buildings (near Petrolia, Pa.), several bridges, and many miles of railway track; seven inches of rain reported from Irwin, Pa., estimated damage, $300,000.

RELATIVE HUMIDITY.

The percentages of mean relative humidity for the month range as follows: New England, 60 to 81; Middle Atlantic states, 60 to 80; South Atlantic states, 63 to 82; Gulf States, 57 to 79; Ohio Valley and Tennessee, 57 to 70; Lower Lakes, 64 to 70; Upper Lakes, 67 to 72; Upper Mississippi valley, 61 to 73; Lower Missouri valley, 67 to 71; Red River of the North valley, 72 to 75; Eastern Rocky Mountain slope, 21 to 81; Rocky Mountain stations, 38 to 50; Western Plateau, 13 to 34; California, 33 to 78; Oregon, 61 to 65; Arizona, 27 to 43. *High stations* report the following averages, not corrected for altitude: Mount Washington, 86.4; Pike's Peak, 50.7.

WINDS.

The prevailing winds at the Signal Service stations are shown by the arrows flying with the wind on chart No. II. The *maximum velocities* per hour have been given in the descriptions of movements of areas of low pressure.

Total movements of the air.—The following are the *largest* monthly movements in miles recorded at the Signal Service stations: Mount Washington, 20,152 miles; Cape Lookout 13,200; Cape Hatteras, 11,129; Kittyhawk, 10,573; Dodge City, 9,725; Wood's Holl, 9, 407; Pike's Peak, 9,239; Indianola, 8,949; Sandy Hook, 8,713; Smithville, 8,694; Cape May, 8,268; Breckenridge, 7,586. The *smallest* movements are: La Mesilla, 1,593 miles; Tucson, 1,806; Nashville, 1,911; Silver City, 1,941; Florence, 2,039; Lynchburg, 2,199; Indianapolis, 2,634; Augusta, Ga., 2,755; Olympia, 2,785; Morgantown, 2,810; Cairo, 2,886.

Local storms.—During the month local storms have been numerous and occasionally quite severe. Those notable for *heavy rain* or *hail* will be found under the respective headings. The following is a summary of those accompanied by high or destructive winds: On the 2d severe local storms occurred in Dakota, Minnesota, Iowa, and Wisconsin, preceding low pressure area No. I, as follows: At Elkhorn, Dak. T., 5.30 p. m., tornado from SW. to SE. in circular course, destroying buildings, &c.; the storm in Goodhue County, Minnesota, Wednesday night and Thursday morning (2d—3d) seemed to start four miles beyond Vasa, the place of geatest destruction, and traveled toward the SW.; nine persons killed and thirty injured; at Lake Emily five persons injured, considerable stock killed, granary lifted from foundation and carried 80 feet distant—storm crossed the Mississippi River at Red Wing into Pierce County, Wisconsin; at Warrenton a "house was carried away, and four persons who were in it were drowned while attempting to escape, the house being flooded several feet deep;" persons were killed by lightning at Winnebago and Mountain Lake, and "every town in south and east portions of Wisconsin suffered severely;" a "terrible" wind storm was also reported in northern part of Plymouth County, Iowa, between 6 and 7 p. m., destroying houses and killing two men; the storm cloud was observed from Lemars, and is described as "having first, the appearance of an hour-glass, after which it assumed a straight column, and then seemed to break into fragments and drift away; it was in sight about half an hour. On the 6th "violent" NW. wind storm at Logansport, Ind. On the 10th and 11th severe storms accompanied low area No. III in Michigan, Ontario, Ohio, Pennsylvania, New York, and Maryland, as follows: 11th, Thornville, Lapeer County, Michigan, "hurricane," many buildings demolished, and in adjoining town two persons killed; at Port Huron "heaviest wind ever recorded here; numerous buildings unroofed and trees blown down, all lying from W. to E."; Sardinia, Ontario, noon, terrific storm "apparently from across the river, in the direction of Port Huron, lasting 15 minutes, doing much damage to buildings and crops;" Sandusky, maximum velocity of wind for 10 minutes, 72 miles per hour; Logan County, Ohio, perfect hurricane in southwestern part of county, buildings damaged and stock killed, track seven miles wide and ten long, one man killed by lightning; Maumee Valley, much damage to houses and trees; Erie County, destructive storm at 3 p. m., lasting five minutes, reported to have alternately touched the ground and then left it for a while, general direction of storm toward the southeast, fallen trees generally lying in that direction, but some lying toward the NW.—an observer to the north of the storm states "that a funnel-shaped cloud descended to the ground, rested a moment, and then bounded off, its general appearance was a heavy bank of clouds, reaching to the surface of the ground;" in the Juniata Valley, Pa., a storm doing much damage; most destructive at Mifflin, one person killed; at Lewistown, buildings were blown down. On the 13th, heavy storms are reported to have visited Wrightsville and Hawkinsville, Ga., demolishing buildings, &c. On the 14th, during passage of low area No. IV, at Niagara Falls, N. Y., "severe local storm, injuring buildings and trees," and at Wells' River, Vermont, 5.45 p. m., "violent hail-storm and tornado" lasting fifteen minutes. On the 15th, accompanying low area No. V, severe storms in various parts of Ontario during afternoon, doing great damage to buildings and crops; Montreal, Canada, night, severe thunder-storm, one person killed; Binghamton, N. Y., violent storm, one person killed, also one person killed at Skaneateles Falls by lightning. On the 16th, accompanying same depression, very severe storms occurred over New York and New England, which were most destructive in a belt of country including the Mohawk and Upper Hudson valleys, Massachusetts, and Connecticut. They appear to have commenced in the Mohawk valley, about 1 p. m., where "a violent hurricane seemingly about fifteen miles wide," passed over Herkimer, Fuller, Montgomery, Schenectady, Albany (2 p. m.) and Rensselaer Counties, devastating orchards, and leveling grain crops; a "violent storm" commenced at Coxsackie, Greene County, at 2.30 p. m.; Kingston and Saugerties, Ulster County, 4 p. m., "tornado, crops ruined, barns demolished, ice fell in large chunks." In *Connecticut*, at Sheltour, "heavy storm," two men killed, and two injured by lightning; off Long Island, boat capsized and two men drowned. *Massachusetts*—Pittsfield, 2.30 p. m., "tornado from west, three persons killed and four injured, buildings unroofed and blown down, storm took a course from NW. to SE., following along the valley, track not over sixty rods wide, in which hundreds of trees were leveled, and buildings demolished;" Lanesborough, immense hail-stones, seven inches in circumference, great damage to crops, one person killed; West Stockbridge, one person killed; Springfield, 3.15 p. m., heavy storm; Northampton, 3 p. m., terrible storm, buildings and trees demolished, fearful wind, followed by heavy rain; Fitchburg, 3.35 p. m., "tornado, lasting three minutes," much damage to buildings and trees; Boston, and vicinity, 4.17 p. m., severe wind and hail storm, houses unroofed, and one man killed; at Hull, captain of schooner washed overboard and drowned; off Baker's Island, sloop capsized and all on board drowned; off Salem, boy washed overboard and drowned; at Paddock's Island, man drowned; at Dover, townhall demolished, and one man killed; at Brookline, church and townhall badly damaged; on Bird's Island flats, yacht capsized and six persons drowned; off Scituate, two boats capsized and three persons drowned; at Newton, trees uprooted and houses badly damaged; South Braintree, houses demolished, and two persons injured; Lawrence, Essex County, storm began at 4 p. m., NW. gale for fifteen minutes. Taunton, Bristol County, 5.30 p. m., storm lasting five minutes, followed for two hours by a severe NW. gale. Nantasket, Norfolk County, "hurricane struck here at 5.30 p. m.," buildings demolished, and six persons injured; near Governor's Island, two yachts capsized and five persons were drowned. In all thirty persons were drowned on that day in and around Massachusetts Bay. Woods' Holl "tornado or squall from 5 to 5.30 p. m." *Rhode Island.*—Newport, between 5 and 6 p. m., "terrible storm of wind, rain, and hail." Off Montauk Point, L. I., schooner Annie and Millard struck by lightning during heavy thunder shower during Wednesday night. Schooner Agnes parted chains in Hamstead Harbor, L. I. Schooner Harriet Lewis parted chains in Dutch Island Harbor, and several vessels lost sails and topmasts in Long Island Sound. On the 17th terrific thunder-storms, with heavy rains, were reported in northeastern part of Texas, near Jefferson, two horses were killed by lightning, and at Kildare a house was struck and one person killed; Chatanooga, Tenn., heavy storm, houses blown down; Portsmouth, Va., one person killed by lightning. On the 18th, off Point aux Trembles, 21 miles from Quebec, shortly before 9 p. m., yacht capsized and eight persons drowned. On the 23d, accompanying low area No. VI, at Smith Falls, Ontario, terrific thunder-storm, one person killed; Oakland, Ky., destructive wind-storm over northern section of county. On the 20th, accompanying low area No. VII, at Pittsburgh, Pa., a very violent storm of wind, with heavy rains, producing floods in the Youghiogheny, Monongahela, and Alleghany valleys; at Philadelphia, Pa., heavy storm, houses unroofed. On the 28th, at Fort Wallace, Kans., a "violent NW. wind," and at McKinney, Tex., evening, "tornado" from the N., demolishing a church. 29th, Corsicana, Tex., "tornado" from west to east. 30th, Syracuse County, New York, "tornado" in southwestern part of county at 3 p. m., track three miles wide and ten miles long, lasting 20 minutes, deluge of water, crops much damaged.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily weather indications for June with the telegraphic reports for the succeeding twenty-four hours shows the general percentage of omissions to be 1.41 per cent., and of verifications to be 84.8 per cent. The percentages for the four elements have been weather, 91.5; direction of the wind, 87.0; temperature, 82.4; barometer, 78.3. The percentages of verifications by geographical districts have been: New England 83.9; Middle states, 89.1; South Atlantic states, 82.3; East Gulf states, 80.8; West Gulf states, 82.5; Lower Lake region, 87.7;

Upper Lake region, 86.3; Tennessee and the Ohio valley, 82.4; Upper Mississippi valley, 87.6; Lower Missouri valley, 85.0; Northern Pacific coast region, 91.7; Central Pacific coast region, 100; Southern Pacific coast region, 100. Of the 3,813 predictions that have been made 149, or 3.91 per cent., are considered to have entirely failed; 116, or 3.04 per cent., were one-fourth verified; 423, or 11.09 per cent., were one-half verified; 457, or 11.99 per cent., were three-fourths verified; 2,614, or 68.55 per cent., were fully verified, so far as can be judged from the tri-daily weather maps.

Cautionary signals.—98 cautionary signals were displayed during the month, of which 82, or 83.7 per cent., were justified. No cautionary off-shore signals were displayed. The above does not include signals ordered at 47 display stations, where the velocity is only estimated.

NAVIGATION.

Stage of water in rivers.—In the table on the right-hand side of chart No. III are given the highest and lowest readings of the Signal Service river gauges for the month, with the dates of same. With one exception (Omaha from the 1st to the 4th) the rivers at the Signal Service stations have not reached the danger line during the month. The Red River at Shreveport, and the Missouri at Yankton, Omaha, and Leavenworth have continued to fall slowly throughout. The Mississippi has fluctuated considerably, but continued in a good navigable state throughout. The Ohio at Pittsburg continued low (between 1 foot and 2 feet 6 inches) from the 1st to the 12th, when it rose to 4 feet 8 inches by the afternoon of the 13th; it then gradually fell to 7 inches on the 23d (lowest of the month), but rose to 7 feet 6 inches (highest of month) on the 27th. At Cincinnati and Louisville the river continued quite low, and without much change throughout month. The Cumberland at Nashville, the Tennessee at Chattanooga, and the Monongahela at Morgantown, remained low throughout month, except the flood in latter on the 26th, which is noted under its appropriate heading. The Savannah at Augusta, continued below 4½ feet, except on the 19th and 20th, when it rose to 5 feet 9 inches, and on the 30th, when it rose to 9 feet 6 inches. The observer at Fayetteville, N. C., reported the Cape Fear River lower this season than at any time for the past ten years, the water at one time being so low that steamers could not get within nine miles of the city; the heavy rains during latter part of month caused a rise of about 15 feet. The observer at New Westminster, B. C., reported the Fraser River very high on the 25th, when it was 11 feet 1 inch above low-water.

TEMPERATURE OF WATER.

The *temperatures of water*, as observed in rivers and harbors, with average depth at which the observations were taken, are given on chart No. II. The observations at San Francisco were interrupted from the 19th to the 31st, on account of breakage of thermometer.

ATMOSPHERIC ELECTRICITY.

Thunder storms.—Thunder storms have occurred in too large numbers during the month to allow of their being enumerated in detail. An examination of the storms, after being charted, shows that the greatest average number prevailed in the Middle Rocky Mountain slope, where from five stations an average of eight storms is reported. The Middle Atlantic and Lower Missouri valley and Lower Lakes average five, while New England, Upper Missouri valley, Upper Lakes, and Eastern Gulf range from an average of four to four and a half. Very few of these storms were reported from the Western Gulf, the Plateau districts, and the Northwest, and none are reported from the Pacific coast.

Auroras.—The most extensive aurora of the month occurred on the 24th, being reported from New England as far south as Westborough, Mass., New York, and several points in Dakota. Cloudy weather from Lake Erie to Lake Superior, occurring at that time, prevented observations in those districts. Its appearance and disappearance must have been nearly simultaneous from New England to Dakota, it being noted at 10 p. m. in both sections, and disappeared only at dawn. At Burlington, Vt., it was reported to have an arch of emerald green, with a few very brilliant streamers; its color was noticeably green at both Burlington and Eastport, and no rose spots seen. Mount Washington observer, however, reported it as pale yellow, with streamers of deeper hue. At Buffalo its color was faint white. An aurora is reported from Milton and Wellsborough, Pa., on the 25th. On the 16th at Vevay, Ind., maximum brilliancy at 11.45 p. m. On the 17th at Vevay and New Corydon, Ind., and Mount Solon, Va. On the 19th at New Corydon, Ind., at 10 p. m., and at Monticello, Iowa.

Magnetic variations.—Prof. F. Hess reports the variation of the magnetic needle near Pagosa Springs, Colo., July 2, as 14° 24′ east, and on the 18th, near the Blanco river, Colorado, 14° 32′ east.

Atmospheric electricity interfering with telegraphic communication at Santa Fé, N. M., from the 7th to the 11th, and from the 18th, excepting the 21st, daily to the 28th inclusive; 10th, violent electrical storm on the summit of Pike's Peak, causing hair to stand out; for a considerable time buzzing noises emitted from all metallic substances; 12th, at sloop Point, N C.

OPTICAL PHENOMENA.

Solar halos.—Solar halos are reported in very considerable numbers from New England, the Lower Lakes, Ohio valley, and Upper Mississippi; but three are reported from the South Atlantic states, three in the Gulf states, and one in the Northwest. Elsewhere none prevailed or have not been deemed worthy of report. A remarkable solar halo, a report of which was received too late for the June REVIEW, occurred on June 4, at Port Blakely, Wash. The sun was surrounded by four distinctly marked rings; the two inner, which were perfectly round, displayed rainbow colors, the third oval, and the fourth round in form, were white. A huge circle, also of rainbow hues, passing through the sun's center, intersected the rings described. A mock sun of blinding brilliancy appeared at the intersection of this outside circle with the lower half of the oval ring. The phenomenon continued for more than an hour.

Lunar halos.—These were reported in considerable numbers, especially in the sections south of 38° N. and east of 100° W., where, however, only eight solar halos were reported. But two were reported west of the hundredth meridian, one at San Diego, and one at Santa Fé, and but four in the entire Lake region and Northwest.

MISCELLANEOUS PHENOMENA.

Polar bands.—10th, at Tabor, Iowa; 7th, 11th, 16th, 27th, at Gardner, Me.; Cape Vincent, N. Y., on 24th; Jacksonsburg. Ohio, on the 12th.

Prairie fires.—Near Mason, Tex., on 16th, and in Virginia previous to the 24th.

Zodiacal light.—Lynchburg, 14th, 16th, 18th, 21st.

Mirage.—Breckenridge, Minn., on the 20th; Olivet, Dak., on the 27th.

Pollen in air on 7th and 11th, at Breckenridge, Minn.

Sand storm on the 26th, at Visalia, Cal.

Distant lightning on the 23d, at Visalia, Cal.

Cotton worm first seen on 31st, at Okaloosa, La.

Grasshoppers, 31st, at Bismarck, doing much damage; Salt Lake City, disappeared near the end of the month; 29th, North Platte, locusts flying north, none alighted; Ringgold, Ohio, grasshoppers injuring tobacco from 12th to 19th; Kansas City, Mo., present during the month, but did little damage.

Earthquakes, 26th, Cairo, Ill., at 11.45 a. m., lasting three seconds, motion from north to south; also felt at Mound City, Ill.

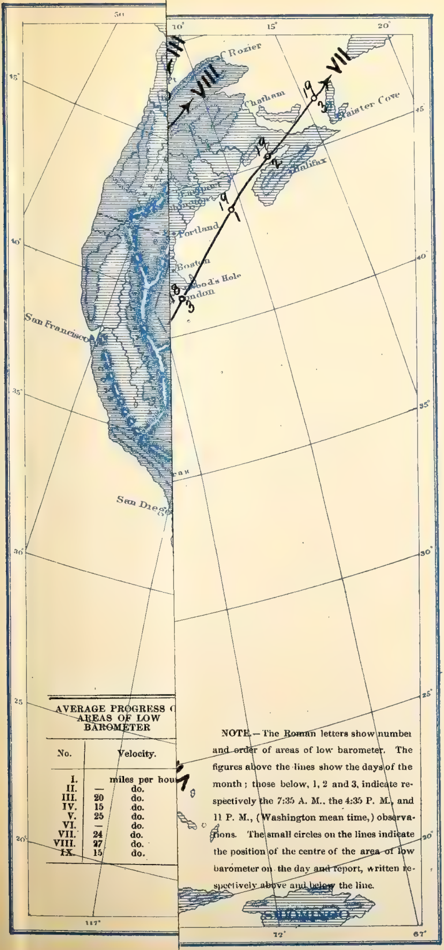
Sunsets.—The characteristics of the sky at sunset, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from 135 stations show 4,164 observations to have been made, of which 37 were reported doubtful; of the remainder, 3,389 or 82.1 per cent., were followed by the expected weather.

Sun spots.—The following record of observations, made by D. P. Todd, Assistant, has been forwarded by Prof. S. Newcomb, U. S. Navy, Superintendent Nautical Almanac, Washington, D. C.:

Date.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	
July, 1879.									
1st, 3 p.m.	1	1	0	0	1	1	2	4	
2d, 3 p.m.	0	0	0	0	0	0	2	4	
3d, 2 p.m.	0	0	0	0	0	0	2	3	Faculæ.
7th, 2 p.m.	0	0			0	0	0	0	Faculæ.
9th, 3 p.m.	0	0	0	0	0	0	0	0	
10th, 2 p.m.	1	5	0	0	0	0	1	5	
11th, 2 p.m	0	0	0	0	0	0	1	4	
12th, 3 p.m	0	0	0	0	0	0	1	4	
14th, 3 p.m.	0	0	0	0	0	0	1	1	
15th, 2 p.m.	0	1	0	0	0	0	1	2	
16th, 2 p.m	0	0	0	0	0	0	1	1	Faculæ.
17th, 3 p.m	0	0	1	1	0	0	0	0	Faculæ.

Observations were also made on the 18th, 19th, 22d to 24th, 26th, and 28th, at 2 p. m., and 21st, at 3 p. m., but no spots seen. Mr. Wm. Dawson, observing at Spiceland, Ind., reports, the 1st, 29 spots in one group (the same that was near center of S. E.

No. 1.



AVERAGE PROGRESS (
AREAS OF LOW
BAROMETER

No.	Velocity.	
I.		miles per hou
II.	—	do.
III.	20	do.
IV.	15	do.
V.	25	do.
VI.	—	do.
VII.	24	do.
VIII.	27	do.
IX.	15	do.

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	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	
July, 1879.									
1st, 3 p. m.	1	1	0	0	1	1	2	4	
2d, 3 p. m.	0	0	0	0	0	0	2	4	Faculæ.
3d, 2 p. m.	0	0	0	0	0	0	2	3	Faculæ.
7th, 2 p. m.	0	0	0	0	0	0	0	0	
9th, 3 p. m.	0	0	0	0	0	0	0	0	
10th, 2 p. m.	1	5	0	0	0	0	1	5	
11th, 2 p. m	0	0	0	0	0	0	1	4	
12th, 3 p. m	0	0	0	0	0	0	1	4	
14th, 3 p. m.	0	0	0	0	0	0	1	1	
15th, 2 p. m.	0	1	0	0	0	0	1	2	
16th, 2 p. m.	0	0	0	0	0	0	1	1	Faculæ.
17th, 3 p. m.	0	0	1	1	0	0	0	0	Faculæ.

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No. 1.

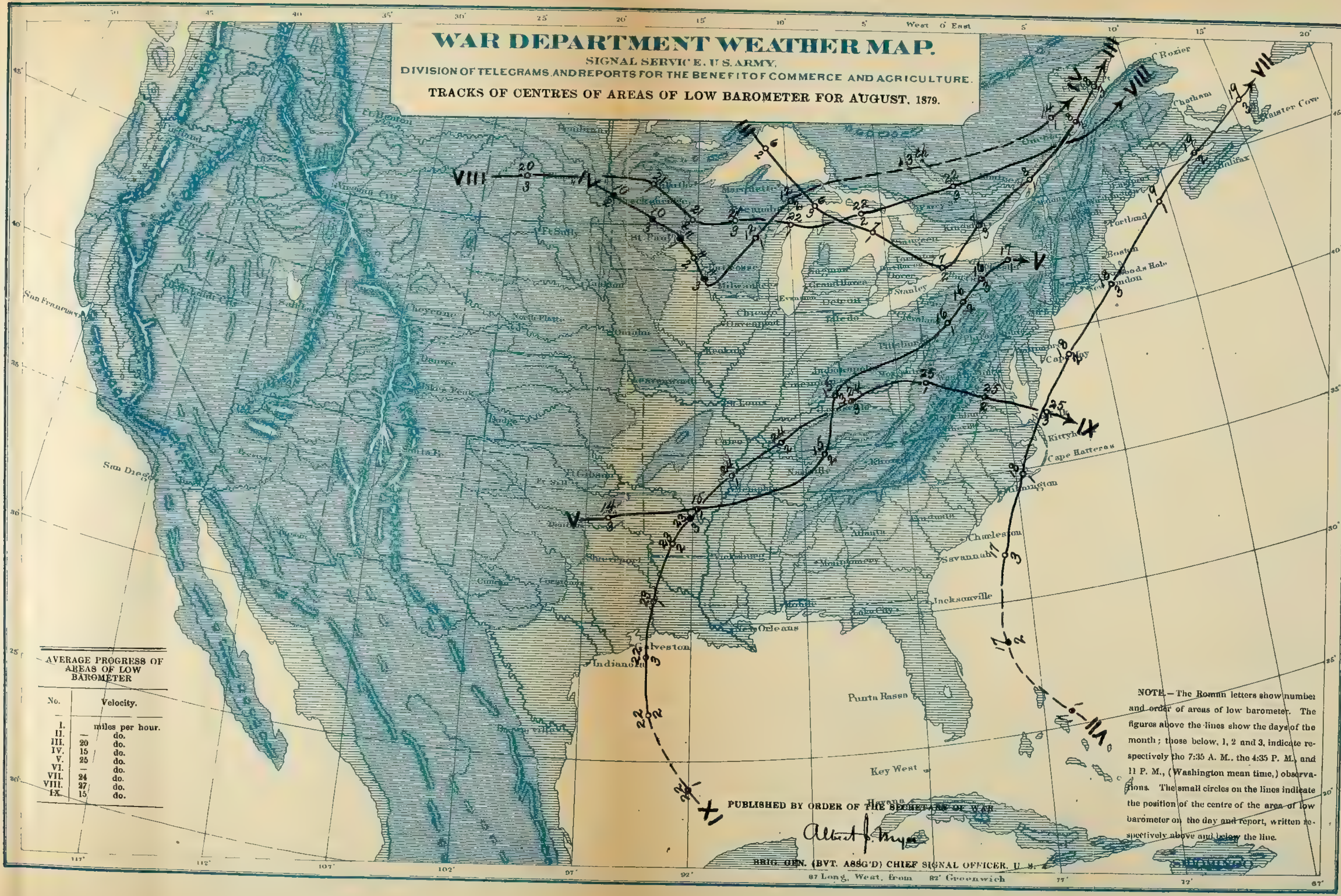
THE PREPARATION OF CHARTS OF THIS SERIES COMMENCED NOVEMBER 8, 1870

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

TRACKS OF CENTRES OF AREAS OF LOW BAROMETER FOR AUGUST, 1879.



No.		Velocity.
I.		miles per hour.
II.	—	do.
III.	20	do.
IV.	15	do.
V.	25	do.
VI.	—	do.
VII.	24	do.
VIII.	27	do.
IX.	15	do.

AVERAGE PROGRESS OF AREAS OF LOW BAROMETER

NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7:35 A. M., the 4:35 P. M., and 11 P. M., (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above and below the line.

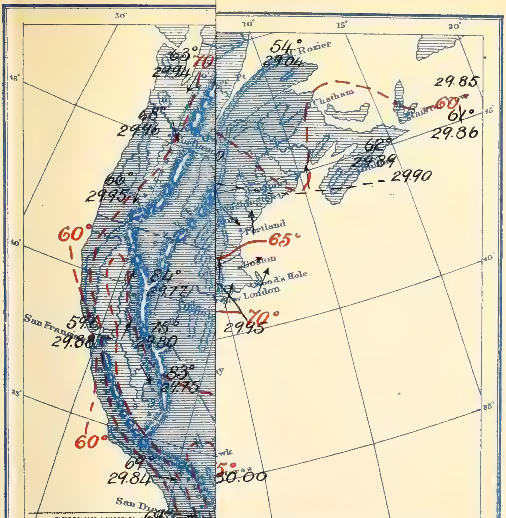
PUBLISHED BY ORDER OF THE SECRETARY OF WAR

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

87 Long. West. from 82° Greenwich

No. II.



TEMPERATURE OF WATER FOR AUGUST, 1879.

STATIONS	Temperature at bottom. Max.	Temperature at bottom. Min.
Alpena	73	65
Augusta	87	75
Baltimore	80.5	75.5
Buffalo	77.0	67.0
Burlington, Vt.	74	61
Charleston	86	80
Chicago	78	66
*Cleveland	79	70.5
Detroit	77	66
Duluth	66.5	64.5
Eastport	51.5	47.5
Escanaba	73	60
Galveston	87.5	78.5
Grand Haven	80	68
Jacksonville	87	81
Key West	92	85
Marquette	67	61
Milwaukee	70	—
Mobile	87	80
New London	71	63.3
New York	77	70
*Norfolk	83	75
Portland, Maine	61	56
Punta Rassa	—	—
San Francisco	—	—
Sandusky	81	67
St. Marks	77	72.5
Savannah	83	76
†Toledo	79.5	69
Wilmington	85	72
Wood's Holl	76	68

* Observations for 30 days only.
† Observations for first 25 days only.

AGE TEMPERATURES FOR AUGUST, 1879.

ICTS.	Average for August Signal Servise Observations. For several years.	Average for August Signal Servise Observations. For 1879.	Comparison of August, 1879, with the average for several years.
SLOPE.			
	64°.5	63°.0	1°.5 below.
	66 .5	68 .0	1°.5 above.
	58 .2	59 .6	1°.4 above.
	68 .9	69 .0	Normal
	73 .2	74 .9	1°.7 above.
PLATEAU.			
	75 .0	76 .0	1°.0 above.
	76 .0	76 .4	0°.4 above.
	75 .0	76 .2	1°.2 above.
lt. slope	65 .1	66 .3	1°.2 above.
Mt. slope.	73 .5	72 .9	0°.6 below.
y Mt. slope	77 .5	75 .0	2°.5 below.
	73 .7	73 .4	0°.3 below.
lley & Minn.	71 .6	70 .5	1°.1 below.
gion	67 .4	67 .0	0°.4 below.
gion	69 .8	68 .2	1°.6 below.
l Tennessee	75 .8	73 .2	2°.6 below.
lley	85 .8	82 .6	3°.2 above.
tates	82 .0	79 .8	2°.2 below.
tates	80 .2	77 .3	2°.9 below.
	81 .3	81 .2	Normal.
States	79 .1	78 .1	1°.0 below.
States	74 .3	73 .3	1°.0 below.
	67 .7	65 .2	2°.5 below.
alley	68 .0	64 .0	4°.0 below.
time stations	64 .2	61 .7	2°.5 below.
n. N. H.	47 .5	[illegible]	2°.1 below.
ol	39 .1	[illegible]	Normal.

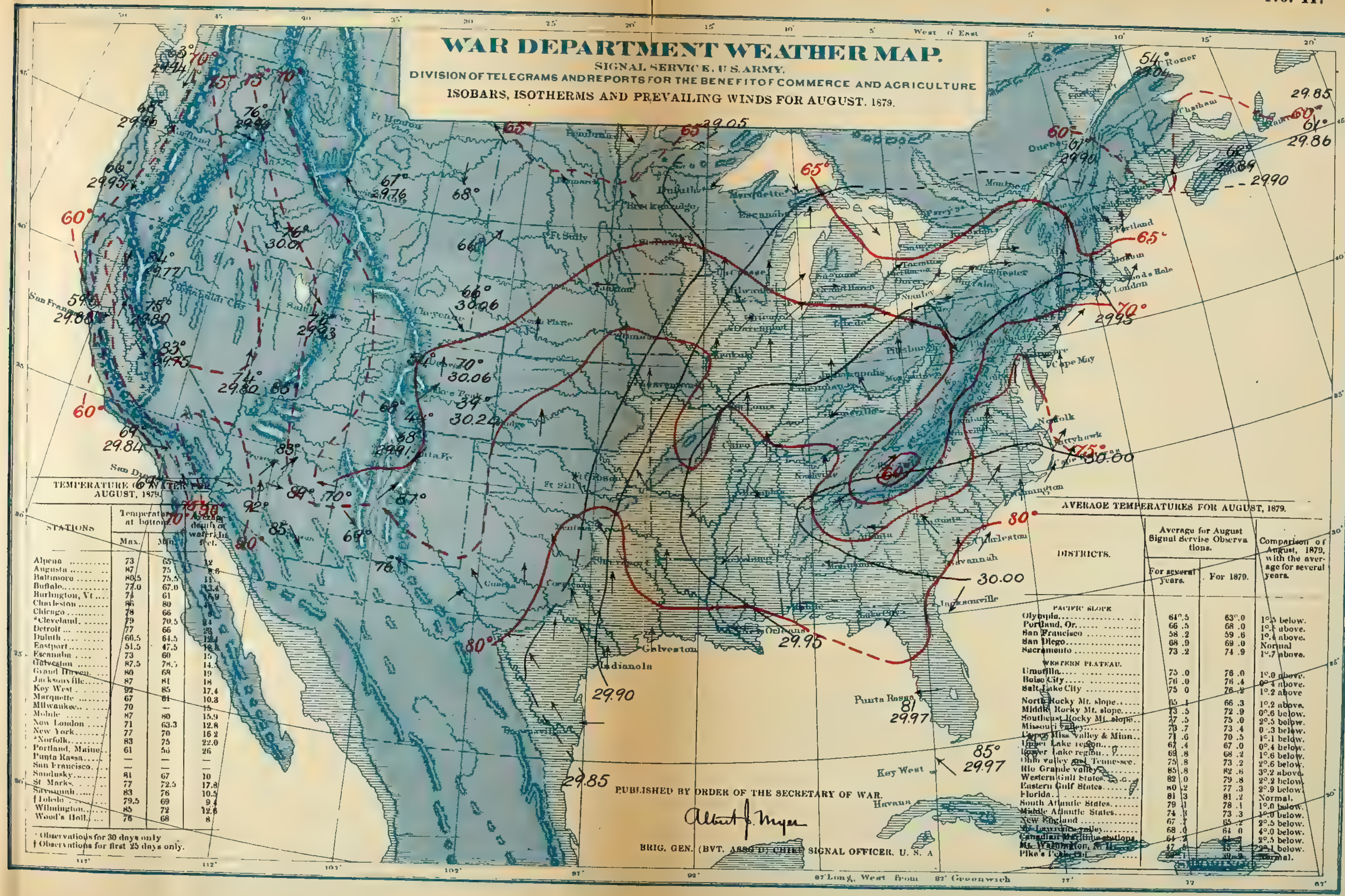
117°
72°
67°

No. 11.

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY.
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE

ISOBARS, ISOTHERMS AND PREVAILING WINDS FOR AUGUST, 1879.



TEMPERATURE OF WATER FOR AUGUST, 1879.

STATIONS	Temperature at bottom.		Average depth of water in feet.
	Max.	Min.	
Alpena	73	65	12
Augusta	87	75	[illegible]
Baltimore	80.5	75.5	11
Buffalo	77.0	67.0	13.4
Burlington, Vt	74	61	[illegible]
Charleston	86	80	[illegible]
Chicago	78	66	[illegible]
*Cleveland	79	70.5	[illegible]
Detroit	77	66	[illegible]
Duluth	60.5	64.5	[illegible]
Eastport	51.5	47.5	[illegible]
Escanaba	73	60	15
Galveston	87.5	78.5	[illegible]
Grand Haven	80	69	19
Jacksonville	87	81	18
Key West	92	85	17.4
Marquette	67	61	10.8
Milwaukee	70	—	15
Mobile	87	80	15.9
New London	71	63.3	12.6
New York	77	70	16 2
*Norfolk	83	75	22.0
Portland, Maine	61	56	26
Punta Rassa	—	—	—
San Francisco	—	—	—
Sandusky	81	67	10
St Marks	77	72.5	17.8
Savannah	83	76	10.5
†Toledo	79.5	69	9.4
Wilmington	85	72	12.6
Wood's Holl	76	68	8

* Observations for 30 days only
† Observations for first 25 days only.

AVERAGE TEMPERATURES FOR AUGUST, 1879.

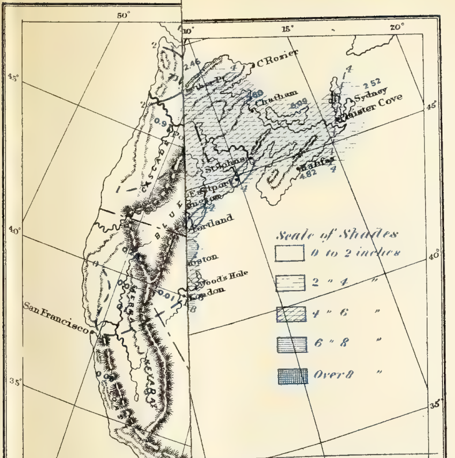
DISTRICTS.	Average for August Signal Service Observations.		Comparison of August, 1879, with the average for several years.
	For several years.	For 1879.	
PACIFIC SLOPE.			
Olympia	64°.5	63°.0	1°.5 below.
Portland, Or.	66 .5	68 .0	1°.5 above.
San Francisco	58 .2	59 .6	1°.4 above.
San Diego	68 .9	69 .0	Normal
Sacramento	73 .2	74 .9	1°.7 above.
WESTERN PLATEAU.			
Umatilla	75 .0	76 .0	1°.0 above.
Boise City	76 .0	76 .4	0°.4 above.
Salt Lake City	75 0	76 .2	1°.2 above
North Rocky Mt. slope	65 .1	66 .3	1°.2 above.
Middle Rocky Mt. slope	73 .5	72 .9	0°.6 below.
Southeast Rocky Mt. slope	77 .5	75 .0	2°.5 below.
Missouri valley	73 .7	73 .4	0°.3 below.
Upper Miss. valley & Minn.	71 .6	70 .5	1°.1 below.
Upper Lake region	67 .4	67 .0	0°.4 below.
Lower Lake region	69 .8	68 .2	1°.6 below.
Ohio valley and Tennessee	75 .8	73 .2	2°.6 below.
Rio Grande valley	85 .8	82 .6	3°.2 above.
Western Gulf States	82 .0	79 .8	2°.2 below.
Eastern Gulf States	80 .2	77 .3	2°.9 below.
Florida	81 .3	81 .2	Normal.
South Atlantic States	79 .1	78 .1	1°.0 below.
Middle Atlantic States	74 .3	73 .3	1°.0 below.
New England	67 .7	65 .2	2°.5 below.
St. Lawrence valley	68 .0	64 0	4°.0 below.
Canadian Maritime stations	64 .2	[illegible]	2°.5 below.
Mt. Washington, N. H.	47 .6	[illegible]	2°.1 below.
Pike's Peak, Col.	[illegible]	39 .3	Normal.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

No. III.



RS ABOVE LOW-WATER MARK, AUGUST, 1879.

Danger point on gauge.		HIGHEST WATER.			LOWEST WATER.		
		Date,	Height.		Date.	Height.	
ft.	in.	August.	ft.	in.	August.	ft.	in.
29	9	25	4	6	14	1	1
25	0	25	5	7	5	1	0
20	0	1	9	5	31	5	9
16	0	1	13	0	31	7	4
21	0	3	12	9	31	6	8
14	6	4	4	1	17	2	3
18	0	1	3	9	28, 29	1	3
21	10	1	8	4	31	2	6
15	0	1	6	3	27 to 30	1	5
14	6	1	7	4	31	2	5
30	0	1, 17	16	0	31	8	9
40	0	1,10, 11	15	4	19, 20	11	7
34	0	1	11	7	22	7	8
41	0	6	16	4	27	12	5
—3	6	30	—10	3	27	—12	2
20	0	8	4	11	15	1	2
50	0	25	15	9	22	5	11
24	0	26	12	0	1, 2	3	2
42	0	31	2	11	12, 13, 29	0	11
33	0	4	4	4	21	1	3
28	0	28	2	1	3, 24	0	8
20	0	8	4	11	15	1	2
		3	22	0	14, 15	14	11

mark of 1874.

ST DOMINGO

72°

67°

AVERAGE PRECI

DISTRICTS.	A For y In
St. Lawrence Valley	
New England	
Middle Atlantic States	
South Atlantic States	
Eastern Gulf States	
Western Gulf States	
Tennessee	
Ohio Valley	
Lower Lake Region	
Upper Lake Region	
Upper Mississippi Valley	
Minnesota	
Lower Missouri Valley	
Upper Missouri Valley	
California Coast	
Portland, Or	

117°

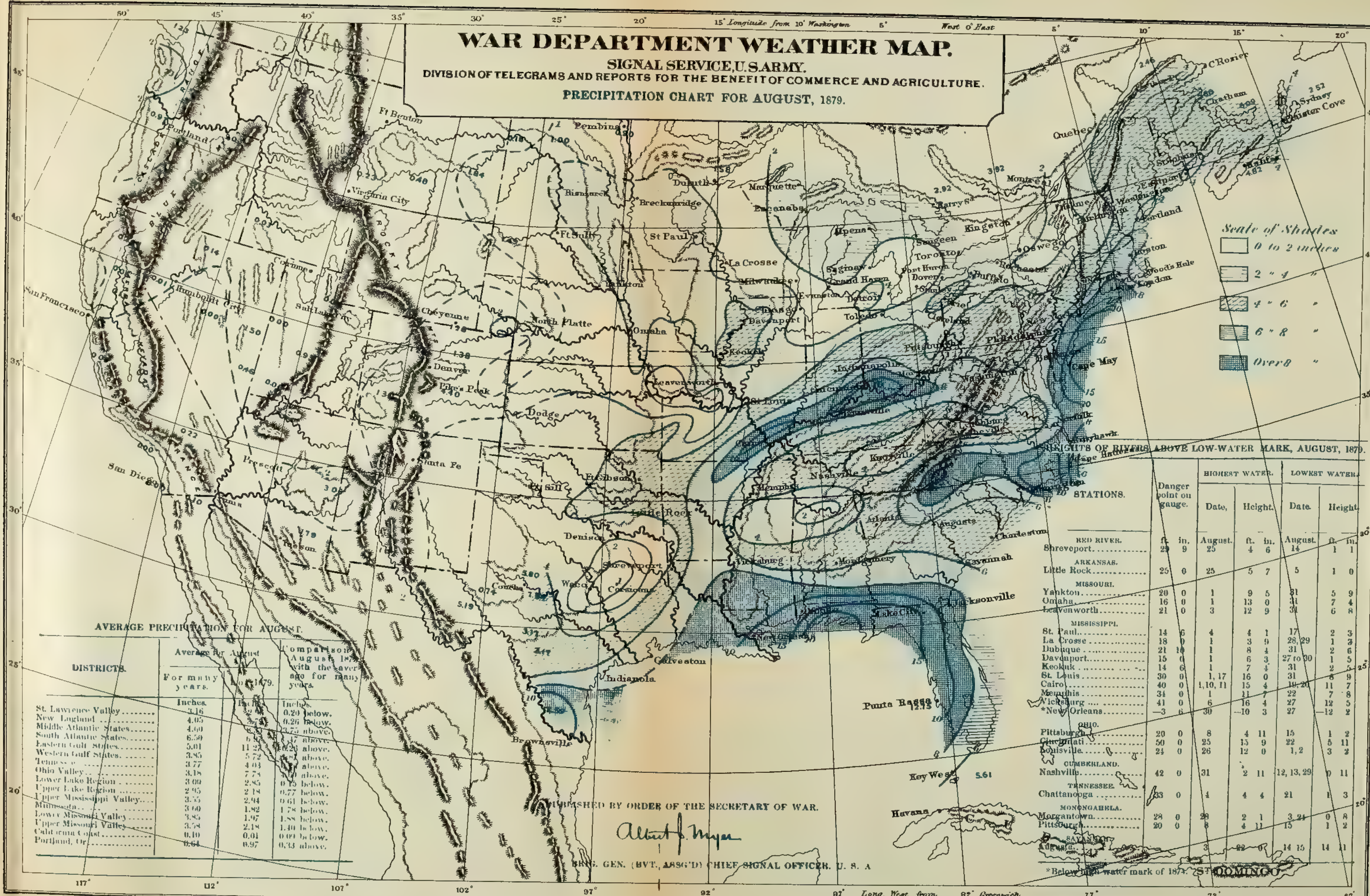
No. III.

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

PRECIPITATION CHART FOR AUGUST, 1879.



AVERAGE PRECIPITATION FOR AUGUST.

DISTRICTS.	Average for August		Comparison August 1879 with the average for many years.
	For many years.	For 1879.	
	Inches.	Inches.	Inches.
St. Lawrence Valley	3.16	2.9[illegible]	0.20 below.
New England	4.05	3.7[illegible]	0.26 below.
Middle Atlantic States	4.60	8.3[illegible]	3.75 above.
South Atlantic States	6.50	6.[illegible]	[illegible].47 above.
Eastern Gulf States	5.01	11.27	[illegible].2[illegible] above.
Western Gulf States	3.85	5.72	[illegible] above.
Tennessee	3.77	4.03	[illegible] above.
Ohio Valley	3.18	7.78	4.[illegible]0 above.
Lower Lake Region	3.00	2.85	0.15 below.
Upper Lake Region	2.95	2.18	0.77 below.
Upper Mississippi Valley	3.55	2.94	0.61 below.
Minnesota	3.60	1.82	1.78 below.
Lower Missouri Valley	3.85	1.97	1.88 below.
Upper Missouri Valley	3.58	2.18	1.40 below.
California Coast	0.10	0.01	0.09 below.
Portland, Or.	0.64	0.97	0.33 above.

HEIGHTS OF RIVERS ABOVE LOW-WATER MARK, AUGUST, 1879.

STATIONS.	Danger point on gauge.		HIGHEST WATER.			LOWEST WATER.		
			Date.	Height.		Date.	Height.	
	ft.	in.	August.	ft.	in.	August.	ft.	in.
RED RIVER.								
Shreveport	29	9	25	4	6	14	1	1
ARKANSAS.								
Little Rock	25	0	25	5	7	5	1	0
MISSOURI.								
Yankton	20	0	1	9	5	31	5	9
Omaha	16	0	1	13	0	31	7	4
Leavenworth	21	0	3	12	9	31	6	8
MISSISSIPPI.								
St. Paul	14	6	4	4	1	17	2	3
La Crosse	18	0	1	3	9	28, 29	1	3
Dubuque	21	10	1	8	4	31	2	6
Davenport	15	0	1	6	3	27 to 30	1	5
Keokuk	14	6	1	7	4	31	2	5
St. Louis	30	0	1, 17	16	0	31	8	9
Cairo	40	0	1, 10, 11	15	4	19, 20	11	7
Memphis	34	0	1	11	7	22	7	8
Vicksburg	41	0	6	16	4	27	12	5
*New Orleans	—3	6	30	—10	3	27	—12	2
OHIO.								
Pittsburgh	20	0	8	4	11	15	1	2
Cincinnati	50	0	25	15	9	22	5	11
Louisville	24	0	26	12	0	1, 2	3	2
CUMBERLAND.								
Nashville	42	0	31	2	11	12, 13, 29	0	11
TENNESSEE.								
Chattanooga	33	0	4	4	4	21	1	3
MONONGAHELA.								
Morgantown	28	0	29	2	1	3, 24	0	8
Pittsburgh	20	0	8	4	11	15	1	2
SAVANNAH.								
Augusta			3	22	0	14 15	14	11

*Below high-water mark of 1874.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT., ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

quadrant on the 27th ultimo), 1 spot and prominent faculæ at E. edge; 2d, 14 spots—4 very prominent—in large group, 2 or 3 spots at E. side of sun; 3d, 15 spots—3 very prominent—in large group, 2 spots in E. quadrant; 5th, 1 spot of large group very near west edge, two spots in the other group a few degrees NE. of center; 10th, 14 spots, one group, about half way from east edge to center; 11th, 20 spots, one group; 12th, 14 spots, one group, near center, one spot quite large, with very prominent penumbra; 13th, 8 spots, one group, the large spot near 8,000 miles long, and about half as wide, penumbra fading; 14th, 15 spots, one group; 15th, 8 spots, one group; 16th, 10 spots, one group; 17th, 4 spots, one group, near west edge; 18th, no spots, large faculæ where the group was; 28th, 7 spots, one group a few degrees from SE. limb; 29th, 4 spots, one group. Observations were made, but no spots observed, from the 6th to the 9th, 20th to the 27th, and on 30th and 31st. Mr. David Trowbridge, observing at Waterburg, N. Y., reports, 1st, 2 spots; 3d, 1 spot near west margin; 5th, spot disappeared by solar rotation; 13th, group of at least 2 large and 1 small spots near center; 14th, 1 large spot; on the 10th, 18th, 20th, 24th, 29th, and 31st, no spots were observed. Mr. F. Hess, of Fort Dodge, Iowa, observing "in the San Juan valley, Colorado, reports, 1st, 8 spots in two groups; 2d, one large and two small spots; 12th, one large and one small spot." Prof. G. Hinrichs, in the bulletin of the Iowa Weather Service, reports "a group of spots visible about the middle of the month." Observations were made throughout the month at Fort Whipple, Va., but no spots seen. Mr. H. D. Gowey, North Lewisburg, Ohio, reports "on the 14th, at 7 a. m., local time, one spot quite large and two-thirds across the sun and near its equator."

Published by order of the Secretary of War.

ALBERT J. MYER,
Brigadier General, Brevet Assigned, Chief Signal Officer, U. S. A.

PAPER 34.

MONTHLY WEATHER REVIEW, AUGUST, 1879.

INTRODUCTION.

In preparing this Review the following data, received up to September 13, have been used, viz: The regular tri-daily weather charts, containing the data of simultaneous observations taken at 132 Signal Service stations and 12 Canadian stations, as telegraphed to this office; monthly journals and means 143 and 156, respectively, from the former; reports from 37 sunset stations; 213 monthly registers from voluntary observers; 17 monthly registers from United States Army post surgeons; marine records; international simultaneous observations; monthly reports from voluntary observers in, and the local Weather Service of Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

Upon chart No. II is shown by the isobaric lines the general distribution of atmospheric pressure, as reduced to sea-level, for the month. The barometric pressure, as compared with the means of the seven preceding years, shows that the mean of the entire country has been abnormally low. Cincinnati only shows a normal pressure. The average deficiencies for the various districts are as follows: New England, 0.08 inch; Middle Atlantic states, 0.06, South Atlantic states, from 0.05 on the coast to 0.02 in the interior; Gulf states, 0.07; Tennessee and Ohio valley, 0.02; Lower Lake region, 0.04; Upper Lake region, 0.045; Upper Mississippi and Lower Missouri valleys, 0.06; Northwest, 0.07; Rocky Mountain slope, 0.035; San Diego, Cal., 0.10; San Francisco, Cal., 0.08; Portland, Oreg., 0.11.

The local barometric ranges were as follows: California from 0.25 of an inch at San Diego to 0.48 at Red Bluff; Oregon from 0.51 at Roseburg to 0.63 at Olympia; Northern and Middle Plateaux from 0.59 at Salt Lake City to 0.63 at Boise City; Southern Plateau from 0.34 at Tucson to 0.55 at Phœnix; Rocky Mountain slope from 0.31 at Pike's Peak and 0.40 at Fort Davis to 0.74 at Dodge City and 0.85 at Cheyenne; Rio Grande valley from 0.48 at Rio Grande City to 0.55 at Brackettville; Western Gulf states from 0.55 at Indianola to 0.91 at Shreveport; Eastern Gulf states from 0.26 at Key West to 0.45 at Mobile; South Atlantic states from 0.42 at Augusta to 1.05 at Cape Lookout; Middle Atlantic states, from 0.47 at Philadelphia to 0.99 at Kittykawk and 1.22 at Cape Henry; New England states from 0.51 at Springfield to 1.05 at Eastport, 1.07 at Newport, and 1.13 at Wood's Holl; Ohio valley and Tennessee from 0.51 at Columbus to 0.76 at Cairo; Lower Lake region from 0.46 at Toledo to 0.63 at Oswego; Upper Lake region from 0.50 at Chicago to 0.75 at Alpena; Upper Mississippi Valley from 0.49 at Davenport to 0.64 at Saint Paul; Red River of the North Valley from 0.63 at Pembina to 0.67 at Breckenridge; Lower Missouri valley from 0.63 at Leavenworth to 0.69 at Yankton.

Areas of high barometer.—No areas of high barometer of particular energy have passed over the country during the month, but the four following are the most important:

No. I.—This area was present off the North Carolina coast on the morning of the 1st—Cape Lookout and Cape Hatteras barometers 0.29 abnormally high. This pressure remained nearly stationary until the morning of the 2d. During this time fresh southeast to southwest winds, with partly cloudy weather and no rain, prevailed in the South Atlantic states, and fresh variable winds, mostly southerly, were reported from the Gulf states, with heavy rainfalls; that at Saint Marks amounting for the twenty-four hours ending at the afternoon report of the 1st to 10.81 inches, being probably the heaviest ever reported from the Signal Service station in one day. On the 2d the pressure gradually dissipated, during which day fresh southerly winds, with cloudy weather and rain, generally prevailed in the South Atlantic states.

No. II.—At midnight of the 8th the area of high barometer, which had gradually appeared during the 7th and 8th in the extreme Northwest, was just within the limits of the Signal Service stations, and was central in Dakota—Breckenridge barometer 0.36 above the normal. Moving southeastwardly on the morning of the 9th it was central in the Lower Missouri valley—Leavenworth barometer 0.24 above the normal. On the morning of the 10th there was but slight change in the location of the center, but the area had extended eastward, and cool, clear weather prevailed over the whole country, except the Gulf states. A minimum temperature of 43° was reported at Saugeen. Its general path during the day was easterly; at the morning report it was central in Virginia—Lynchburg barometer 0.18 above the normal. By the morning of the 12th the area was passing over the North Carolina coast in advance of low area No. IV. This area induced minima temperatures generally in Texas, for parts of the Lower Lake region, generally in Tennessee, the Ohio valley, the Middle and South Atlantic states, and parts of New England.

No. III.—The afternoon of the 14th an area of high pressure suddenly appeared in the Upper Lake region. At midnight of that date the pressure at Bismarck was 0.17 above the normal. At that time, in connection with this area and low area No. V, then forming in the Southwest, brisk north to east winds prevailed in the Upper Lake region, with maximum velocity of NE. 27 miles at Escanaba. During the 15th the area extended itself gradually eastward over the Lake region, while low area No. V moved slowly eastward. Brisk to high east to northeast winds, with cloudy weather and rain, prevailed in the Lower Lake region. Signals hoisted in the afternoon of the 16th were fully justified, as shown in the description of low area No. V. During the 17th this area gradually dissipated, while low area No. V disappeared. This area produced the minima temperatures of the month for the Northwest, the Upper Missouri valley, the Lake region, parts of the Mississippi valley, and New England. Frosts were reported on the 16th from stations in Iowa, Wisconsin, and Michigan, in which latter State some damage was done on low grounds to vegetation, particularly in Lansing and surrounding townships.

No. IV.—This area appeared in the Northwest on the morning of the 26th in the rear of low area No. IX. Moving very slowly southeastward it was central during the 28th in Tennessee and the Ohio valley. Generally cool and partly cloudy weather with no dangerous winds marked its passage during these dates. It remained nearly stationary until the 30th—Cincinnati barometer fluctuating from 0.15 to 0.30 above the normal. On the morning of the 31st it had disappeared.

Areas of low barometer.—Eleven areas have been sufficiently marked to merit description, but the centers of only six have followed tracks well enough defined to enable them to be properly located from reports yet received. The tracks of these six are shown on Map No. I.

No. I was a continuation of area No. IX, described in the July REVIEW. Its course during August was too far north of the signal service stations to allow accurate charting. On the morning of the 1st it was central in southeastern Dakota, and by afternoon it had probably moved into Manitoba, its progress being marked by little precipitation and brisk SW. winds on Lake Michigan, a maximum velocity being reported from Milwaukee of SW. 26 miles at that time. During the 2d it apparently moved eastward through the country north of the lakes, during which day light rainfalls and fresh to brisk SW. and W. winds were reported from the Lake region. On the morning of the 3d it probably passed over the Gulf of Saint Lawrence to the north of the Canadian maritime stations. The lowest abnormal pressure, at a regular report, during its passage was—0.32 at Father Point, midnight of the 2d. No signals were displayed in connection with the passage of this area.

No. II.—On the afternoon of the 3d a barometric fall was reported from the Rocky Mountains eastward over the whole country, except a slight rise in Illinois, the Lower Lake region and Saint Lawrence valley, the depression being most rapid in Kansas and Nebraska. At that time cloudy weather, with rain-fall, was reported from all districts east of the Rocky Mountains, except the Northwest and Tennessee and Ohio valley, and fresh to brisk N. to W. winds prevailed in the Lower Lake region, with a maximum velocity of N. 29 miles reported from Sandusky. Brisk westerly winds also were reported from the Middle and South Atlantic states, with a maximum velocity of S. 33 miles at Barnegat. At midnight the pressure was reported as decreasing from the Northwest and Upper Lake region to the Western Gulf states. Brisk westerly winds, with cloudy weather, prevailed in the Lower Lake region, with a maximum velocity of SW. 26 miles at Sandusky, and partly cloudy weather with brisk NW. winds were reported from the South Atlantic coast, with a maximum velocity of SW. 27 miles to Kittyhawk. The barometer continuing to fall in the Lower Missouri Valley on the morning of the 4th, a well-defined depression was central in southeastern Nebraska; Omaha barometer 0.18 abnormally low. At this time the barometric fall was general east of the Rocky Mountains, except in New England, and cloudy weather, with rain, prevailed over the Lower Lake region, where the pressure had not fully recovered from the effects of low area No. I. During the 4th the pressure fell generally over the Lake region, the Mississippi valley, and the Atlantic States, leaving no well-marked center at midnight, at which time partly cloudy weather and gentle to fresh westerly winds prevailed in the Lake region, with a maximum velocity of NW. 30 miles at Escanaba, and cloudy weather, with rain and fresh to brisk westerly winds, in the Middle Atlantic and South Atlantic states, with maxima velocities of N. 36 miles at Sandy Hook and SW. 34 miles at Cape May. On the morning of the 5th the pressure was below the normal over the whole country, except on the Gulf and South Atlantic coasts, being lowest—and still falling—over the Lake region and New England, where partly cloudy weather and fresh S. to W. winds prevailed. During this time a very low pressure probably prevailed north of Ontario. On the morning of the 6th the reports showed for the preceding 24 hours a generally-decreasing pressure from the Northwest to the Atlantic Ocean, accompanied by generally cloudy weather, and rain-fall in all districts except that of the Upper Lakes. The pressure was then least in the Saint Lawrence valley—Father Point barometer 0.42 inch abnormally low—where clear weather and gentle to fresh W. and SW. winds prevailed. From the afternoon of the 6th to the morning of the 7th the depression was central over the Gulf of Saint Lawrence—the Sydney barometer at the last report 0.69 below the normal—while partly cloudy weather and fresh to brisk NW. winds were reported from New England and the Saint Lawrence valley, none dangerous. No signals were displayed during the passage of this area.

No. III.—This area formed from the remains of low area No. II. It was apparently central north of Lake Superior the afternoon of the 6th—Marquette barometer 0.18 abnormally low—at which report fresh to brisk southerly winds prevailed in the Upper Lake region, with partly cloudy weather. At midnight of the 6th central over the northern portion of Lake Michigan—Escanaba barometer 0.18 below the normal—it reached, with increasing depression, Lake Huron the morning of the 7th—Alpena barometer 0.23 abnormally low. Meanwhile partly cloudy weather in the Lower Lake region and rain from Ohio to New Jersey were reported. Moving southeast, it was central over the western end of Lake Ontario the afternoon of the 7th, whence changing its course to the northeast—with pressure still decreasing—it reached eastern Ontario at midnight—Kingston barometer 0.32 below the normal. At that time the abnormal isobar of —0.20 embraced within its limits the Middle Atlantic states and Lower Lake region, over which districts cloudy weather and rain prevailed. In the afternoon a maximum velocity of NW. 28 miles was reported from Grand Haven. At midnight brisk NW. to SW. winds prevailed in the Lower Lake region, with maxima velocities of N. 28 miles at Port Huron and Sandusky, and brisk southerly winds on the New Jersey and North Carolina coasts, with maximum velocity of SW. 32 miles at Cape Lookout. The morning report of the 8th showed a long barometric trough extending from Maryland to Canada central in Quebec. Cloudy weather was reported in the Middle Atlantic states and New England. Brisk northwest winds prevailed in the Lake region—maxima velocities NW. 28 miles at Port Huron and N. 28 miles at Sandusky, while brisk westerly winds, with maximum velocity of SW. 32 miles at Cape Lookout, were reported from the Atlantic coast. On the afternoon of the 8th it was central in the Lower Saint Lawrence valley—Quebec barometer 0.26 below the normal—with brisk northwest winds prevailing from Michigan to New Jersey and brisk southwest winds on the North Carolina coast. Maxima velocities of NW. 28 miles at Alpena and S. 28 miles at Cape Lookout were reported. Moving slowly northeast its position at midnight was but slightly changed. Cloudy weather, with rain and brisk variable winds, continued on the North Carolina coast, where a subsidiary depression apparently existed. Variable winds of maxima velocities of 25 and 26 miles were reported from that coast. The morning report of the 9th showed that the center had passed northeastward beyond the Canadian maritime stations. No signals were displayed during the passage of this area.

No. IV.—The morning reports of the 10th showed that the pressure had generally decreased from the Northwest to the Gulf of Mexico. Partly cloudy weather, with southerly winds, prevailed in the Upper Mississippi and Lower Missouri valleys, and rain was reported from Manitoba and Michigan. On the afternoon of the 10th a slight depression was central in the valley of the Red River of the North. The midnight reports showed the pressure decreasing in the Lower Missouri and Upper Mississippi Valleys, where fresh southerly winds and generally clear weather prevailed, while from the Lake region slight precipitation was reported. The depression was then central in Western Minnesota—Breckenridge barometer 0.14 abnormally low. Moving southeast very slowly and with little energy, it was central in Northeastern Iowa at midnight of the 11th—La Crosse barometer 0.20 below the normal. Its progress during the 11th was marked by fresh to brisk southerly winds, cloudy weather, and light rain in the Upper Lake region and Upper Mississippi valley, with generally clear weather prevailing from the Lower Lake region to New England. Changing its course at midnight of the 11th to the northeast, and passing with increased pressure the morning of the 12th through Wisconsin, it was central that afternoon over the eastern part of Lake Superior. At that time cloudy weather and rain prevailed over the Upper Lake region, and brisk southerly winds on Lakes Michigan and Huron, with a maximum velocity of SW. 25 miles at Milwaukee. At midnight the center had passed northeast into Canada. Cloudy weather then prevailed over the Lake region—with heavy rainfall in upper part—with brisk S. to W. winds, a maximum velocity of W. 48 miles being reported from Milwaukee. The course of the depression during the 13th was through Canada too far north to allow its center to be accurately located by reports yet received. During the 13th it caused in the Lower Lake region cloudy weather and rain with brisk S. and SW. winds, maxima velocities of SW. 27 and 28 miles being reported from Oswego at afternoon and midnight, respectively. At the morning report of the 14th the center, with decreased pressure, was in the Lower Saint Lawrence Valley—Quebec and Father Point barometers 0.46 below normal. Brisk southerly winds with cloudy weather then prevailed in New England, and cloudy and rainy weather with westerly winds in the Saint Lawrence valley. On the afternoon of the 14th it had passed over the Gulf of Saint Lawrence, cloudy weather and occasional rain, with brisk westerly winds, being reported from New Jersey to the Gulf of Saint Lawrence, with a maximum velocity of W. 25 miles at Boston.

No. V.—The barometer fell steadily from Kansas to Texas from midnight of the 13th to midnight of the 14th, at which latter time a depression existed central in Indian Territory—Denison barometer 0.15 below the normal. Moving east to Central Arkansas the morning of the 15th and thence northeastward, its center was in the Tennessee Valley the afternoon of the 15th at which time cloudy weather and rain prevailed in the Atlantic States, Lower Lake region, Tennessee, and Ohio valley. Brisk to high northeast winds were reported in the Lower Lake region, and brisk southeast on the Atlantic coast, with maxima velocities of E. 25 miles at Kittyhawk and NE. 40 at Sandusky. Cautionary signals were ordered from Smithville north along the Atlantic coast to include New York, and also for all stations on Lakes Huron, Erie, and Ontario. The course of the center changing to the north, at midnight of the 15th was in the Ohio valley—Louisville barometer 0.21 abnormally low. At that time the Lower Lake reports showed brisk to high northeast winds—Sandusky maximum velocity NE. 27 miles—with cloudy weather and rain, while on the New Jersey and North Carolina coasts brisk east and southeast winds, cloudy weather, and rain prevailed. Moving northeastward the depression on the morning of the 16th was central in Western Pennsylvania, with slightly decreased pressure—Pittsburgh barometer 0.24 below the normal. Cloudy weather and rain generally prevailed, with brisk to high winds, northeast in Lower Lake region, easterly in New England and on Middle Atlantic coast, and southerly on North Carolina coast, with maxima velocities reported at Cape Hatteras SW. 26, Sandy Hook SE. 36, Toledo NE. 26, and Sandusky NE. 59 miles. Cautionary signals were continued on the South and Middle Atlantic coasts, and were ordered for all New England stations. The position and conditions of this depression had changed but slightly at midnight. Cloudy weather and rain prevailed in the Lower Lake region and Atlantic states, with brisk southerly winds on the New Jersey and North Carolina coasts—maxima velocities S. 25 at Cape May, S. 28 at Cape Lookout, NE. 28 at Toledo, and 26 miles at Sandusky. The signals for Lake Huron and at Toledo were then lowered, having been justified by reported velocities of 25 and 20 miles, except at Alpena. At midnight, the center being in New York, brisk southerly winds, with maxima velocities of S. 26 at Cape May and S. 28 miles at Kittyhawk, were reported, with partly cloudy weather for the Middle and South Atlantic coasts, while fresh northeast winds and rainy weather generally prevailed in the Lower Lake region. On the morning of the 17th the depression, nearly stationary and central in New York, was evidently filling up, and signals from Eastport southward along the coast, to include New York, were lowered. On the afternoon of the 17th signals along the coast from Sandy Hook to Kittyhawk were lowered, leaving signals displayed at Smithville, Wilmington, Macon, Cape Lookout, and Cape Hatteras in advance of low area No. VII.

No. VI.—This area appeared on the Southern Pacific coast on the 15th, and moving slowly northward, attained its minimum of pressure at Portland, Oreg., midnight of the 18th—barometer 0.35 below the normal. Its course cannot be accurately charted; its passage was attended by partly cloudy weather and no precipitation. The pressure increased somewhat during the 19th. At midnight of the 19th and morning of the 20th rain was reported from Olympia, which, extending southward, reached Roseburg by the morning of 21st. Reports at that time showed that during the past

24 hours the barometer had fallen, ranging from 0.20 at Roseburg to 0.26 at Olympia, the latter being 0.44 below the normal. Light rain fell during the 21st from Olympia southward to San Francisco, and also in western parts of Nevada and Idaho, while the pressure steadily increased on the Pacific coast, and the center, moving eastward into the Plateau districts, was filled up during the 22d.

No. VII.—A few reports already received from the West Indies, Bahamas, and vessels at sea seem to indicate the existence of this storm for some days previous to its appearance on the Atlantic coast, but are not sufficient to justify the charting of its center, as yet, farther southeast than shown on chart. The paucity of reports may be, in part, attributed to the small area of the storm. The barometer fell slowly at the Florida stations during the 16th until midnight, when the pressure became stationary. Partly cloudy weather and variable winds prevailed until midnight, when a calm was reported from Havana, fresh northwest winds from Key West, and brisk north from Punta Rassa. On the morning of the 17th an abnormal barometric fall of 0.07 was reported from Jacksonville, Punta Rassa, and Saint Mark's. The wind at Saint Mark's remained southwest, but at Jacksonville changed to brisk north. Clear or partly cloudy weather prevailed along the coast from South Carolina to Cuba. The afternoon (17th) report showed a stationary barometer in the South Atlantic states and Florida, except a sharp fall at the coast stations from Smithville to Jacksonville; the latter barometer 0.28 below the normal. Clear, calm weather prevailed at Havana; fresh west winds and partly cloudy weather at Key West and Punta Rassa; fresh northwest winds and partly cloudy weather, with a light rainfall, at Saint Mark's; gentle northeast and east winds, partly cloudy weather, from Charleston to Jacksonville, with moderate rainfall at Charleston and Savannah. A very heavy local rain of 1.45 inches, with a northeast wind, was reported from 2.23 to 5.30 p. m. at Gulf Hammock, western coast of Florida. The depression was then probably central some 200 miles east of the central Florida coast. The cautionary signals displayed in connection with area No. V were ordered down except from Cape Hatteras south to include Smithville, which remained displayed for this depression. During the day at Cape Lookout "a tremendous southeast sea-swell broke on the beach all day, with an unusually high tide in the afternoon." At Savannah heavy rain fell from 11.25 a. m. to 6 p. m., with southeasterly wind backing to northwest during the afternoon. At 7.50 p. m. the gale commenced at Cape Lookout with a heavy southeast rain-squall, which lasted until 10.05 p. m. At 10 p. m. the gale commenced at Macon. The schooner *Abbie K. Bentley*, which passed Hatteras at 8 p. m., going north, experienced fresh breezes at midnight, which obliged light sails to be furled. At midnight of the 17th the reports showed a stationary or rising barometer over the whole country east of the Mississippi river, except in Georgia, South Carolina, and the southern part of North Carolina, with the greatest abnormal fall of 0.17 at Charleston (barometer 0.35 below the normal). Brisk to high southeast winds and cloudy weather prevailed from Cape Hatteras to Cape Lookout, brisk east and northeast winds from Smithville to Charleston, with heavy rain and a brisk northwest wind at Savannah. Clear weather, with gentle northeast winds, prevailed over Florida and the interior of Georgia. High winds were reported on the Carolina coast ranging from NE. 25 at Charleston to SE. 32 miles at Cape Lookout. The storm-center was then off the South Carolina coast. Cautionary signals were then ordered at Cape Henry and Kittyhawk. The gale after midnight increased at Smithville, the wind backing to northeast, with heavy rain and rapidly falling barometer. Between 3 and 4 a. m. (18th), the wind backed to northwest with increasing force, and at the same time (3.15 a. m.) the gale commenced at Wilmington. At 4 a. m. at Cape Henry the wind, which had been southwest, died away to a calm, and rain commenced, followed immediately by light north and northeast winds. At 5 a. m. the wind reached its greatest velocity, 37 miles NW. at Smithville, and at 5 a. m. at Wilmington W. 68 miles. At that time (5 a. m., 18th) at Cape Lookout, the wind had increased to SE. 80 miles, the rain fell in torrents, and a fearful sea swept away the stable and outbuildings. Schooner *Seychelle* came ashore as wind veered to southwest, and although drawing 12 feet was carried, a total wreck, above the highest tide mark, over ground never remembered to have been overflowed before. After 5 a. m. the wind and rain abated at Smithville, with 2.10 inches rainfall in preceding ten hours. At 6.30 a. m. (18th) at Macon, the anemometer registered 80 miles and then the electrical connections failed. At 6.30 a. m. the barometer at Cape Lookout, which, at 6 a. m., was 29.22 had fallen to 29.15, and the anemometer cups were blown away, the wind then blowing at the rate of 138 miles per hour. The barometer remained at 29.15 till 7 a. m., the wind and sea still increasing. By 7.30 a. m. the barometer had risen to 29.18 with wind at its greatest force—an estimated velocity of SW. 165 miles. At Portsmouth, N. C., the wind at 6.30 a. m. had attained a velocity of SE. 49 miles. The 7.35 a. m. reports showed the cyclone central inland of the North Carolina coast stations, lowest pressure, Cape Lookout 29.24,—0.75 below the normal and a gradient of 0.30 between that station and Cape Hatteras. Signals were ordered from Norfolk north along the coast to include Boston. Heavy rains had set in about 2 a. m. at Cape May, at which station the barometer at this report was 0.18 below the normal. At 8.45 a. m. the wind at

Portsmouth, N. C., was SE. 97 miles when the recording apparatus became temporarily disabled. At Macon the wind veered to SW. at 8 a. m. (18th) and the tide rose four feet above the ordinary high tide. At 8.30 a. m. the wind reached its maximum recorded velocity at Cape Hatteras, SE. 74, when the cups were blown away, and at Kittyhawk at 9.50 a. m., SE. 100 miles. The gale continued at Wilmington until 10 a. m., with a total rainfall of 4.60 in 6½ hours. At Norfolk, at 10.45 a. m., the barometer had fallen in preceding hour from 29.58 with NE. 24 miles to 29.16 NE. 48. At 10 a. m. (18th) schooner *A. K. Bentley*, latitude 37° 26′ N., 74° 2′ W., which had been compelled at 8 a. m. to close-reef sails, experienced brisk, southeast winds, which increased rapidly in force, at 11 a. m. blowing a southeast hurricane, which carried away jib and obliged her to take in nearly all sail. At noon the wind was hardest ever experienced, rain very heavy and waves estimated at 40 feet from trough to crest. At 2.20 p. m. (barometer compared with Signal Service at New London and found to be an excellent instrument) read 29.20. Hurricane increased to 3 p. m., when it carried away mainsail and obliged her to scud under bare poles. Wind blew violently until 4.30 p, m., when it settled down to severe gale, little north of west, until 8 p. m. At 11 a. m., the wind at Cape Henry had reached a velocity of N. 66 miles, when it moderated for a short time to 35 miles, and shifted to northwest, blowing with hurricane violence 70 miles at 11.30 a. m. At 11.15 a. m. (probably the time the wind lulled at Cape Henry) the Norfolk barometer reached 29.12, lowest point, and the wind fell to NE. 39. The barometer had risen at 11.30 a. m. and 11.45 a. m. to 29.13 (NE. 34) and 29.20 at which latter time the wind changed to north and attained its maximum velocity, 72 miles. During this half hour the greatest part of the damage, at Norfolk, and its vicinity, was done. At 12.30 p. m. the rising mercury reached 29.42 while the wind backed to NW. 60. At the same hour (12.30 p. m., 18th) at Cape Henry the wind had reached a velocity of NW. 76 when the anemometer cups were carried away. The wind increased steadily, and about 2 p. m. attained its greatest velocity—estimated at NW. 100. At Johnsontown, eastern shore, Virginia, about 35 miles north of Cape Henry, the barometer was at its minimum between 12.30 and 1.30 p. m. The wind on that day (18th) was heavy NE. until noon and then "shifted" to NW. with heavy gusts. Thirty panes of glass were blown from the observer's house *outward against* the wind's direction. The bark *Eliza J. McManeny* at noon (18th) 45 miles southeast of Five Fathom Bank lightship, reported barometer, early in the day, falling very rapidly, with SE. wind and rain in torrents. At 2 p. m. the wind ceased blowing from the SE. leaving a terrific sea, and suddenly the wind came out of the NW. and blew "a perfect cyclone" for two hours. At Atlantic City the maximum recorded velocity NE. 60 miles was at 3 p. m., after which time the flooded battery failed to record, and at Barnegat N. 64 miles about 5 p. m., at which time 5.39 inches rain had fallen in nine hours. The U. S. S. *Wachusett* reports that 4 a. m. (18th) off Virginia capes, barometer stood 30.04. SSE. wind, force 2, and squally weather and moderate swell; 8 a. m. barometer 30.03, 10 a. m. 30.01, weather unchanged. At noon position 38° 45′ N. 73° 51′ W., wind E. force 6, ship heading NNE. At 2 p. m. headed E. by N., barometer 29.71, E. wind, force 9, sails furled. At 4 p. m. barometer 29.46, wind SE., force 10. At the afternoon report of the 18th (4.35 p. m.), the pressure was central about 100 miles east of Barnegat. At that time cautionary signals were ordered up at Portland and Eastport. The signals displayed at Baltimore and on the North Carolina coast, from Smithville to Cape Lookout inclusive, and at Kittyhawk, were lowered. From Lewes northward along the Atlantic coast, to include New York, the cautionary signals were changed to off-shore. At 4 p. m. the wind, which had been increasing steadily at Cape May during the day, attained a velocity of N. 60 miles and shortly after the wind backed to west, and the rain—which had commenced at 2 a. m. (18th) ceased—total amount 8.46 inches. At this report, New England, where heavy rains, east and northeast winds had prevailed for preceding day in connection with the remains of low area No. V, felt the influence of the advancing depression as far north as to include the greater part of Massachusetts. The storm commenced at New Haven about noon, soon increasing to a severe northeast gale which soon backed to N., and at 9.20 p. m. blew 33 miles. Rainfall in 15 hours 4.15 inches. At New London a sharp barometric fall since noon was shown by the 2 p. m. report, when a heavy rain-storm set in with heavy gusts from the N. and NW.—the heaviest from the N.—attaining a velocity of 37 miles about midnight. At Sandy Hook the minimum barometer and highest wind occurred at 9 p. m. (18th) 29.59, NW. 52 miles. At New York City, however, the maximum velocity was but NE., 24 miles during p. m. 18th. At 5.30 p. m. the U. S. S. *Wachusett*, about 39° N., 73° 30′ W., reported the barometer fallen to 29.15—a fall of 0.86 inch in seven and one-half hours—wind SE. by E., force 11. Then fell a calm with confused, heavy seas. At 5.45 p. m. light airs from NNW., and then a hurricane from NW., until 10 p. m. At 6 p. m. barometer 29.32 (a rise of 0.17 in 30 minutes), NW. wind, force 11. At 8 p. m. barometer 29.52, wind force 12. At midnight wind moderated, W. by N., force 7, barometer 30.08, a rise of 0.93 inch in six and one-half hours. The U. S. S. *Constellation* left Newport 2 p. m., August 18th, barometer at noon 30.02, slowly falling to 29.96 at 3 p. m. Rounded Point Judith, 4 p. m. barometer 29.90 and 5 p. m. 29.80 with very heavy rain and NE. squalls;

shortened sail. Shortened sail still further between 6 and 7 p. m., wind increasing, barometer 6 p. m. 29.75, 7 p. m. 29.63. Could not see Red Flash Race Light although less than a mile distant. Wind increased to whole gale, backing slowly, and barometer fell rapidly—at 8 p. m. 29.43 and 9 p. m. 29.32. Between 8 p. m. and midnight obliged to take in all but storm sails, send down yards, and bend sheet cables. 9 p. m. barometer 29.30 and 10 p. m. 29.25, 10.15 p. m. 29.23 (lowest point), 11 p. m. 29.27, midnight 29.35 (rain ceased), 1 p. m. (19th) 29.48, 1.30 p. m. 29.50, at which time wind moderated very much, 2.30 a. m. 29.61. At 10 p. m. the bark *Glint*, 20 miles SSW. of Fire Island, had a hurricane from ESE. to NNW., lasting an hour and a half. At the midnight report (18th) the storm was central just east of Long Island. The signals then displayed from New Haven, at all coast stations east and north to include Portland, were then changed to off-shore signals. Assistant Surgeon W. M. Mew, on steamer *Johns Hopkins*, 20 miles north of Chincoteague, forwards the following observations: 18th, a. m., very heavy rains, barometer (aneroid, compared before and after the storm with mercurial standard) stationary at 29.95 till 12.30 p. m., wind SSE.; 1 p. m., half a gale from SE. by S., barometer 29.80; 1.30 p. m., whole gale from ESE., barometer 29.65, very heavy sea. From this time the barometer fell with almost incredible rapidity, standing at 29.05 at 2 p. m; at 2.15 p. m. the wind suddenly died out and at 2.30 p. m. was almost calm, barometer 28.90, sun occasionally seen; at 2.50 p. m. the wind blew with great fury from NNW. and the barometer rose as rapidly as it had fallen; 5 p. m. moderate weather. The storm commenced from New Bedford, Mass., to Portsmouth, N. H., at about 8 p. m. At that time the barometer at New Bedford stood at 29.48 with a strong E. by S. wind, which increased to a gale by 10.30 p. m. At midnight a calm, probably at the center of the depression; at 12.20 a. m. (19th) the barometer had reached its minimum 29.05. The wind then recommenced with great violence (direction not given but probably NW.) and attained its maximum force between 2 and 3 a. m. At 5 a. m. (19th) the barometer had risen to 29.62, and a strong W. by S. wind prevailed. At Newport the storm commenced about 8.30 p. m.; the wind attained by 11 p. m. a velocity of 26 miles NE. At 11.23 p. m. (18th) the center was probably very near the station, the barometer standing at 29.11—a fall of 0.72 inch in the preceding 6 hours and 25 minutes—and the wind lulled to 6 miles per hour. At midnight the wind shifted to violent northwest, attaining a velocity of 44 miles at 2 a. m., and the barometer rose with a rapidity equal to its fall, showing 8½ hours later a rise of 0.71 inch. At Wood's Holl the storm which began at 8.15 p. m., reached its height at 2.30 a. m. (19th), when the wind blew at the rate of 56 miles from the northwest. The midnight report showed a barometric fall of 0.78 inch in 6½ hours. At Boston the gale which had commenced at about 6 p. m. was extremely severe; the wind attained its highest velocity NE. 44, at 11.30 p. m. At Thatcher's Island, commencing at 8 p. m., the storm was at its height at 3.40 a. m. (19th), the wind blowing 54 miles NE. The barometric fall at midnight report of 18th was 0.42 inch in preceding 6½ hours. At Highland Light, Cape Cod, the gale continued from 5 p. m. (18th) until 10 a. m. (19th), being the severest for years; the wind attained a velocity of 40 miles. At Newburyport, Mass., the storm commenced about 8 p. m. and from 9 to 12 p. m. (18th) a veritable hurricane was reported to have prevailed. The barometer at 10 p. m. (local time) was 29.62 showing a fall of 0.43 inch in preceding 7 hours. The barometer must have been much lower during the night, as at 6 a. m. (19th) it stood at 29.55. At Portsmouth, N. H., commencing at 8 p. m. (18th), the gale lasted only until 3 a. m. (19th), the wind attaining its maximum velocity NE. 50 miles, at midnight. The 7.35 a. m. report of the 19th showed the cyclone central a short distance south of Eastport, at which station heavy rain, barometer 29.30—0.70 below the normal, and wind E. 54 miles were reported, while at the remaining New England and the Middle Atlantic stations brisk to high NW. winds and clear or clearing weather prevailed. Signals were ordered down from New York eastward and northward to include Boston and also at Cape Hatteras. The signal at Eastport was changed to off-shore. At Portland, Me., a heavy rain had commenced and a northwest gale sprung up early in the morning. At 7 a. m. (local time) the barometer stood at 29.53, fall of 0.48 inch in 17 hours, with a NW. wind of 20 miles, and a rainfall of 2.03 inches in 15 hours. At 8 a. m. (morning report of 19th) the barometer had risen to 29.55 with wind NW. 24 miles. The maximum wind velocity NW. 42 miles occurred at 4 a. m., 19th. At Eastport the barometer continued to fall, standing at 10.30 a. m. (19th), 29.20 NE. 34 miles; at 11 and 11.15 a. m. 29.16 (lowest) NE. 34 and 32 miles; 12 m. 29.19 N. 21; 1 p. m. 29.29 NW. 34; 2 p. m. 29.37 NW. 26; 3 p. m. 29.45 NW. 27; at 5.15 p. m. (afternoon observation) 29.56 NW. 36. Heavy rain prevailed until 12.30 p. m. and then light rain until 4.30 p. m. The barometer at 11.15 a. m. had fallen 0.95 inch in 27 hours. At the afternoon report (19th) the storm had passed into New Brunswick—Halifax barometer 0.42 below the normal. Signals were lowered from Lewes northward to include all displayed, except at Eastport, which were lowered at midnight. By midnight of the 19th the storm was probably central over the Gulf of Saint Lawrence, moving northeast.

This storm is especially interesting on account of the rapid and extreme fluctuations of pressure and the attending phenomena near the immediate center.

The following tabulated statement shows the most marked phenomena attendant on its passage as compiled from reports now at hand:

Place.	Barometer.					Wind.				Time of occurrence of central calm, 18th.	Total rain fall.
	Lowest reading.	Fall.		Rise.		In front of storm.		In rear of storm.			
		Inch.	H. m.	Inch.	H. m.	Direction.	Max. vel.	Direction.	Max. vel.		
Macon	......	......	......	......	......	SE.	*100	......	......	......	......
Lookout	29.17	0.73	8.00	0.72	7.00	SE.	*138	SW.	*165	......	4.29
Norfolk	29.12	0.56	4.15	0.75	5.15	NE.	48	NW.	60	......	6.03
Cape Henry	29.05	0.68	4.30	0.80	4.30	N.	65	NW.	100	11.10 a. m.	4.62
Steamer Johns Hopkins, 20 miles N. of Chincoteague	28.90	1.05	2.00	......	......	E.	*60	NNW.	*90	2.30 p. m.	Very heavy.
Cape May	29.51	0.41	6.30	0.40	9.00	N.	64	NW.	60		8.46
Schr. A. K. Bentley, 38° N. 74° W	29.20	......	......	......	......	SE.	*90	......	......	3 p. m.	Very heavy.
U. S. S. Wachusett, 39° N. 74° W	29.15	0.85	5.30	0.93	6.30	SE. by E.	†75	NNW.	†90	5.45 p. m.	......
U. S. S. Constellation	29.33	0.79	10.15	0.38	4.15	......	†65	......	......	......	Torrents.
Newport	29.11	0.72	6.25	0.71	8.30	N.	26	NW.	44	11.23 p. m.	1.96
New Bedford	29.05	0.84	10.20	0.57	4.40	E. by S.	*50	NW.	*50	Midnight.	1.74
Wood's Holl	29.08	0.78	6.30	0.70	8.38	ESE.	40	NW.	56	......	2.40
Eastport	29.16	0.95	27.00	0.67	12.30	E.	56	N.	38	......	3.34

*Estimated. †Converted from a scale of 0 to 12.

The amount of damage done by this storm cannot be enumerated in detail within the limits of this review. The injury to inland property over sections traversed by the immediate center was very extensive. Fortunately this damage was confined to the track of the storm-center itself, and consequently, its area was quite limited. The damage to maritime property must have been enormous; reports already at hand show that over one hundred large vessels were shipwrecked or suffered serious injury, while the number of yachts and smaller vessels which were destroyed or seriously damaged must certainly exceed two hundred.

No. VIII.—During the 20th the barometer fell steadily in the Northwest, and at midnight a depression was central in western Dakota, at which time Bismarck reported barometer 0.19, abnormally low, and a heavy local rainfall. On the morning of the 21st the area was central, with decreased pressure, in Eastern Dakota—Breckenridge barometer 0.35 below the normal. Cloudy weather and occasional rain, with fresh to brisk southerly winds, then prevailed over the Upper Lake region. By that afternoon it had moved southeast into Minnesota with no change of pressure, when partly cloudy weather, occasional rains, and brisk southerly winds were reported from the Upper Lake region, with maxima velocities of SW. 26 miles at Milwaukee and S. 25 at Grand Haven. Moving slowly east through Wisconsin, the night of the 21st it was central, with decreased pressure, over Lake Michigan the morning of the 22d—Escanaba barometer 0.42 below the normal. At that time rain and partly cloudy weather were reported from the Upper Lake region, clear or partly cloudy weather from the Lower Lake region, cloudy weather and rain from New England and Saint Lawrence valley, and brisk southwest winds from Wisconsin to New England—maximum velocity SW. 28 miles at Milwaukee. The area was central that afternoon over Lake Huron; brisk southerly winds still continuing from the Lower Lake region to New England, with maxima velocities of SW. 28 miles at Sandusky, 27 at Cleveland, and 34 at Milwaukee; there was but little precipitation reported save in Saint Lawrence valley. Moving northeast, the center reached the Saint Lawrence valley at midnight—Montreal barometer 0.54 below the normal. Generally clear weather prevailed from the Lower Lake region to New England, with brisk SW. winds in the Middle Atlantic states and New England, and maxima velocities reported of S. 27 miles at Cape May and W. 32 at Port Huron. The center moving northeastward, the morning of the 23d was in the lower Saint Lawrence valley with decreased pressure—Father Point barometer being 0.63 below the normal. Brisk southwest winds prevailed from Middle Atlantic states to New Brunswick, with partly cloudy weather. By afternoon the center was over the Gulf of Saint Lawrence. No signals were displayed during the passage of this area.

No. IX.—During the 20th and 21st a low pressure prevailed over the Gulf of Mexico, and on these days brisk easterly winds, cloudy weather, and occasional rain were reported along the Gulf coast. At midnight of the 21st cautionary signals were ordered at Mobile, Port Eads, New Orleans, and Galveston. On the morning of the 22d the abnormal isobar of —0.20 inch included Louisiana and the greater part of Texas—Galveston barometer 0.31 below the normal. Brisk east to north winds prevailed from Saint Mark's to Galveston along the Gulf coast, with cloudy weather and occasional rain. Cautionary signals were then ordered for Indianola. During the day the barometer fell rapidly over the whole Gulf region, and at the afternoon report cloudy weather and rain generally prevailed, with brisk southeast winds from Key West to New Orleans, and brisk northwest winds on the Texas coast, with maxima velocities of NW. 27 miles at Indianola, NW. 38 at Galveston, and SW. 36 at New Orleans. The depression was then central in the northwest part of the Gulf of Mexico —Galveston barometer 0.48 below the normal. Very heavy rainfalls of 1.55 at New Orleans and 2.27 inches at Mobile in past 8 hours were reported. The barometer continued to fall at Galveston until 7 p. m. of the 22d, then reading 29.34, or 0.55 abnormally low. At midnight of the 22d, the course of the depression having changed from northwest to north, it was central in eastern Texas, northeast of Galveston, at which station the barometer was 0.48 below the normal. Cloudy weather and rain prevailed in the Gulf states, with brisk easterly winds, except in southern Texas, where northerly winds, with maxima velocities of N. 28 miles at Indianola and W. 36 at Galveston were reported. Moving slowly north with decreasing pressure the area was yet central in eastern Texas the morning of the 23d—Shreveport barometer 0.73 below the normal. Cloudy weather, with rain and brisk southeast winds, were reported from the East Gulf states, with a maximum velocity of SE. 30 miles at Mobile; partly cloudy weather, with north to west winds, in Texas, and cloudy, rainy weather, with heavy rainfalls, in Tennessee. Signals were then lowered at Galveston and Indianola, having been justified by velocities of NW. 28 miles at Indianola, and NW. 38 at Galveston. By afternoon of the 23d the center, moving slowly with increasing pressure, had reached southern Arkansas—Shreveport barometer 0.60 abnormally low. Cloudy weather, with southerly winds, generally prevailed east of the Mississippi river and south of the Lake region. Cautionary signals were then lowered at Port Eads, New Orleans, and Mobile, having been fully justified by velocities of SE. 30 miles at Mobile and SE. 40 at New Orleans. Moving slowly NNE. the depression at midnight was in central Arkansas, with existing conditions slightly changed, except in the Lower Lake region, where the winds changed from SW. to NE. On the morning of the 24th the center was in northeastern Arkansas—Cairo barometer 0.56 below the normal. Cloudy weather, with generally light rainfall and southerly winds, were reported from the Atlantic and Gulf states, and cloudy weather, with brisk northwest winds, in the Lower Lake region—maxima velocities NE. 25 miles at Toledo and NE. 29 at Sandusky. Cautionary signals were ordered for all stations on the New Jersey coast and in the Lake region, except Duluth, Marquette, and Escanaba. The center, the afternoon of the 14th, reached western Kentucky. Brisk southwest winds, cloudy weather and occasional rain, were reported from the Atlantic states; partly cloudy weather and brisk northeast winds from the Lake region, and northerly winds, cloudy weather, and rain from the Ohio valley. At midnight the area was central in the Ohio valley, with considerably increased pressure—Cincinnati barometer 0.45 below the normal—with existing conditions but slightly changed. Maxima velocities of NE. 25 miles at Toledo and NE. 26 at Sandusky were reported. The course of the depression having changed to the east, the center, with still increasing pressure, was in West Virginia the morning of the 25th. Brisk northeast winds, with cloudy weather and rain then prevailed in the Lower Lake region and New England and along the New Jersey coast. Maxima velocities of N. 28 miles at Toledo and NE. 39 at Sandusky were reported. Signals were then lowered at Lake Michigan stations; not justified. During the day the course of the depression was S. of E., and in the afternoon it was central in Virginia—Washington barometer 0.37 abnormally low. Brisk northeast winds, with cloudy weather and rain, prevailed on the New Jersey coast, and brisk to high southwest winds, with partly cloudy weather, on the North Carolina coast; cloudy weather and brisk northerly winds in the Lower Lake region. Maxima velocities from the Lake region of N. 26 miles at Milwaukee, N. 35 at Sandusky, were reported, and several instances on the Middle and South Atlantic coasts ranging from NE. 26 miles at Barnegat to SW. 36 at Cape Lookout. Cautionary signals were ordered at New York and from Lewes southward to include Cape Lookout. At midnight the center was near the Virginia capes, with existing conditions attendant on the depression substantially unchanged. The winds on the coast from Sandy Hook to Smithville, with unchanged direction, had increased in violence, except at Cape Henry, which was near the center. Actual velocities along the coast ranged from 23 miles at Kittyhawk to 36 at Cape Lookout, and the maxima velocities were generally somewhat higher. Maxima velocities of N. 26 miles at Toledo and N. 29 at Sandusky were reported from Lake Erie. All signals remaining in the Lake region were then lowered, having been justified at all stations except at Buffalo and Port Huron, the wind at the latter place, however, attaining a velocity of 24 miles. On the morning of the 26th the central depression had passed eastward over the Atlantic Ocean. Cloudy or rainy weather, however, generally prevailed on the Atlantic coast, with brisk to high winds NE. from Boston to Cape May and from NW. to SW. on the North Carolina coast. All stations on the New Jersey coast reported maxima velocities ranging from 28 to 36 miles, Cape Hatteras SW. 30, and Cape Lookout W. 36. Cautionary signals were ordered from New Haven eastward and northward to include Boston. During the afternoon the pressure increased rapidly from North Carolina to New England, with cloudy weather and rain. The winds changed on the North Carolina coast to northwest and decreased in violence, but on the New Jersey coast remained brisk to high—from 24 to 40 miles—and Boston reported a maximum velocity of NE. 26 miles. At midnight all signals from Boston southward along the coast, to include Norfolk, were lowered. North Carolina reports missing. The signal at Cape Henry was not lowered until the afternoon of the 27th. All signals from Boston southward to include Norfolk and Cape Henry were fully justified by velocities ranging from NE. 26 miles at Boston to E. and NE. 40 at Lewes, Atlantic City, and Barnegat. The low pressure on the North Carolina coast recovered itself slowly during the 27th and 28th, during which reports were missing from a part of the coast stations. Subsequent reports showed that brisk to high winds prevailed from the morning of the 27th to the afternoon of the 28th from Kittyhawk to Cape Lookout. The signals at these stations were lowered on the afternoon of the 28th, having been fully justified by velocities of NE. 28 miles at Cape Lookout, NE. 30 at Cape Hatteras, and NE. 36 at Kittyhawk.

No. X.—An area of low barometric pressure appeared on the Oregon and northern California coasts during the 25th, and on the morning of the 26th Olympia reported a barometer 0.25 below the normal, with light rain. During the 26th and 27th cloudy weather, with light rainfalls, prevailed in Oregon and northern California, with an abnormal pressure of about —0.20 covering Oregon. On the 27th the barometer fell generally from Idaho to Minnesota, and at midnight the lowest pressure was at Virginia City. On the morning of the 28th the abnormal isobar of—0.20 included Utah, northern Wyoming, and part of Dakota, with the lowest pressure at Salt Lake City, 0.34 below the normal. During the day occasional light rains were reported in Montana and Northwestern Dakota, and at midnight the barometer was lowest 0.42 below the normal at Bismarck—with a well-defined center in western Dakota. During the 29th it moved northeastward into Manitoba, its passage marked by light rain in the Northwest and by isolated cases of brisk, variable winds on Lakes Superior and Michigan. Cautionary signals were displayed at Marquette on the morning and at Duluth and Escanaba on the afternoon of the 28th, and were lowered the morning of the 30th, having been fully justified at Duluth by a maximum velocity of NE. 32 miles.

No. XI.—The low pressure in the Gulf, consequent on area No. IX, recovered very slowly after the passage of that area, and on the morning of the 26th was nearly normal in the Western Gulf states. On that afternoon a slight general fall occurred from Arizona to Alabama, which, continuing till the afternoon of the 27th, reduced the pressure in the Gulf to about 0.20 below the normal—Punta Rassa and Saint Mark's 0.21 below the normal, and Indianola 0.17 below the normal. The pressure remained substantially unchanged until the afternoon of the 28th, when brisk easterly winds prevailed from Indianola eastward to Saint Mark's, and gentle south winds with cloudy weather and rain at Punta Rassa and Key West. At midnight the pressure had risen very slightly at the Gulf stations, but the winds on the Texas coast changed to brisk northeasterly, and at Indianola attained a maximum velocity of NE. 33 miles. The pressure slowly declined at the morning and afternoon reports of the 29th, but rose slightly at midnight; partly cloudy weather and brisk northeast winds generally prevailed during the day with a maximum velocity of E. 32 miles at Indianola. During the 30th brisk northeast winds with cloudy weather and occasional rain prevailed from Saint Mark's to Indianola, while the barometer generally and slowly fell. On the morning of the 31st the fall continued, New Orleans reporting barometer 0.21 below the normal, and brisk north and east winds prevailed from Saint Mark's to Brownsville with rain from New Orleans to Havana. Signals were ordered for Port Eads, Mobile, New Orleans, Galveston, and Indianola. The fall continued steadily during the day. At midnight the New Orleans barometer was 0.29 below the normal; winds of 31 miles N. at Indianola, 28 N. at Galveston, and 24 E. at New Orleans had been reported during the day. At midnight signals were yet flying, having been fully justified, except possibly at Mobile. A special report of the wind at Port Eads covering seventy-one hours, ending 10 a. m. of the 31st, gives the mean velocity during that time as 28½ miles per hour, attaining a maximum of 35 miles ENE. at 7 a. m. and NE. 35 at 9 a. m. of the 30th. The wind blew steadily from ENE. from 11 a. m. of the 28th till 10 a. m. of the 30th, and for the succeeding 24 hours from the NE. Such steadiness of velocity and direction had never before been known at that point.

INTERNATIONAL METEOROLOGY.

On chart No. IV. are shown the probable tracts of storm-centers over the oceans, deduced from data received at this office up to August 5, 1879, and in the upper right-hand corner will be found an index to the same. Below is a brief notice of the above, and also of some storms over the southern hemisphere:

North Atlantic Ocean.—No. I is a continuation of the secondary depression attending area of low barometer No. II of the June REVIEW; on the 8th and 9th of June it was central to the north of Newfoundland, and on the 10th probably passed to the north-northeast, inducing the S. and SW. winds and rain reported on that day in 50° N. 41° W. No. II probably originated on this day (the 10th) in the southern quadrant of the preceding depression, or about 40° N. 50° W., and is the extended track of storm No. V given on chart No. VII of the July REVIEW. On the 11th its center was apparently indicated in about lat. 43° N. 43° W.; on and after the 12th its track was about as previously shown, although reports since received change the position for the 12th and 13th a little toward the south. No. III probably originated in about 45° N. 15° W. on June 10, in the south quadrant of No. II, July REVIEW, although, as the reports from the Azores are not yet to hand, this may be considered somewhat doubtful. No. IV was central on June 30, about 53° N. 20° W., having probably developed in the southwest quadrant of area No. VI, July REVIEW; it passed over the British Isles on the 1st and 2d of July, during which days northwesterly gales and high seas were experienced from 20° to 30° W. and about 50° N. No. V is a continuation of area of low barometer No. I, chart No. I, described in the July REVIEW; on the 4th it passed south of Newfoundland, and on the 5th was probably joined by No. VI from Labrador; on the 5th, the center was probably more to the north than indicated, but high seas were reported from 30° to 50° W. and between 44° and 50° N.; 6th and 7th, "terrific" westerly gales and high seas were reported between 20° and 30° N. and 50° to 55° W.; S. S. *Leipzig*, on the 7th, in 50° N. 16° W., and on the 8th in 50° N. 18° 30′ W., reports, "7th and 8th, had very heavy gales with rain, from southwest to west and northwest, and high rough seas." No. VII is a continution of area of low barometer, No. II (chart No. I), of July REVIEW; on the morning of the 10th it was central near Cape Breton, and on the morning of the 11th south of Newfoundland; southerly gales and high seas were reported off the banks of Newfoundland in advance of the center of depression, which, as it moved eastward, was followed, on the 11th, by dense fogs; at 8 p. m. S. S. *Virginia* was wrecked on Sable Island; 12th and 13th it was northeast of Newfoundland, and on the 14th and 15th developed into a quite severe storm about 50° N. 30° W.; on the 16th it passed south of Ireland, and on the 17th was dissipated over Western Europe. No. VIII is a continuation of area of low barometer, No. VI (chart I), July REVIEW, and was north of Newfoundland on the 25th, but after this its track may be considered doubtful and farther north than as shown on chart. *South Pacific Ocean.*—Ship *David Crockett*, from New York to San Francisco, reports: "Passed Cape Horn May 28, 1879, and took fearful gale from W. to SW., lasting twelve days, with fearful squalls of hail and snow and fearful high sea, and on June 9 had drifted back to Cape Saint John, Staten Island; sustained considerable damage to rigging, and did not get past Cape Horn the second time until June 11." Ship *Ellen Sharp*, from Melbourne, at San Francisco, August 7, reports: "lost topsails, &c., in hurricane June 16, 1879." Bark *B. L.*, from San Francisco, put into Auckland June 11, 1879, with pumps choked, and sailed thence for Lyttleton, N. Z., on the 14th; was wrecked at Timaru, New Zealand, June 29, at 11 p. m., during heavy SE. gale; "the master was not able to get any observations for three days previous;" a tug was dispatched from Christ Church, but could not reach wreck on account of tremendous sea. Ship *Frank Pendleton*, from San Francisco at Deal, England, August 7, shipped heavy seas off Cape Horn, during which two of her crew were drowned. *Indian Ocean.*—Ship *Victoria Cross* encountered stormy weather May 21, 1879, in lat. 43° S., 61° E.; sea broke over vessel, started deckhouse, and damaged boats. Bark *Caroline*, June 11 and 12, 1879, in 30° to 31° S. and 57° to 58° E. had a terrific gale from N. to WNW., with hard squalls, heavy rain, and a high sea—barometer 29.50. At Mauritius, on the 11th, it was "getting gloomy at SSE.," and on the 12th the pressure fell to 29.98, with a westerly wind and light rain. *Bay of Bengal.*—On chart No. IV is shown the track of a slight depression, which probably moved northward over northern India, from May 30 to June 6; it was accompanied by heavy rain (nearly 7 inches) at Cuttack on the 30th, and severe gale at Darjeeling on the 5th.

TEMPERATURE OF THE AIR.

The isothermal lines upon chart No. II show the general distribution of the temperature for August, 1879. By reference to the table of average temperatures given on the same chart it will be seen that there has been a general deficiency, as compared, with the means for many years, in all districts east of the Rocky Mountain slope, except Florida, which shows a normal temperature, and the Northern Rocky Mountain slope, which shows a slight excess. The greatest deficiencies are reported from the Gulf states, especially Texas, Tennessee, and the Ohio valley and the New England states. The smallest from the Lake region, Lower Missouri valley, and Middle Eastern Rocky Mountain slope. An excess is reported from the plateau districts and the Pacific coast, except at San Diego, where it is normal.

Maximum and minimum temperatures.—Upon charting the maximum temperatures of the month it appears that throughout the country generally the range was from 90° to 99°. At isolated stations on the Atlantic coast from Maine to North Carolina and in the Lake region maximum temperatures ranging from 81° to 89° were reported. The lowest maximum on the Atlantic coast was 81° at Cape Lookout, and in the Lake region 82° at Buffalo. The lowest maximum on the Pacific coast was 81° at San Diego. The line of maximum temperatures of 100° and above confines within its limits all of Texas except the coast stations, the southern half of Arizona, and the interior of California. The highest reported temperature during the month from the Signal Service stations was 115° at Yuma, Arizona.

Upon charting the minimum temperatures for the month, it is found that, excepting at the elevated stations, but one station—Marquette, 37°—reported a minimum temperature of less than 40°. The area of from 40° to 50°, included the interior portion of New England, excepting isolated southern stations, the northern portion of the Upper Mississippi valley, the Northwest, and Northern Rocky Mountain slope. The area from 60° to 70° comprises within its limits the Middle Atlantic states, Virginia, the interior of North Carolina, Tennessee and the Ohio valley, Central Mississippi valley, the Lower Missouri valley, Nebraska and Indian Territory, portions of Texas and Arizona, and California. The only minima temperatures above 70° yet reported are 71° at Galveston and Indianola, and 72° at Tucson, Arizona.

Minimum and maximum temperatures are respectively as follows: *Maine:* 43° at *Orono, 49° at Eastport, and 93° at Portland. *Vermont:* 43° at *Lunenburg, 45° and 90° at Burlington, and 97° at *West Charlotte. *Massachusetts:* 46° at *Springfield Armory and 51° at Thatcher's Island, 94° at Boston, and 100° at *Somerset. *Rhode Island:* 55° and 87° at Newport. *Connecticut:* 49° to 89° at New Haven and 97° at *Mystic. *New York:* 42° at *Waterburg, 48° at Rochester, 90° at New York City, and 98° at *Starkey *Pennsylvania:* 38° at *Franklin, 50° at Pittsburgh, 93° at Philadelphia, and 97° at *Chambersburg. *Delaware:* 60° and 90° at *Dover. *Maryland:* 50° at *Woodstock, 56° and 92° at Baltimore. *District of Columbia:* 55° and 96° at Washington. *Virginia:* 45° at *Snowville, 57° and 95° at Lynchburg. *West Virginia:* 51° and 85° at Morgantown. *North Carolina:* 46° at *Highlands, 56° at Charlotte, 98° at Wilmington and *Weldon. *South Carolina:* 60° at *Spartanburg, 62° and 95° at Charleston. *Georgia:* 56° at *McPherson Barracks, 64° at Augusta, and 97° at Savannah. *Florida:* 62° at *Fort Barrancas, 65° and 91° at Saint Mark's, and 102° at *Houston. *Alabama:* 59° at *Wilsonville, 67° and 94° at Mobile. *Mississippi:* 62° at *Fayette, 62° and 97° at Vicksburg. *Louisiana:* 61° and 96° at Shreveport and 98° at *Point Pleasant. *Texas:* 48° at Fort Davis and 105° at Pilot Point. *Ohio:* 44° at *Westerville and *Urbana, 56° and 96° at Cincinnati. *Kentucky:* 57° and 96° at Louisville. *Tennessee:* 50° at Knoxville and 96° at Nashville. *Arkansas:* 61° and 96° at Little Rock. *Michigan:* 34° at *Lansing, 37° at Marquette, and 96° at *Lansing and Marquette. *Indiana:* 46° at *Wabash, 53° and 93° at Indianapolis, and 95° at *Logansport. *Illinois:* 45° at *Riley, 52° and 91° at Chicago, and 100° at *Louisville. *Missouri:* 47° and 100° at *Kansas City, 55° and 99° at Saint Louis. *Kansas:* 49° at *Lawrence, 55° and 95° at Dodge City, and 103° at *Holton and *Wellington. *Wisconsin:* 40° at *Neillsville, 48° and 90° at La Crosse, and 95° at *Manitowoc. *Iowa:* 42° at Ames and Guttenburg, 48° and 93° at Des Moines, and 100° at *Boonsboro'. *Nebraska:* 36° at *Sidney Barracks, 46° at North Platte, 99° at North Platte and *Sidney Barracks. *Indian Territory:* 56° at Fort Sill, and 104° at Fort Gibson. *Minnesota:* 44° and 92° at Breckenridge, 96° at *Fort Snelling. *Dakota:* 41° and 98° Fort Buford. *Colorado:* 23° at Pike's Peak, 32° at *Georgetown, 50° and 95° at Denver. *New Mexico:* 48° at Silver City, and 104° at La Mesilla. *Wyoming:* 40° and 92° at Cheyenne. *Montana:* 40° and 97° at Fort Keogh. *Utah:* 46° and 95° at Salt Lake City, 102° at *Kanab. *Nevada:* 45° and 96° at Pioche, 100° at Carson City. *Arizona:* 42° at Prescott, 115° at Yuma. *Idaho:* 46° and 103° at Boise City. *California:* 34° at Campo, 48° at Visalia, and 108° at Visalia and Red Bluff, and 121° at *Indio. *Oregon:* 45° and 92° at Roseburg.

Ranges of temperatures at Signal Service stations.—The *monthly* ranges will appear from an examination of the maxima and minima just given. The greatest *daily* ranges vary in New England from 15° at Wood's Holl, and 26° at Mount Washington to 30° at Eastport and Springfield. Middle states from 16° at Cape May to 26° at Washington. South Atlantic states 13° at Portsmouth, N. C., to 29° at Charleston. Gulf states from 15° at Galveston and New Orleans to 31° at Corsicana. Tennessee and Ohio valley from 20° at Cairo to 31° at Pittsburgh. Lower Lake region, from 21° at Buffalo to 30° at Rochester. Upper Lake region from 21° at Chicago to 34° at Marquette. Upper Mississippi valley from 23° at Davenport to 31° at Des Moines. Lower Missouri valley from 26° at Omaha to 34° at Yankton. Northwest from 39° at Bismarck to 42° at Pembina. Rocky Mountain slope from 24° at Pike's Peak and 27° at Denison and Henrietta to 44° at Santa Fé and 45° at Cheyenne. Rio Grande valley from 25° at Laredo and Rio Grande City to 36° at Brackettville. California, from 29° at San Francisco to 46° at Visalia.

Frost.—2d, Fort Buford; 5th and 15th, Lunenburg, Vt.; 8th and 16th, Cresco, Iowa; 8th, 16th, and 17th, at Neillsville, Wis.; 8th, 16th, and 24th, at Lansing, Mich.; 16th, cut corn and potatoes in Lansing and sourrounding townships badly, and in Locke township killed corn, buckwheat, tomatoes, &c.; 9th, (?) Palouse City, Wash. Ty., killing vegetables, ice formed but damage not extensive." 9th, Embarrass, Wis., and Fort Stevenson, Dak.; 10th, Litchfield and Catawissa, Pa.; 11th, Cooperstown, N. Y.; 15th, Ontonagon, Mich., "nipping tender vines"; 17th, Thornville, Mich.; 29th, Winnemucca, Nev., wilting potato and other vines; 30th, Georgetown, Colo., "water froze 100 feet above the town." Summit, Colo. (elevation 11,300 feet), frost every night. 31st, Virginia City, Mont.

Ice.—7th, Mount Washington, N. H., ⅛ of an inch; 9th, (?) Palouse City, Wash., ⅛ of an inch; 16th, Locke Township, Mich.; 30th, near Georgetown, Colo.

PRECIPITATION.

General notes on precipitation of month.—The general distribution of rainfall for the month is illustrated as accurately as possible on chart No. III by returns from about 500 stations. In the lower left-hand corner of the chart will be found a table giving the average precipitation for August by districts. In general, the rainfall has been deficient from New England westward to the Rocky Mountains, and in California; in excess from the Middle and South Atlantic states westward to include the Lower Mississippi valley and Texas. The deficiencies were most marked in Minnesota and Missouri. The excess of precipitation has been greatest in the Eastern Gulf states, Ohio valley, and the Middle Atlantic states. In the remaining districts the departure from the normal rainfall has not been marked. None but local droughts have been reported. The deficiencies reported from Minnesota and the Missouri valley compensate for the excess of precipitation during July, while the great excess in the

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Those marked with * are voluntary reports.

Ohio valley and Western Gulf states counterbalance the marked deficiencies which existed in those districts during the previous month.

Specially heavy rains.—1st, Saint Mark's, Fla., 6.41 inches; 2d, Forsyth, Ga., 2.43 inches in 6 hours; Fort Barrancas, Fla., 2.73 inches in 3 hours 50 minutes; Franklin, N. C., 5.90 inches; 3d, Hudson, Mich., 2.20 inches in 8 hours; 4th, Accotink, Va., 1.40 inches in 9 hours; Morgantown, 2.31 inches; Gainesville, Ga., 3.60 inches; 5th, Keokuk, 2.11 inches; Augusta, Ill., 2.76 inches; Mount Auburn, Ohio, 2.33 inches in 1 hour 15 minutes; Cincinnati, 1.79 inches in 2 hours 45 minutes; 6th, Indianapolis, 2.05 inches; 7th, Woodstock, Md., 2.35 inches in 9 hours; Mount Auburn, Ohio, 2.27 inches in 6 hours; 9th, Portsmouth, N. C., 3.69 inches; Cape Lookout, 2.58 inches on the 8th and 9th; Point Pleasant, La., 3.02 inches in 1 hour; 10th, Gulf Hammock, Fla., 2.40 inches in 3 hours; 13th, New Orleans, 2.54 inches; Vevay, Ind., 1.90 inches in 30 minutes; Brookhaven, Miss., 4.50 inches in 13 hours; 14th, Mobile, 3.90 inches; Fort Barrancas, Fla., 6.07 inches in 3 hours and 35 minutes; 15th, Louisville, 2.86 inches; Sandusky, 2.70 inches on the 15th and 16th; Anna, Ill., 4.26 inches in 16 hours; Louisville, Ill., 14th and 15th, 2.50 inches; Saint Meinrad, Ind., 4.55 inches in 24 hours and 55 minutes; 16th, Erie, 3.11 inches; Rochester, N. Y., 2.65 inches; Oswego, N. Y., 3.14 inches; Cleveland, Ohio, 2.59 inches; 17th, Highland, N. C., 2.00 inches in 8 hours; Fort Barrancas, Fla., 2.73 inches; Lynchburg, Va., 1.04 inches; Cape Lookout, N. C., 4.29 inches on the 17th and 18th; 18th, Atlantic City, N. J., 8.97 inches, 6.72 inches in 9 hours; Sandy Hook, N. J., 6.38 inches; New London, Conn., 4.16 inches; New Haven, Conn., 5.12 inches; Norfolk, Va., 603 inches, 5.13 inches in 9 hours; Wood's Holl, Mass., 2.27 inches; Wilmington, N. C., 8.04 inches, 4.38 inches in 8 hours and 35 minutes; Thatcher's Island, Mass., 4.77 inches on the 18th and 19th; Springfield, Mass., 4.36 inches on the 18th and 19th; Cape May, N. J., 8.46 inches, 6.85 inches in 9 hours; 19th, Mount Washington, N. H., 2.60 inches; 20th, Fayetteville, N. C., 3.50 inches in 1 hour; 21st, Fayetteville, N. C., 2.25 inches in 1½ hours; 22d, Fort Barrancas, Fla., 3.35 inches; New Orleans, La., 2.11 inches; Mobile, La., 2.79 inches; Northport, Mich., 3.55 inches; 23d, Saint Mark's, Fla., 2.34 inches; Shreveport, La., 3.47 inches; Little Rock, Ark., 4.04 inches; Point Pleasant, La., 22d and 23d, 6.73 inches, of which 4.31 inches fell in 24 hours; 24th, Urbana, Ohio, 2.07 inches in 14 hours; College Hill, Ohio, 24th and 25th, 2.50 inches in 22 hours; Bethel, Ohio, 3.50 inches in less than 24 hours; Mount Auburn, Ohio, 24th and 25th, 2.54 inches in 27 hours; Cincinnati, Ohio, 2.68 inches on the 24th and 25th; New Harmony, Ind., 3.45 inches; Cairo, Ill., 2.98 inches; Louisville, Ky., 3.76 inches; Anna, Ill., 5.08 inches in 12 hours, total of 6.14 inches in 21 hours; Louisville, Ill., 3.00 inches in 12 hours; 25th, Atlantic City, N. J., 2.08 inches; Pittsburgh, Pa., 2.59 inches; Dover, Del., 25th and 26th, 2.50 inches; Arlington, Ind., 24th and 25th, 2.75 inches; Vevay, Ind., 23d to 25th, 4.45 inches in 42 hours; Saint Meinrad, Ind., 23d to 25th, 4.75 inches; Highlands, N. C., 24th and 25th, 3.47 inches; Wellsburgh, W. Va., 2.87 inches in 6 hours; 26th, Saint Mark's, Fla., 4.46 inches; Accotink, Va., 1.00 inch in 3 hours; 30th, Gulf Hammock, Fla., 2.60 inches; Moorestown, N. J., 17th, 2.78 inches in 24 hours; 17th to 19th, 4.31 inches; Atco, N. J., 16th to 18th, 7.23 inches; Somerville, N. J., 15th to 18th, 5.56 inches in 74 hours; South Orange, N. J., 15th to 18th, 4.60 inches; Vineland, N. J., 16th to 18th, 4.60 inches in 78 hours; Freehold, N. J., 16th to 18th, 7.56 inches, of which 5.34 inches fell in 24 hours; Trenton, N. J., 15th to 18th, 5.80 inches, of which 4.58 inches fell within 36 hours; Wappinger's Falls, N. Y., 16th to 19th, 3.75 inches in 72 hours; Penn Yan, N. Y., 16th to 19th, 2.60 inches in 18 hours; Ardenia, N. Y., 15th to 18th, 3.30 inches in 72 hours; Boyd's Corner, N. Y., 15th to 18th, 3.68 inches in 71½ hours; Lenoir, N. C., 15th, 16th, 5.50 inches in 43 hours; Fayetteville, N. C., 16th to 18th, 6.00 inches, of which 3.00 fell in 18 hours; Greensboro', N. C., 17th, 2.90 inches in 7 hours and 30 minutes; Urbana, Ohio, 15th, 2.06 inches in 20 hours; Little Mountain, Ohio, 15th, 16th, 2.20 inches in 29 hours; Cleveland, Ohio, 16th, 2.46 inches in less than 24 hours; Bethel, Ohio, 15th, 16th, 3.50 inches in 44 hours; Mount Solon, Va., 15th, 17th, 3.85 inches, of which 2.40 inches fell in 4 hours; Accotink, Va., 16th, 18th, 3.05 inches, of which 1.60 inches fell in one day; Lake Village, N. H., 18th, 19th, 3.05 inches; Weir's Bridge, N. H., 16th to 19th, 4.08 inches; Belmont, N. H., 17th, 18th, 3.75 inches; Wolfeboro, N. H., 18th, 19th, 2.54 inches; Dover Mine, Va., 17th, 18th, 2.45 inches in 16½ hours; Johnsontown, Va., 18th, 7.70 inches in 11 hours; Fallsington, Pa., 18th, 2.48 inches in 13 hours, 6.01 inches from 15th to 18th; Egypt, Pa., 18th, 2.80 inches; White Plains, N. Y., 15th to 18th, 4.80 inches, of which 3.90 inches fell in 15 hours; Dunbarton, N. H., on the night of the 18th, 3.12 inches; Southington, Conn., from 16th to 19th, 5.40 inches; Sandy Springs, Md., from 15th to 17th, 4.23 inches; Hulmeville, Pa., 16th to 18th, 4.08 inches; Fort Hamilton, N. Y., from 9.00 p. m. of 17th to 9 p. m. 18th, 5.00 inches; Philadelphia, Pa., 16th to 18th, 5.84 inches; Gainesville, Ga., 2.58 inches in 7 hours; Vevay, Ind., 14th to 16th, 3.65 inches, 2.95 inches in 13 hours; Rowe, Mass., 18th, 19th, 2.40 inches in 24 hours; New Market, Md., 17th, 2.79 inches in 36 hours; Lawrence, Mass., 16th to 19th, 5.78 inches; Westborough, Mass., 16th to 19th, 5.47 inches in 70 hours; Somerset, Mass., 18th, 2.36 inches in 15 hours; Mystic, Conn., 18th, 3.00 inches; Dover, Del., 16th to 18th, 7.60 inches in 57½ hours; Newburyport, Mass., 16th to 19th, 4.22 inches in 74 hours; Mystic, Conn., 18th, 1.90 inches; West Waterville, Me., 16th to 19th, 5.25 inches; Mount Desert, Me., 16th to 19th, 3.10 inches; Gardiner, Me., 16th to 19th, 4.62 inches; Orono, Me., 16th to 19th, 4.80 inches; Mendon, Mass., 16th to 18th, 6.20 inches; Clinton, Mass., 16th to 19th, 5.29 inches in 68, hours; Fall River, Mass., 16th to 19th, 3.40 inches in 66 hours; Springfield, Mass., 16th to 19th, 5.89 inches in 73 hours, 4.28 inches fell within 24 hours; Antrim, N. H., 16th to 19th, 4.12 inches in 70 hours.

Largest monthly rainfalls.—Fort Barrancas, Fla., 25.07 inches; Saint Mark's, 18.09; Cape May, 16.58; Atlantic City, 14.67; Fayetteville, N. C., 13.25; Gulf Hammock, Fla., 12.77; Punta Rassa, 12.75; Laredo, Tex., 12.59; Arma, Ill., 12.51; Dover, Del., and Franklin, N. C., 12.45; Sandy Hook, 12.44; Barnegat, 12.33; Point Pleasant, La., 12.28; Cape Lookout, 11.90; Rio Grande, Tex., 11.75; Cincinnati, 11.72; Bethel, Ohio, 11.62; Wilmington, 11.37; Johnsontown, Va., 10.85; Vineland, N. J., 10.63; Mobile, 10.54; New Orleans, 10.44; Centreville, Mo., 10.27; Louisville, Ky., 10.02; Summit of Mount Washington, 9.55; Fort McKavett, 7.54.

Smallest monthly rainfalls.—Within the line marked zero on chart No. III, including portions of California, Nevada, and Arizona, rain has only been reported at two stations, viz: Campo, 0.10, and San Gorgonia, 0.22; no rain fell at Clark's Fork in Central Missouri. The following are the smallest monthly rainfalls reported: 0.01 at Carson City, Nev.; 0.02 at San Francisco; 0.03 at Boise City and Umatilla; 0.05 at Knight's Landing and Willows, Cal.; 0.06 at Williams, Cal., Salt Lake City, and Saint George, Utah; 0.14 at Winnemucca; 0.16 at North Platte; 0.18 at Leavenworth; 0.23 at Virginia City; 0.28 at Red Bluff; 0.54 at Corsicana. East of the Mississippi the lowest rainfalls reported are: 0.64 inch at Port Huron; 0.73 at Ithaca, N. Y.; 1.40 at Neillsville, Wis.; and 1.60 at Decatur, Ala.

Rainy days.—The number of days during which rain or snow has fallen varies as follows: New England, from 8 to 14; Middle Atlantic states, 10 to 16; South Atlantic states, 10 to 20; East Gulf states, 16 to 18; West Gulf states, 3 to 13; Ohio valley and Tennessee, 5 to 12; Lower Lake region, 8 to 11; Upper Lake region, 5 to 12; Upper Mississippi valley, 8 to 12; Missouri valley, 4 to 11; Red River of the North, 7 to 8; Eastern Rocky Mountain slope, 1 in northern Texas and 4 in western Nebraska to 7 in southwestern Dakota; Rocky Mountains, 2 to 13 and on Pike's Peak, 20; Western Plateau, 4 in Idaho and Utah and 5 in central Arizona to 6 in southeastern Nevada; California, 0 to 2; coast of Oregon and Washington Territory, 3 to 9.

Cloudy days.—The number varies in New England from 7 to 14; Middle Atlantic states, 6 to 14; South Atlantic states, 7 to 17; East Gulf states, 7 to 13; West Gulf states, 2 to 7; Lower Lake region, 5 to 10; Upper Lake region, 4 to 10; Ohio valley and Tennessee, 6 to 11; Upper Mississippi valley, 6 to 7; Missouri valley, 1 to 5; Red River of the North, 2 to 4; Eastern Rocky Mountain slope, 1 in northern Texas, and 2 in southeastern Dakota to 6 in Kansas and Nebraska; Rocky Mountains, 0 to 9; North and Middle Plateau, 2 to 3; Southern Plateau, 0 to 1; California, 0 to 3; coast of Oregon and Washington Territory, 6 to 11.

Hail.—But few hail-storms have been reported during the month. The only stations reporting more than one storm are: Pike's Peak, 6; Summit, Colo., 7; De Soto and Omaha, Nebr., 3. Two states report two separate storms in one day, on the 12th at Ames and Monticello, Iowa; 23d, Bellefontaine and Jacksonburg, Ohio. Hail fell 1st, at Cincinnati and Buffalo; 2d, Chicago; 6th, Georgetown, Colo., Kansas City, Mo., and Wellington, Kans.; 12th, Milwaukee, "large enough to kill fowls"; 13th, Lawrence, Kans.; 14th, Yankton, Dak.; 16th, Chambersburg, Pa.; 21st, Wilsonville, Ala.; 22d, Mount Washington; 23d, Corning, Mo., and Freehold, N. J.; 28th, Fort Keogh, Mont., large size and doing much damage. No hail was reported west of the Rocky Mountains.

Snow.—Red Bluff, Cal., 21st, on coast range; on the summit of Pike's Peak, 4th to 6th, 7th, 12th, 13th, 15th, 16th, 19th to 21st, 28th and 29th; Virginia City, 29th, on mountains near; Summit, Colo., 13th, 16th, 28th; Carson City, Nev., 28th, on mountains near; Burlington, Vt., 17th, on mountains near, 2 inches; Mount Bridger, near Fort Ellis, Mont.

Droughts.—Throughout the month droughts were reported as existing in Utah, the Lower Missouri valley, the Upper Mississippi valley, northeastern part of Pennsylvania, and southeastern Michigan. Droughts commencing late in the month continued on the 31st in eastern Wisconsin, northeastern Illinois, and Indiana. The droughts reported as prevailing in Nevada and Texas at the end of July ended in Nevada, excepting in the Humboldt valley, on the 1st of August; in Texas from the 9th to the 12th, except in Navarro county, where creeks and tanks were reported dry and stock suffering dreadfully at the end of August. On Carson river, Nevada, all mills were reported shut down on 22d, for lack of water.

Floods and water-spouts.—3d, near Milton, Pa., on the west branch of the Susquehanna; 11th, water-spout at entrance to Pensacola Bay, at 11.20 a. m., course from southwest to northeast; 16th, Mayport, Fla., moved over the sea from southwest to northeast for about four miles, and then broke; 12th to 14th, high water in the Rio Grande river, overflowing the valley between Rio Grande City and Brownsville, doing considerable damage.

RELATIVE HUMIDITY.

The percentages of mean relative humidity for the month range as follows: New England, 65 to 87; Middle Atlantic states, 71 to 83; South Atlantic states, 69 to 84; Gulf states, 69 to 85; Ohio valley and Tennessee, 62 to 77; Lower Lakes, 64 to 72; Upper Lakes, 63 to 70; Upper Mississippi valley, 61 to 68; Lower Missouri valley, 60 to 65; Red River of the North valley, 63 to 76; Rocky Mountain slope, 49 to 66; Plateau districts, 22 to 70; California, 31 to 78; Oregon, 33 to 59. High stations report the following averages, not corrected for altitude: Mount Washington, 83.9; Pike's Peak, 52.3.

WINDS.

The prevailing winds, at the Signal Service stations, are shown by the arrows flying with the wind on chart No. II. The maximum velocities per hour have been given in the descriptions of movements of areas of low pressure.

Total movements of the air.—The following were the *largest* monthly movements in miles recorded at the Signal Service stations: Mount Washington, 18,638; Cape Lookout, 12,656; Portsmouth, N. C., 11,954; Kittyhawk, 10,982; Cape Hatteras, 10,501; Pike's Peak, 10,470; Sandy Hook, 9,613; Cape May, 9,406; Barnegat, 9,213; Dodge City, 8,661; Indianola, 8,554; San Francisco, 8,264; North Platte, 8,112. The *smallest* movements were: Silver City, N. Mex., 848; La Mesilla, 1,148; Fredericksburg, Texas, 1,818; Nashville, 1,920; Graham, 1,928; Lynchburg, 2,019; Tucson, 2,051; Roseburg, 2,144; Deadwood, 2,254; El Paso, 2,322; Visalia, 2,374.

Local storms.—On the 3d a heavy wind storm at Phœnix, Ariz. 14th, heavy storm at Portland, Me., blowing down houses, uprooting trees, &c., in the adjoining country. From the 17th to the 19th a series of violent storms were reported along the Atlantic coast from South Carolina to Maine in connection with the cyclone which then passed along the coast. 22d, Biloxi, Miss., whirlwind about 100 feet wide passed through the center of the Sea Shore Camp Grounds, demolishing five cabins and taking off a portion of the roof of the tabernacle, scattering it some 300 feet. Large oak trees were lifted out by the roots and in some instances broken off short. One person fatally and one seriously injured. On the 28th, at 4.20 p. m. a violent gale from the northwest occurred at Fort Keogh, Mont. The wind attained a velocity of 52 miles at 4.45 p. m., and was accompanied by heavy rain and large hailstones, the latter doing much injury. Several buildings were seriously damaged. The storm lasted 35 minutes.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily weather indications for August with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of omissions to be 2.44 per cent., and of verifications to be 84.0 per cent. The percentages for the four elements have been: weather, 92.4; direction of the wind, 84.1; temperature, 83.6; barometer, 74.7. The percentages of verifications by geographical districts have been: New England, 85.9; Middle states, 86.6; South Atlantic states, 81.9; East Gulf states, 85.0; West Gulf states, 84.7; Lower Lake region, 85.8; Upper Lake region, 82.6; Tennessee and the Ohio valley, 84.5; Upper Mississippi valley, 81.0; Lower Missouri valley, 80.3; Northern Pacific coast region, 85.8; Central Pacific coast region, 95.7; Southern Pacific coast region, 100. Of the 3,720 predictions that have been made, 162, or 4.4 per cent., are considered to have entirely failed; 131, or 3.5 per cent., were one-fourth verified; 484, or 13.0 per cent., were one-half verified; 360, or 9.7 per cent., were three-fourths verified; 2,583, or 69.4 per cent., were fully verified, so far as can be judged from the tri-daily weather maps.

Cautionary signals.—87 cautionary signals were displayed during the month, of which 73, or 83.9 per cent., were justified. 13 cautionary off-shore signals were displayed, which were all fully justified both as to direction and velocity. 75 cases of winds of over 25 miles per hour were reported, when signals were not ordered. The above does not include signals ordered at 47 display stations where the velocity is only estimated and not measured.

NAVIGATION.

In the table, on the right-hand side of chart No. III, are given the highest and lowest readings on the Signal Service river-gauges for the month, with the dates. The rivers in general remain quite low and falling throughout the month and in no case did the water reach the danger-line. The only important freshets were those following the heavy rains attending storm-area No. IX, in the Red, Arkansas, and Lower Ohio rivers. On the 23d the water in the Upper Mississippi was so low as to interfere with navigation north of La Crosse.

High tides.—15th, Toledo highest of the season, very near the highest point ever known; 17th, Cape Lookout; 18th, Macon and Portsmouth, N. C., and Cape May and Atlantic City, N. J.; 21st, Galveston, 28th, Mayport, Fla.; 31st, Indianola, Texas.

Low tides.—1st to 3d, Indianola, Texas.

Tidal waves.—18th, at Fisk's Mills, Sonoma County, California, four persons drowned.

TEMPERATURE OF WATER.

The temperatures of water, as observed in rivers and harbors, with average depth at which the observations were taken, are given on chart No. II. No observations were taken during the month at San Francisco owing to the breakage of the thermometer. At Milwaukee the minimum temperature for the month is omitted as the reports for several days during the month indicated that the thermometer was out of order. The following reports were received too late to be incorporated in the regular table: Punta Rassa, maximum temperature at bottom 91°, minimum temperature at bottom 79°, average depth of water 12.3 feet.

ATMOSPHERIC ELECTRICITY.

Thunder storms.—Thunder storms have been reported in too large numbers during the past month to permit their enumeration in detail. They have been reported on the greatest number of days, in the following states, viz: Iowa, 17; Ohio and North Carolina, 14; Illinois, 13; Indiana, Massachusetts, and New Jersey, 10; Florida and Nebraska, 9; Summit, Colo. (elevation 11,300), reported such storms on 14 days; Pike's Peak on only 3 days. On 5th, 6th, 14th, and 22d they were frequent in the Ohio valley; on 16th, 17th, 21st, and 22d in the Middle and South Atlantic states; on 22d and 29th, in New England; on the 10th, 11th, and 12th in the Upper Mississippi and Lower Missouri valleys; on the 14th, thunder-storms generally in New England and at isolated stations in New York, New Jersey, Pennsylvania, Ohio, and Indiana. But two such storms have been reported west of the main range of the Rocky Mountains, at Phœnix and Tucson, Ariz.

Auroras.—Five auroras have been reported during the month; that of the night of 1st and 2d was noticed at Burlington, Vt., where it appeared as a well defined dark segment of an emerald green; that of the 6th was seen at New Corydon, Ind., at 9 p. m., at Oregon, Mo., dark to 10 p. m., diffused light, and at Urbana, Ohio, from 6 p. m., as reddish light, becoming white at 9 p. m., and ending at 9.30 p. m.; that of the 9th was observable from Burlington, Vt., on the east to Alpena, Breckenridge, and Bismarck on the west. At Breckenridge at 9.55 p. m., bluish colored streamers shot out along the whole length of the lower arch and extended from one to ten degrees along the upper arch; at 10 p. m. only a faint light remained; that of the 7th at Oregon, Mo., from dark to 10 p. m., no streamers; that of the 23d was observed at Newburyport, Mass., where it was quite faint, and at Gardiner, Me., at which place it was visible from 10 p. m. to midnight; also at Alpena, Mich.

Atmospheric electricity interfering with telegraphic communication.—Pembina, 1st and 24th; Phœnix, Ariz., 3d; in Texas, at Eagle Pass, 3d, 4th, 7th, 15th, and 19th; at Brackettville, 4th and 6th; at Graham and Jacksboro on the 7th; Castroville, 6th, 7th, and 15th; Rio Grande City, 8th; Brownsville, 15th; Mason, 17th; Fort Sill, 6th; Santa Fé, 5th, 6th, 9th, 13th, 14th, 16th, 18th; Pike's Peak, 12th, remarkable display; Macon, N. C., 8th.

Magnetic variation.—Prof. F. Hess reports the variation of the magnetic needle on the 9th, about 10 p. m., in the San Juan valley, Colorado, as "14° 3½′."

OPTICAL PHENOMENA.

Solar halos.—But few were reported in comparison with previous months. None with any remarkable phenomena attending were reported.

Lunar halos.—But few lunar halos were reported; the largest number, 6, from Dubuque, Iowa. That of the 24th was observed at several stations in Iowa and Illinois, but no particular phenomena in connection therewith was reported.

MISCELLANEOUS PHENOMENA.

Lightning at Visalia, Cal., 18th.

Sand storms at Coleman, Texas, 4th, and Visalia, Cal., 26th.

Grasshoppers.—Air full of them, moving south on 31st at Holton, Kans. Shasta valley overrun with them early in month; they devoured everything green, and crops suffered much from them. Martis valley, Truckee river, vegetation completely destroyed by them, requiring cattle range to be abandoned for the season.

Mirage.—Henrietta, Tex., 3d; Olivet, Dak., 7th, 24th, and 31st; Breckenridge, Minn., 9th, 22d; Pembina, Dak., 29th.

Prairie fires.—Fort Gibson, Ind. T., 2d, 14th; Burlington, Vt., 2d, 5th to 10th, 12th to 14th; Boise City, Idaho, 4th to 9th, 13th to 17th; near Salt Lake City, 8th to 20th, 27th; Creswell, Kans., 8th, 9th, 23d, 31st; Port Huron, 27th; 1st, southeast of San José, Cal.; 1st to 7th, Yuba river valley, Cal.; 3d, Stanislaus County, California; 4th, Santa Clara County, California; 6th to 20th, near Verdi, Nev., doing much damage; 11th to 23d, Calaveras County, California, "hundreds of acres of thrifty young timber destroyed."

Sunsets.—The characteristics of the sky at sunset, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from 129 stations show 4,892 observations to have been made, of which 34 were reported doubtful; of the remainder 4,858, or 66.6, per cent., were followed by the expected weather.

Meteors.—Meteors were reported in considerable numbers, being most general from the 9th to the 11th and from 19th to 22d. The largest numbers were reported from Indiana, Maryland, New Jersey, and New York. None were reported west of the 100th meridian, except at Georgetown and San Juan valley, Colo., on the 5th, 10th (on which date they were very numerous in Indiana and Colorado), and 23d, and at Tucson, Ariz., on the 9th.

Earthquakes.—On the 10th, 1.15 p. m., very slight at Los Angeles, Cal. The motion was more perceptible at Santa Monica, about 13 miles distant, and a tidal wave which followed was attributed to it. At San Fernando the shock was quite severely felt. At 12.30 p. m. of the 21st, at Buffalo, N. Y., a light shock, followed by others, from 1.20 to 1.32 p. m., attended in latter case by a rumbling sound. August 21, in Ontario, at Niagara, Saint Catherines, Thorald, Welland, Allanburg, Port Dalhousie, and Beansville. It was the most violent at Saint Catherines at 2.55 a. m., duration estimated from two to ten seconds; movement was from east to west. At Lockport, N. Y., a shock was felt at 4.30 p. m. (lasting five seconds) with very loud report.

Sun spots.—The following record of observations made by D. P. Todd, assistant, has been forwarded by Prof. S. Newcomb, U. S. Navy, superintendent Nautical Almanac, Washington, D. C.:

Date, August, 1879.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	
10th, 2 p. m.	1	4	0	0	0	0	1	4	
10th, 3 p. m.	0	0	0	0	0	0	1	4	
12th, 4 p. m.	1	10	0	0	0	0	2	14	
12th, 5 p. m.	0	0	0	0	0	0	2	14	Faculæ.
14th, 5 p. m.	0	0	1	12	0	0	1	2	
16th, 3 p. m.	0	0	1	2	0	0	0	0	
20th, 4 p. m.	1	1	0	0	0	0	1	1	Faculæ.
21st, 5 p. m.	0	0	1	1	0	0	0	0	Faculæ.
24th, 5 p. m.	1	12	0	0	0	0	1	12	
27th, 3 p. m.	1	8	0	4	1	8	2	11	Faculæ.
28th, 3 p. m.	0	0	0	1	0	0	2	10	Faculæ.
30th, 5 p. m.	0	0	1	2	0	0	1	3	The 8 spots of the group which reappeared on the 27th have coalesced into three spots, one of them quite large.
31st, 2 p. m.	0	0	0	0	0	0	1	3	

Faculæ were also observed on the 2d at 2 p. m. and on the 3d at 3 p. m.; observations were made, but no spots observed on the 1st at 2 and 5 p. m., 5th and 6th 3 p. m., 8th at 2 p. m., 18th at 6 p. m., and on the 19th at 4 p. m. Mr. David Trowbridge, at Waterburg, N. Y., reported 1st to 9th, 11th to 13th, 19th to 23d and 27th, no spots perceptible; 10th, 7.30 a. m. small spot about one-fifth diameter from west margin of disk not visible on the 9th at 3.30 p. m. or on the 11th at 6.30 p. m.; 24th, a group of two or more small spots a little east of the center of disk; 28th, a group of 2, one well defined, near eastern margin; 30th, two spots; 31st, one spot, which was still visible on September 1. Mr. William Dawson, at Spiceland, Ind., reported 1st, 2d, 4th, 7th to 9th, and 17th to 21st, no spots; 10th, eight spots in one group, one spot about half-way from center to western edge; 11th, 15 spots in two groups; new group of 5 little spots in NW. quadrant; 12th, 29 spots in two groups, the northern group having 23 spots, 5 prominent, increased wonderfully in past 24 hours; 13th, 14 spots in two groups; 14th, 9 spots in two groups very near western edge, faculæ in both; 22d, 3 small spots in one group about one-sixth of sun's diameter east of center; 25th, about 15 spots in one group between center and west edge; 26th, 13 spots in two groups, new group of 5 spots at east edge; 27th, 21 spots in three groups; western group has 3 spots, one large; eastern group has 15 spots, finely prominent and filled with faculæ; third group, near southeast margin, has 3 little spots; 28th, 22 spots in two groups, 20 spots, one large, in eastern group, southeast group disappeared; 29th, 26 spots in 2 groups, eastern group 18 spots; one group of eight small spots away south; 30th, 16 spots in eastern group, southern group disappeared; 31st, 19 spots in 2 groups; two little spots in faculæ near east edge. Mr. J. Harcourt, at Wappinger's Falls, N. Y., reports: 10th, one group of 6 spots; 31st, at 8 a. m. and 2 p. m., one large spot and a small group. Mr. F. Hess, at various points in the San Juan valley, Colo., 10th and 11th, one large and three small spots; 24th, 6 a. m., group of 9 spots near sun's center; 27th, 5 p. m., one large and one small spot near northeast limit; 28th, one large and two small spots near southeast limit; 29th to September 6th, one large and one small spot; sun examined, but no spots seen on the 25th. Observations were made throughout the month at Fort Whipple, Va., but no spots seen.

NOTES AND EXTRACTS.

[From Nature, August 14, 1879.]

The statistical review of volcanic phenomena during 1878, which Professor Fuchs has recently published, and which forms the continuation of many previous statistical accounts of the same nature, shows the unusually large number of twelve eruptions in the course of the year. Most of them occurred in remote localities, and gave evidence of the activity of volcanoes which were generally but little known and which are all difficult of access. The following eruptions are mentioned in Nature's article: Mount Vesuvius became active April 20. A small flow of lava took place at the end of September and from November 1st to 9th.

Active and hitherto unknown volcanoes were seen at the southern point of South America from January 10th to 18th. A great eruption occurred in Tanna Island, New Hebrides, on January 10th, lasting a short time and accompanied by a mighty tidal wave, which inundated a great part of the island. A second outbreak followed February 4th. Early in February an eruption happened in the island of Birara, group of New Britain. "The third eruption of February took place from the volcano Isluga, in South America, * * accompanied by a fearful earthquake, and so great were the masses of lava ejected, that villages * * more than five leagues distant from the volcano were completely destroyed by the incandescent streams. Smaller eruptions occurred from Mount Hecla during March; from Asamayama, Japan, and Cotopaxi in October; from Tapaco, the Situa and the Isalco, in San Salvador." Important eruptions took place in the volcanic series of the Aleutian Islands. Raitea and Borabora, Society Islands, are reported completely devastated by volcanic action. The well-known mud volcano near Paterno, Sicily, was in eruption from December 10th to 31st, remaining active at the end of the year.

"The number of earthquakes reported during 1878 amounts to 103, in which only complete earthquake periods are counted. The most violent and destructive took place January 23, in Peru and Bolivia. That of October 2d, in southern part of San Salvador, was also very violent."

Europeane arthquakes.—January 28th, northwestern France and southern England; January 16th, northwestern Switzerland, with repeated shocks. Other repeated earthquakes at Innspruck January 3d, 10th, 11th, February 2d, August 9th; Gross Gerau, January 2d and March 25th; Lisbon, January 26th, 27th, and June 8th; Premont, repeated shocks November 25th; Constantinople, Ismid, and Brussa, from 19th to end of May. The Low Rhenish earthquake August 28th affected over 2,000 geographical square miles, including Arnsbergh and Hanover in the north, Michelstadt and Odenwald to the southeast, Strasburg and Paris in the south, Brussels in the west, and Utrecht in the northwest. "It is remarkable that the phenomenon was only noticed at the surface, * * not one of the eleven hundred miners working at a depth of three hundred meters at Altessen noticed the least shock."

[From Nature, August 7, 1879.]

"Geneva Society of Physics and Natural History, March 6th, M. Ph. Plantamour observed during the cyclone of February 20 a notable depression of level of the lake of Geneva. The wind produced this effect of depression, notwithstanding the diminution of atmospheric pressure indicated by the barometer, and which would tend to raise the level of the water."

Published by order of the Secretary of War.

ALBERT J. MYER,
Brig. Gen. (Bvt. Ass'g'd), Chief Signal Officer, U. S. A.

PAPER 35.

MONTHLY WEATHER REVIEW, SEPTEMBER, 1879.

INTRODUCTION.

In preparing this REVIEW, the following data, received up to October 14, have been used, viz: The regular tri-daily weather charts, containing the data of simultaneous observations taken at 131 Signal Service stations and 12 Canadian stations, as telegraphed to this Office; monthly journals and means 147 and 152, respectively, from the former; reports from 29 sunset stations; 240 monthly registers from voluntary observers; 28 monthly registers from United States Army post surgeons; marine records; international simultaneous observations; monthly reports from voluntary observers in, and the local Weather Service of, Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

Upon chart No. II is shown by the isobaric lines the general distribution of atmospheric pressure, as reduced to the sea level, for the month. East of the Rocky Mountains the pressure during the month has been above the average for the past seven years at all stations except Key West, Punta Rassa, New Orleans, Vicksburg, and Pembina, at which stations the difference is zero. The excess has in general ranged from 0.02 at the other stations on the Gulf coast, 0.05 along the Atlantic coast, in the Lake region and Northwest, to 0.08 in the Ohio valley. On the Pacific coast the difference is very small.

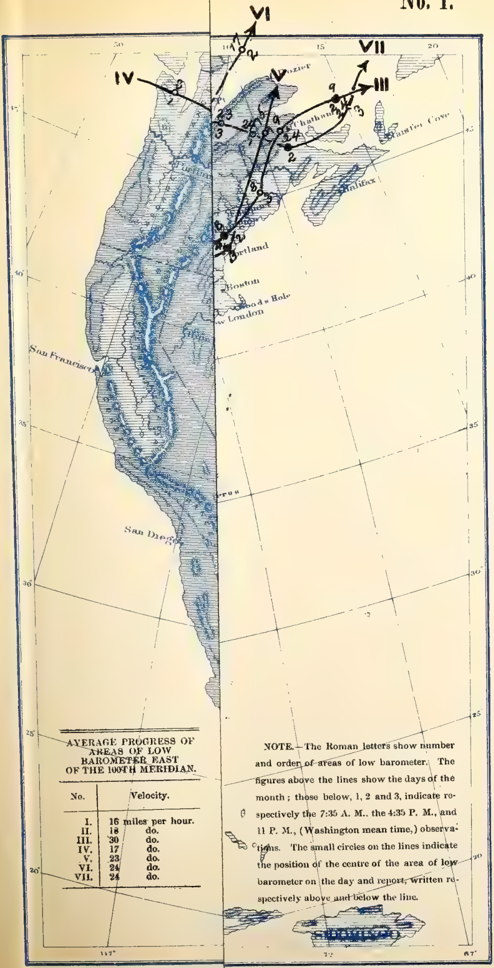
The *local barometric ranges* have been greatest over the Northwest and Lake region and over a narrow belt from New Orleans to Ohio in the track of storm area No. I, and least along the South Atlantic coast and from Texas to California. Taken by districts, they vary as follows: Atlantic states, from 0.79 of an inch at Eastport to 0.26 at Key West; Gulf states, 0.42 at Saint Mark's and 0.45 at Indianola to 0.82 at New Orleans; Tennessee and Ohio valley, 0.72 at Cairo to 0.96 at Cincinnati; Lake region, 0.86 at Oswego and 0.71 at Milwaukee to 1.05 at Port Huron; the Northwest, 0.66 at Saint Louis to 1.05 at Yankton; Rocky Mountains, 0.43 at Santa Fé to 0.59 at Denver; Pike's Peak, 0.37; Western Plateau, 0.31 at Tucson, Ariz., to 0.45 at Pioche and Winnemucca and 0.66 at Boise; California, 0.24 at San Diego to 0.29 at Red Bluff and 0.31 at Visalia; Oregon, 0.72 at Roseburg and 0.89 at Portland.

Areas of high barometer.—Of these, five have been sufficiently marked to merit description.

No. I.—This area was present off the coast of Oregon and Washington Territory at the morning report of September 1, the barometer at Portland being 0.14 inch above the normal. The area moved eastward, and on the morning of the 3d was central near Bismarck, the barometer at that station being 0.29 inch above the normal. North and northwest winds prevailed throughout the Northwest, the Upper Mississippi and Lower Missouri valleys, and over the Upper Lakes. The minimum temperature reported was 33° at Fort Stevenson, Dak. Moving southward, the area was central at North Platte, Nebr., on the morning of the 4th, barometer 0.22 inch above the normal. On the morning of the 5th the area was central near Cairo, Ill., barometer 0.12 inch above the normal; the temperature in the Lower Lake region, the southern portion of the Upper Lakes, and Upper Mississippi valley was slightly below the normal, and generally clear weather prevailed throughout the United States, excepting in the extreme Northwest and in Maine. During the 6th and 7th the area moved eastward and disappeared off the South Atlantic coast. High winds were reported from stations on Lake Michigan on the 3d.

No. II—made its appearance in the Northwest on the 7th, the barometer at Bismarck, Dak., at the morning report being 0.25 inch above the normal. Frost was reported from Fort Stevenson and Deadwood, Dak. The morning report of the 8th showed the area central near Breckenridge, Minn., barometer 0.29 inch above the normal. Light frost was reported from Davenport, Iowa. At the afternoon report of the 9th, the pressures at all stations east of the Mississippi River, excepting those in the New England States, were above the normal, the area being then central over Lake Michigan. The temperatures were below the normal in the Lake region, the Upper Mississippi and Ohio valleys, and Tennessee, and in the Middle and South Atlantic states. Cautionary off-shore signals were ordered up at 12.45 a. m. of the 8th at Sandy Hook, Atlantic City, and Cape May. The signals were justified by velocities of 35 miles at Cape May, 30 miles at Atlantic City, and 32 miles at Sandy Hook. The winds, which had been southerly on the South Atlantic coast, veered to the north during the night of the 8th, and high winds—48 miles at Cape Lookout and 25 miles at Cape Henry—were reported at midnight of that date. Cautionary signals were ordered at Cape Henry, Kittyhawk, Cape Hatteras, Macon, Cape Lookout, and Smithville at mid-

No. I.



AVERAGE PROGRESS OF AREAS OF LOW BAROMETER EAST OF THE 100TH MERIDIAN.

No.	Velocity.
I.	16 miles per hour.
II.	18 do.
III.	30 do.
IV.	17 do.
V.	23 do.
VI.	24 do.
VII.	24 do.

NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7:35 A. M., the 4:35 P. M., and 11 P. M., (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above and below the line.

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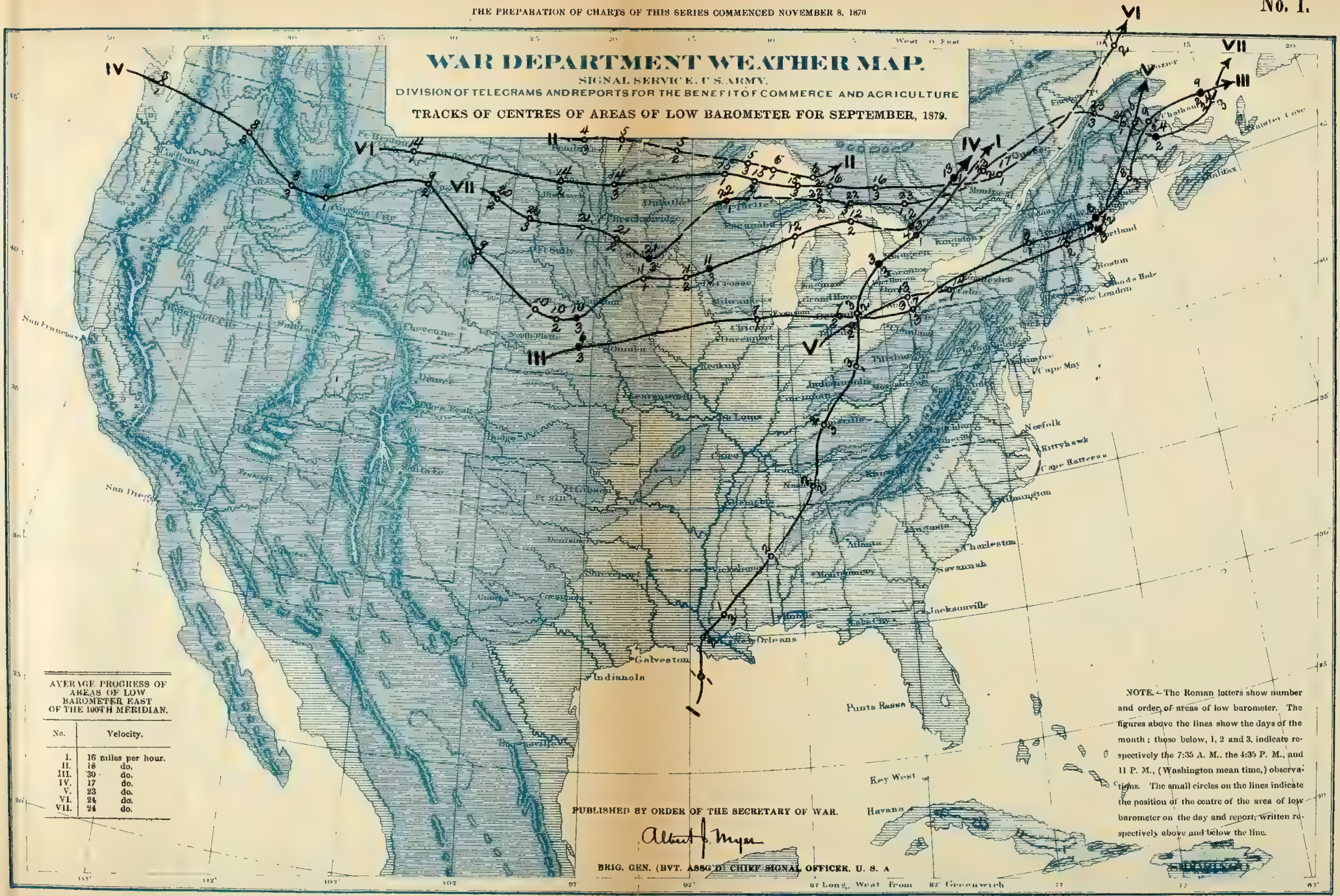
No. 1.

THE PREPARATION OF CHARTS OF THIS SERIES COMMENCED NOVEMBER 8, 1870



WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE

TRACKS OF CENTRES OF AREAS OF LOW BAROMETER FOR SEPTEMBER, 1879.

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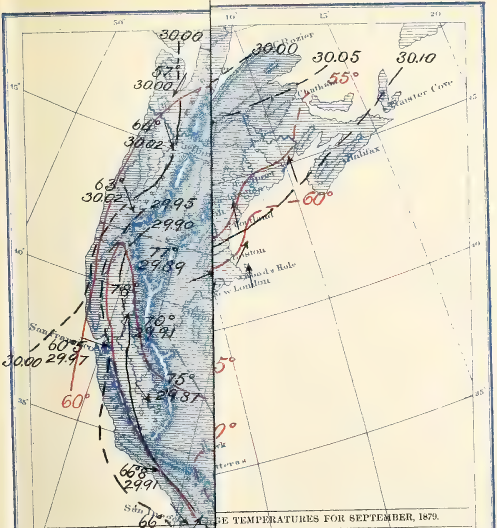
PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A



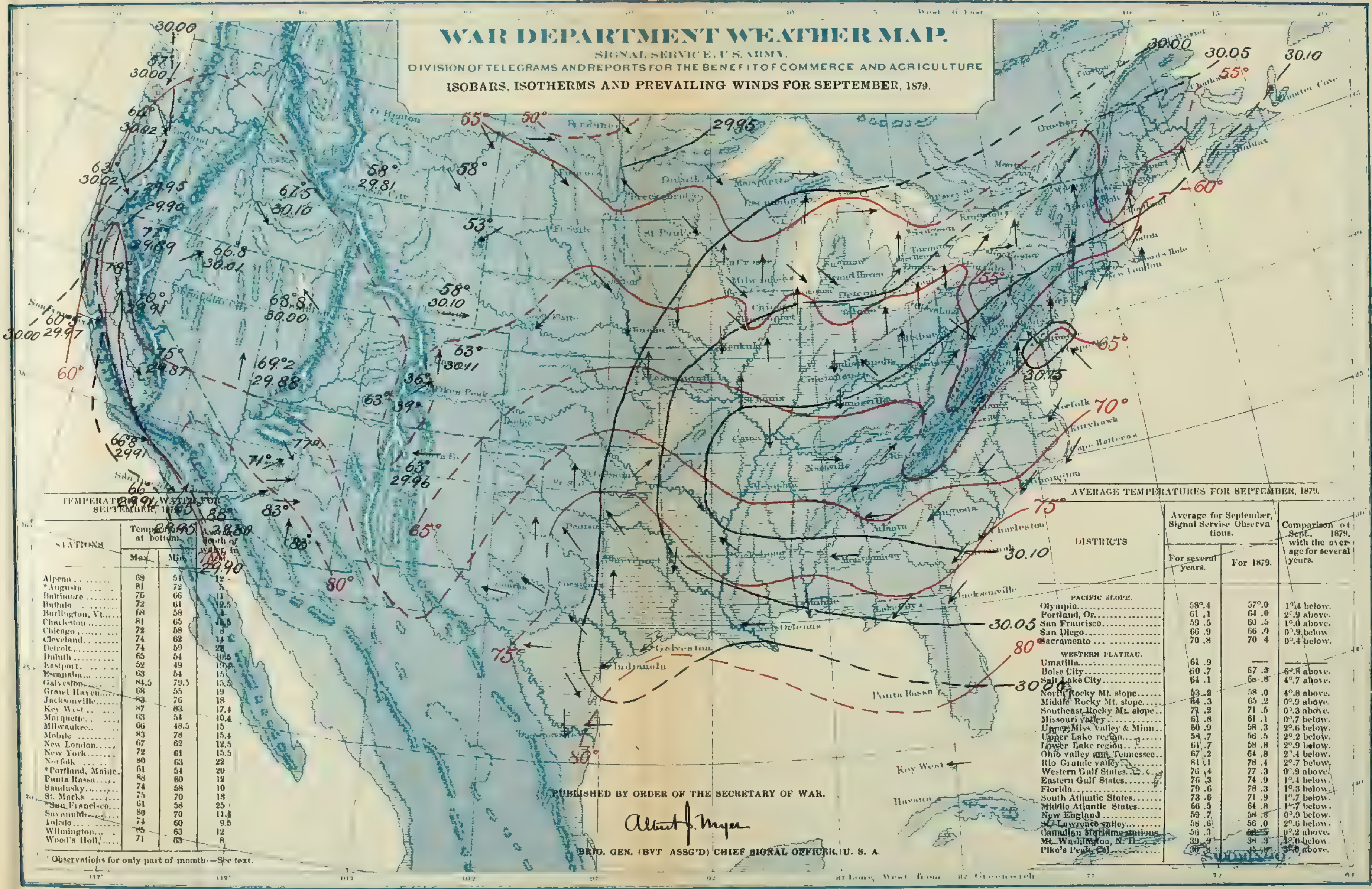
TEMPERATURE OF WATER, SEPTEMBER, 1879.

STATIONS.	Temperature at bottom.	
	Max.	Min.
Alpena	68	54
*Augusta	81	72
Baltimore	76	66
Buffalo	72	61
Burlington, Vt.	68	58
Charleston	81	65
Chicago	72	58
Cleveland	74	62
Detroit	74	59
Duluth	65	54
Eastport	52	49
Escanaba	63	54
Galveston	84.5	79.5
Grand Haven	68	55
Jacksonville	83	76
Key West	87	83
Marquette	63	54
Milwaukee	66	48.5
Mobile	83	78
New London	67	62
New York	72	61
Norfolk	80	63
*Portland, Maine	61	54
Punta Rassa	88	80
Sandusky	74	58
St. Marks	75	70
*San Francisco	61	58
Savannah	80	70
Toledo	74	60
Wilmington	85	63
Wood's Holl	71	63

* Observations for only part of momt

GE TEMPERATURES FOR SEPTEMBER, 1879.

CTS.	Average for September, Signal Servise Observations.		Comparison of Sept., 1879, with the average for several years.
	For several years.	For 1879.	
SLOPE.			
	58°.4	57°.0	1°.4 below.
	61 .1	64 .0	2°.9 above.
	59 .5	60 .5	1°.0 above.
	66 .9	66 .0	0°.9 below.
	70 .8	70 .4	0°.4 below.
LATEAU.			
	61 .9	——	——
	60 .7	67 .5	6°.8 above.
	64 .1	68 .8	4°.7 above.
t. slope	53 .2	58 .0	4°.8 above.
Mt. slope	64 .3	65 .2	0°.9 above.
y Mt. slope	71 .2	71 .5	0°.3 above.
	61 .8	61 .1	0°.7 below.
ley & Minn.	60 .9	58 .3	2°.6 below.
gan	58 .7	56 .5	2°.2 below.
gion	61 .7	58 .8	2°.9 below.
Tennessee	67 .2	64 .8	2°.4 below.
ley	81 .1	78 .4	2°.7 below.
tates	76 .4	77 .3	0°.9 above.
tates	76 .3	74 .9	1°.4 below.
	79 .6	78 .3	1°.3 below.
States	73 .6	71 .9	1°.7 below.
States	66 .5	64 .8	1°.7 below.
	59 .7	58 .8	0°.9 below.
alley	58 .6	56 .0	2°.6 below.
ime stations	56 .3	56 .5	0°.2 above.
n, N. H.	39 .9	38 .3	1°.6 below.
l	3[illegible] .8	35 .[illegible]	3°.0 above.



WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE

ISOBARS, ISOTHERMS AND PREVAILING WINDS FOR SEPTEMBER, 1879.

TEMPERATURE OF WATER FOR SEPTEMBER, 1879.

STATIONS	Temperature at bottom.		Depth of water, in feet.
	Max.	Min.	
Alpena	69	54	12
*Augusta	81	72	5
Baltimore	76	66	11
Buffalo	72	61	19.5
Burlington, Vt.	68	58	[illegible]
Charleston	81	65	[illegible]
Chicago	72	59	8
Cleveland	74	62	14
Detroit	74	59	28
Duluth	65	54	10.5
Eastport	52	49	19.6
Escanaba	63	54	15
Galveston	84.5	79.5	15.5
Grand Haven	68	55	19
Jacksonville	83	76	18
Key West	87	83	17.4
Marquette	63	54	10.4
Milwaukee	66	48.5	15
Mobile	83	78	15.4
New London	67	62	12.5
New York	72	61	15.5
Norfolk	80	63	22
*Portland, Maine	61	54	20
Punta Rassa	88	80	12
Sandusky	74	58	10
St. Marks	75	70	18
*San Francisco	61	58	25
Savannah	80	70	11.4
Toledo	74	60	9.5
Wilmington	85	63	12
Wood's Holl	71	63	8

* Observations for only part of month.—See text.

AVERAGE TEMPERATURES FOR SEPTEMBER, 1879.

DISTRICTS	Average for September, Signal Service Observations.		Comparison of Sept., 1879, with the average for several years.
	For several years.	For 1879.	
PACIFIC SLOPE.			
Olympia	58°.4	57°.0	1°.4 below.
Portland, Or.	61 .1	64 .0	2°.9 above.
San Francisco	59 .5	60 .5	1°.0 above.
San Diego	66 .9	66 .0	0°.9 below
Sacramento	70 .8	70 4	0°.4 below.
WESTERN PLATEAU.			
Umatilla	61 .9	——	——
Boise City	60 .7	67 .5	6°.8 above.
Salt Lake City	64 .1	68 .8	4°.7 above.
North Rocky Mt. slope	53 .2	58 .0	4°.8 above.
Middle Rocky Mt. slope	64 .3	65 .2	0°.9 above.
Southeast Rocky Mt. slope	71 .2	71 .5	0°.3 above.
Missouri valley	61 .8	61 .1	0°.7 below.
Upper Miss. Valley & Minn.	60 .9	58 .3	2°.6 below.
Upper Lake region	58 .7	56 .5	2°.2 below.
Lower Lake region	61 .7	58 .8	2°.9 below.
Ohio valley and Tennessee	67 .2	64 .8	2°.4 below.
Rio Grande valley	81 .1	78 .4	2°.7 below.
Western Gulf States	76 .4	77 .3	0°.9 above.
Eastern Gulf States	76 .3	74 .9	1°.4 below.
Florida	79 .6	78 .3	1°.3 below.
South Atlantic States	73 .6	71 .9	1°.7 below.
Middle Atlantic States	66 .5	64 .8	1°.7 below.
New England	59 .7	58 .8	0°.9 below.
St. Lawrence valley	58 .6	56 .0	2°.6 below.
Canadian Maritime stations	56 .3	56 .5	0°.2 above.
Mt. Washington, N. H.	39 .9	38 .3	1°.6 below.
Pike's Peak, Col.	30 .8	[illegible]	3°.0 above.

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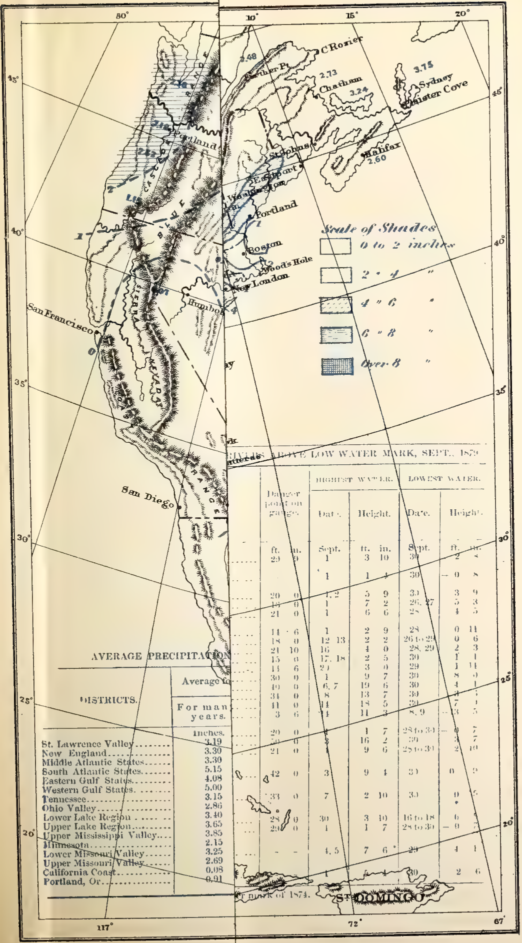
Albert J. Myer

BRIG. GEN. (BVT ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

No. III.



IVERS ABOVE LOW WATER MARK, SEPT., 1879

Danger point on gauges.		HIGHEST WATER.			LOWEST WATER.		
		Date.	Height.		Date.	Height.	
ft.	in.	Sept.	ft.	in.	Sept.	ft.	in.
29	9	1	3	10	30	2	4
		1	1	4	30	− 0	8
20	0	1, 2	5	9	30	3	9
16	0	1	7	2	26, 27	5	3
21	0	1	6	6	28	4	5
14	6	1	2	9	28	0	11
18	0	12, 13	2	2	26 to 29	0	6
21	10	16	4	0	28, 29	2	3
15	0	17, 18	2	5	30	1	1
14	6	20	3	0	29	1	11
30	0	1	9	7	30	8	0
40	0	6, 7	19	6	30	4	1
34	0	8	13	7	30	3	[illegible]
41	0	14	18	5	30	7	[illegible]
3	6	14	11	3	8, 9	− 3	5
20	0	[illegible]	1	7	28 to 30	− 0	7
30	0	3	16	2	30	3	7
21	0	[illegible]	9	6	28 to 30	2	10
42	0	3	9	4	30	0	9
33	0	7	2	10	30	0	5
28	0	30	3	10	16 to 18	6	[illegible]
29	0	1	1	7	28 to 30	− 0	7
–	–	4, 5	7	6	29	4	1
		1	5	4	30	2	6

r mark of 1874.

AVERAGE PRECIPITATION

DISTRICTS.	Average fo
	For man years.
	Inches.
St. Lawrence Valley	3.19
New England	3.30
Middle Atlantic States	3.30
South Atlantic States	5.15
Eastern Gulf States	4.08
Western Gulf States	5.00
Tennessee	3.15
Ohio Valley	2.86
Lower Lake Region	3.40
Upper Lake Region	3.65
Upper Mississippi Valley	3.85
Minnesota	2.15
Lower Missouri Valley	3.25
Upper Missouri Valley	2.69
California Coast	0.08
Portland, Or	0.91

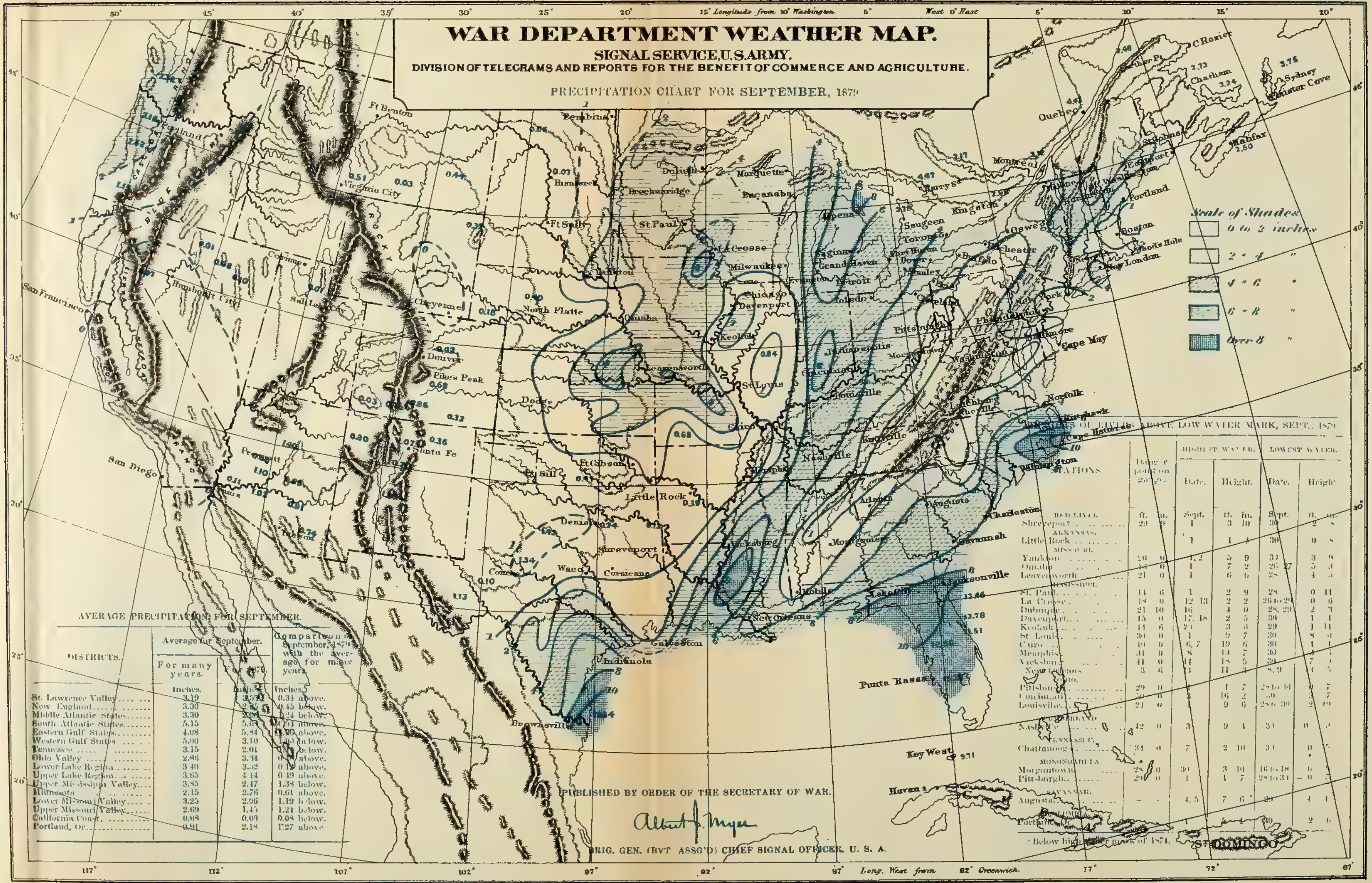
No. III.

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

PRECIPITATION CHART FOR SEPTEMBER, 1879



AVERAGE PRECIPITATION FOR SEPTEMBER.

DISTRICTS.	Average for September. For many years.	For 1879.	Comparison of September, 1879, with the average for many years.
	Inches.	Inches.	Inches.
St. Lawrence Valley	3.19	3.53	0.34 above.
New England	3.30	2.85	0.45 below.
Middle Atlantic States	3.30	2.06	1.24 below.
South Atlantic States	5.15	5.68	0.53 above.
Eastern Gulf States	4.08	5.84	1.76 above.
Western Gulf States	5.00	3.10	1.90 below.
Tennessee	3.15	2.01	1.14 below.
Ohio Valley	2.86	3.34	0.48 above.
Lower Lake Region	3.40	3.52	0.12 above.
Upper Lake Region	3.65	4.14	0.49 above.
Upper Mississippi Valley	3.85	2.47	1.38 below.
Minnesota	2.15	2.76	0.61 above.
Lower Missouri Valley	3.25	2.06	1.19 below.
Upper Missouri Valley	2.69	1.45	1.24 below.
California Coast	0.08	0.09	0.08 below.
Portland, Or.	0.91	2.18	1.27 above

HEIGHTS OF RIVERS ABOVE LOW WATER MARK, SEPT., 1879.

STATIONS	Danger point on gauge.		HIGHEST WATER.			LOWEST WATER.		
			Date.	Height.		Date.	Height.	
	ft.	in.	Sept.	ft.	in.	Sept.	ft.	in.
RED RIVER.								
Shreveport	29	9	1	3	10	30	2	8
ARKANSAS.								
Little Rock			1	1	4	30	0	8
MISSOURI.								
Yankton	20	0	1, 2	5	9	30	3	9
Omaha	14	0	1	7	2	26, 27	5	3
Leavenworth	21	0	1	6	6	28	4	5
MISSISSIPPI.								
St. Paul	14	6	1	2	9	28	0	11
La Crosse	18	0	12, 13	2	2	26 to 29	0	6
Dubuque	21	10	16	4	0	28, 29	2	3
Davenport	15	0	17, 18	2	5	30	1	1
Keokuk	14	6	20	3	3	29	1	11
St. Louis	30	0	1	9	7	30	8	0
Cairo	40	0	6, 7	19	6	30	4	1
Memphis	34	0	8	13	7	30	4	5
Vicksburg	41	0	14	18	5	30	7	1
New Orleans	3	6	14	11	3	8, 9	6	5
OHIO.								
Pittsburg	29	0	1	1	7	28 to 30	0	7
Cincinnati	50	0	3	16	2	30	3	7
Louisville	24	0	1	9	6	28 to 30	2	10
CUMBERLAND.								
Nashville	42	0	3	9	4	30	0	3
TENNESSEE.								
Chattanooga	33	0	7	2	10	30	0*	5
MONONGAHELA.								
Morgantown	28	0	30	3	10	16 to 18	6	9
Pittsburgh	29	0	1	1	7	28 to 30	−0	7
SAVANNAH.								
Augusta	—	—	4, 5	7	6	29	4	1
COLUMBIA.								
Portland, Or.			1	5	4	30	2	6

* Below high-water mark of 1874.

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BRIG. GEN. (BVT ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

night of the 8th. These signals were lowered at 6.30 p. m. of the 9th, having been fully justified. During the 9th, 10th, and 11th the area moved eastward, and at midnight of the 11th was off the New England and Middle Atlantic coasts. On the morning of the 12th it had disappeared.

No. III—made its appearance on the Oregon coast on the 9th, the barometer having risen during the night of the 8th at all stations on the Pacific coast north of Sacramento, Cal. At the morning report of the 10th, the barometer at Portland, Oreg., was 0.25 above the normal. The barometer continued rising rapidly in Oregon, and thence eastward to Dakota, the most rapid rise being at Virginia City, Mont., a rise of 0.21 in eight hours being reported from that station at the afternoon observation of the 10th. The area moved slowly to the southeast, and on the morning of the 13th was central near North Platte, Nebr., where the barometer was 0.28 above the normal. At the morning report of the 14th the area was central near Cairo, Ill.; thence during the 14th, 15th, and 16th it moved northeastward over the Ohio valley, the Middle Atlantic, and New England states, and disappeared. Generally, cool weather marked the passage of this area across the country. Frost was reported from Dodge City on the 11th and Davenport, Iowa, on the 14th. The minimum temperatures for the month were induced by this area at Cheyenne, North Platte, Vicksburg, Miss., New Orleans, La., and Mobile, Ala.

No. IV—appeared in the Northwest on the 17th, the Bismarck barometer being 0.27 inch above the normal at the midnight report of that date. At the morning report of the 18th, the barometer was 0.34 inch above the normal at Bismarck and Breckinridge, and was rapidly rising on the Upper Lakes and in the Upper Mississippi and Lower Missouri valleys. Moving southeastward, it was central at Davenport, Iowa, on the morning of the 20th; thence moving northeastward, it was central on Lake Huron on the morning of the 21st, and at Chatham on the morning of the 22d. The pressures remained high in New England and the Middle Atlantic states and the maritime provinces of Canada during the 22d, and gradually fell on the approach of low area No. VII. The minimum temperatures reported during the passage of the area were Breckenridge, Minn., 24° on the 18th, 36° at Saint Paul and Dubuque, and 34 degrees at Des Moines on the 20th. These were the minimum temperatures for the month at these stations. Cautionary signals were ordered up, in advance of this area, at Cape Hatteras, Lookout, Kittyhawk, and Macon at the midnight report of the 19th; at Cape Henry, Wilmington, and Smithville at 9.20 a. m. of the 20th; and from Norfolk to New Haven during latter part of the 20th and morning of 21st. The signals at Smithville and Wilmington were lowered at 11.50 p. m. on the 21st, those from Norfolk to New Haven on the afternoon and midnight of the 22d, and at Macon, Cape Lookout, Cape Hatteras, Kittyhawk, and Cape Henry at 9 a. m. of the 23d, having been fully justified. The maximum velocity of wind reported was 47 miles at Cape Henry. Cautionary signals were ordered up at Indianola and Galveston at the afternoon observation of the 19th. The signals were not justified at these stations, but rough weather and high north winds were experienced on the Gulf, and eleven vessels were lost on the 19th near Santa Anna, Mexico, during "a severe norther."

No. V—followed in rear of low area No. VII. At the morning report of the 23d, the line of 0.30 inch above the normal pressure embraced within its limits Bismarck, Breckenridge, and Pembina. The temperature at Pembina at this report was 19° (26° below the normal), the minimum temperature reported from any station within the United States during the month. The temperatures reported from stations in the United States were, with a few exceptions, below the normal. The pressure continued increasing in the Northwest during the 23d, the area remaining nearly stationary during that day. Moving first southeastward and then eastward, the area was central in Iowa on the morning of the 24th, at Indianapolis, Ind., on the morning of the 25th, and at Albany on the morning of the 26th. The pressures remained above the normal in the eastern portion of the United States during the remainder of the month, the area being central off the South Atlantic coast at the midnight report of the 30th. This area was accompanied by very low temperatures, the minima temperatures for the month for the Upper Mississippi and Ohio valleys, the Lake region, New England, and the Middle and South Atlantic states. Frost was reported from Yankton on the morning of the 24th; from Toledo, Ohio, Indianapolis, Ind., Cairo, Ill., Cincinnati, Ohio, and Pittsburgh, Pa., on the morning of the 25th; and from Burlington, Vt., Albany, N. Y., New Haven, Philadelphia, Washington, D. C., Lynchburg, Va., and Charlotte, N. C., on the morning of the 26th. Cautionary off-shore signals were ordered in advance of this area at Capes Lookout and Hatteras at 6.42 p. m. of the 24th. These were changed to cautionary signals at midnight of the same date, and signals were ordered up at Cape Henry, Kittyhawk, Macon, and Norfolk. The signals were lowered at 11.50 p. m. of the 26th, having been fully justified. The off-shore signals ordered on the New England and New Jersey coasts are considered in connection with low area No. VII.

Areas of low barometer.—Nine areas have been sufficiently marked to merit description, but the centers of only seven have followed tracks well enough defined to enable them to be properly located on the charts. The tracks of these seven are shown on Map No. I.

No. I.—This storm was a continuation of low area No. XI, described in the August Review. On the morning of the 1st the area was central over the Gulf of Mexico, southwest of New Orleans, at which station the barometer was 0.45 inch below the normal, and the wind was blowing with a velocity of 26 miles from the east. Cautionary signals had been ordered up at Indianola, Galveston, New Orleans, Port Eads, and Mobile, on the morning of August 30th, and were still displayed, and had been justified at all the stations, excepting Mobile. East of the Rocky Mountains, excepting in the extreme northwest, the barometer was below the normal. Cloudy weather and rain were reported from the southern portion of the South Atlantic states, the Eastern Gulf States, and from Tennessee. At the afternoon report of the 1st the storm was central northwest of New Orleans. The barometer had continued to fall rapidly in the Lower Mississippi valley, being now 0.61 inch below the normal at New Orleans, 0.41 at Vicksburg, 0.29 at Shreveport, and 0.36 at Mobile. The barometer had risen slightly in the Lake region; elsewhere it had fallen. Cloudy weather and rain continued in the Mississippi valley, the Eastern Gulf and South Atlantic states, and Tennessee, and were reported from the Ohio valley. Light rains were reported from Chicago, Toledo, and Milwaukee. High winds were reported from Indianola, Galveston, and New Orleans, the maximum velocity reported being 40 miles at the latter station. The temperature had fallen, since last preceding report, in the Lake region, and thence southward to the Gulf states; elsewhere it had risen. Cautionary signals were ordered up at Toledo and Sandusky. At the midnight report the area was central in southern Mississippi. The barometer remained nearly stationary, but had risen slightly at the Gulf stations. The wind at New Orleans had veered to W., and at the time of the report was blowing with a velocity of 26 miles. Maximum velocity since last report, 36 miles. The wind at Mobile remained southeast, and the signal at that station had been justified. The area of cloud and rain had extended itself northward, generally cloudy weather and numerous rains being reported from the Lake region. Heavy rain (1.69 inch in 8 hours) accompanying a thunderstorm was reported from Sandusky; heavy rainfalls were also reported from Indianapolis, Louisville, and Chattanooga. The temperatures remained nearly stationary. Cautionary signals were lowered at Indianola and Galveston, and ordered up at Cleveland, Detroit, and Port Huron. On the morning of the 2d the storm was still central in southern Mississippi, having moved slowly northward. The barometer had risen rapidly in the Gulf, a rise of 0.22 inch in 8 hours being reported from New Orleans. It had fallen in the Lake region, the South Atlantic states, Tennessee, and the Ohio valley. The temperatures had risen slightly in the same districts, and in the Eastern Gulf states and Lower Mississippi valley, the greatest rise, 9° in 8 hours, was reported from Louisville. The winds in the Lower Lake region and southern portion of the Upper Lake region had become NE. or E., and a velocity of 25 miles was reported from Toledo, Ohio. Cloudy weather and rain prevailed in the Lake region, Tennessee, the Ohio valley and the South Atlantic states. Heavy rain was reported from Indianapolis and Cincinnati. Cloudy weather was reported from the Middle Atlantic states, with light rain at Lynchburg, Va. West of the Mississippi river, clear weather prevailed, and a slight fall in temperature was reported. The afternoon report of the 2d showed the storm central at Nashville, Tenn. Cloudy weather and rain prevailed from the Mississippi river north of Vicksburg to New England. The barometer had risen slightly in New England, the Northwest and in the Gulf states, elsewhere it had fallen, the greatest fall, 0.14 inch in 8 hours, being reported from Nashville. In New England and west of the Mississippi the temperature had risen; elsewhere it had fallen. Cautionary signals were ordered up on the Atlantic coast from Savannah, Ga., to New York, and on the lakes at Buffalo, Chicago, Milwaukee, and Section One, Erie, Grand Haven, and Section Three. The storm continued moving north, and at midnight of the 2d was central at Louisville; barometer 0.54 inch below the normal. The barometer had fallen in the Lake region, the Ohio valley, the Middle Atlantic states and northern portion of the South Atlantic states; elsewhere it had remained stationary or risen slightly. The temperature remained nearly stationary. Heavy rainfalls, 1.70 inch, from Indianapolis, 1.40 inch from Louisville, and 1.23 inch from Cincinnati, were reported. Cautionary signals were ordered for Alpena. At the morning report of the 3d the storm was central in Western Ohio, Cincinnati barometer 0.54 inch below the normal. The barometer had risen in the Northwest and Tennessee, and had fallen rapidly in the Lake region and the Middle Atlantic states; elsewhere it had remained nearly stationary, with slight changes in temperature. Clear or partly cloudy weather prevailed, except in the Lake region, the Ohio valley, and the Middle and South Atlantic states, in which districts cloudy and rainy weather continued. Cautionary signals were ordered for Escanaba, Marquette, Duluth, Rochester, Oswego, and Section Six. At the afternoon report of the 30th, the depression was central near Port Huron—barometer 0.60 inch below the normal. The barometer had fallen rapidly in advance of the center, the greatest fall, 0.21 inch in

8 hours, being reported from Saugeen, and had risen rapidly in rear of the center, the greatest rise, 0.32 inch in 8 hours, being reported from Cincinnati. The temperature had fallen in the Lake region, Tennessee, and the Ohio valley, the South Atlantic states and New England; elsewhere it had remained stationary or had risen slightly. Cautionary signals were ordered down at Savannah and Charleston. High winds were reported from Duluth, Milwaukee, Grand Haven and Erie on the lakes, and Kittyhawk and Sandy Hook on the Atlantic coast. Heavy rain continued in the Lake region. The weather in the South and Middle Atlantic states was rapidly clearing. At midnight of the 3d the storm was central on Lake Huron, Saugeen barometer 0.61 inch below the normal, with N. to W. winds in the Upper Lake region, and SE. to SW. on the Lower Lakes. East of the Mississippi river the pressures remained below the normal, excepting in Maine, but were slowly recovering south of the Lakes and west of the Middle Atlantic states. In the Middle Atlantic states and New England and in Canada, the barometer continued falling. High winds were reported from Sandusky, Cleveland, and Alpena. Clear or partly cloudy weather prevailed, excepting in the Lake region, New England, and the northern portion of the Middle Atlantic states. Cautionary signals were ordered down from Smithville to New York, having been justified at all stations north of Cape Hatteras. On the morning of the 4th the storm was central midway between Parry Sound and Toronto, with NW. to W. winds in the Lake region. Winds exceeding 25 miles per hour in velocity were reported from Alpena, Saugeen, Toledo, Sandusky, Cleveland, Erie, Buffalo and Kingston, and clearing weather, with rising barometer, was reported from the Lake region. North of Tennessee and east of the Mississippi river the winds still remained under the influence of the storm. At the afternoon report the storm was central northwest of Montreal. High winds were reported from Alpena, Erie, Rochester, and Kingston, as occurring during the preceding eight hours, but, at the time of report, the winds had fallen to brisk, and signals were ordered down at all stations on the Lakes, excepting Port Huron. Pressures were rapidly recovering in rear of the storm, a rise of 0.30 inch being reported from Kingston. The storm continued moving northeastward, and at midnight of the 4th was central north of Quebec. Cautionary signals were ordered down at Port Huron. On the morning of the 5th the center was too far north of the Signal Service stations to accurately locate it. The pressures on the Lakes rapidly recovered under the influence of the area of high barometer, then central in the Ohio valley. This storm was very severe on Lakes Huron and Erie, and many accidents to vessels were reported. The steame *Bertschy* was lost on Lake Huron. The maximum velocity of wind during the storm was 43 miles at Sandusky at 9.45 p. m. on the 3d. A number of casualties resulting from this storm have been reported from New Orleans. A fleet of coal boats was sunk above the city, loss estimated at $103,000. The steamboat *Trenton* was capsized, and with her cargo proved a total loss; value $25,000. At Berwick and Morgan City the loss was estimated at about $50,000, and several men were washed overboard from vessels and drowned in Calcasieu Pass. At Mandeville, on Lake Pontchartrain, the damage to small boats, houses, &c., was estimated at $5,000. The damage to the cotton crop, in districts visited by the storm, was estimated at about 10 per cent. of the value of the crop. Considerable damage was also caused to the sugar crop.

No. II—made its appearance in Manitoba on the 4th, and, pursuing a course a little south of east, was central on the morning of the 5th NE. of Pembina, and on the morning of the 6th on Lake Superior. At the afternoon report it was central on the eastern shore of Lake Superior; thence pursuing a NE. course, it passed too far north to permit its path to be accurately charted. This area was accompanied by light rains on the Upper Lakes on the 5th and 6th, and on the Lower Lakes on the latter date. Cautionary signals were ordered up at Duluth, Marquette, Escanaba, Milwaukee, and Section One, Grand Haven and Section Three and Chicago on the afternoon of the 5th, and at Sandusky on the morning of the 6th, and were lowered at midnight of the 6th, having been justified at all stations, excepting Duluth and Sandusky, by maximum velocities of W. 27 miles at Milwaukee, SW. 28 at Marquette, and W. 30 at Grand Haven. The lowest barometer reported during the passage of this depression was 29.71 inches, 0.28 inch below the normal at Marquette on the morning of the 6th. No disasters were reported from any of the lake stations.

No. III—was central in Nebraska at the midnight report of the 6th; Omaha barometer 0.14 inch below the normal. Light rain had fallen, since the afternoon report, at Yankton and Saint Paul; elsewhere, throughout the United States, clear or partly cloudy weather prevailed. The temperature was below the normal in the Upper Mississippi valley, the Upper Lake region, and on Lake Erie. On the morning of the 7th the barometer had fallen in the Upper Lake region, and had risen rapidly in the Lower Missouri valley. The temperature had remained nearly stationary. Cloudy weather and light local rains were reported from stations in the Upper Lake region. Heavy rain had fallen during the night at La Crosse, and light rain at Saint Paul, but at the time of the report the rain had ceased, and clear or partly cloudy weather was reported; S. to W. winds prevailed in the Lake region. At the afternoon report the depression was central near Detroit; Detroit and Port Huron barometers 0.16 inch below the normal. The barometer had fallen in the Lower Lake region and in Ohio, and had risen in the Northwest. Cloudy weather and local rains were reported from the Lake region, and from Tennessee and the Ohio valley. High NW. winds, maximum velocities 28 and 32 miles, were reported from Milwaukee and Grand Haven. Cautionary signals were ordered up at Buffalo, Erie, Cleveland, and Section Five, Sandusky, Toledo, Detroit, and Port Huron on the lakes, and at Cape May, Atlantic City, Barnegat, and Sandy Hook on the New Jersey coast. At midnight the depression was central near Erie; Erie barometer 0.24 inch below the normal. Light rains had fallen in the Lake region, the Middle Atlantic states, and the Ohio valley, but in the latter district rain had ceased, and clear weather was reported. High westerly winds, maximum velocity 29 miles, were reported from Sandusky. Cautionary signals were ordered for Lewes and New York, and for stations on the New England coast from New York to Portland, and the cautionary signals on the New Jersey coast were changed to off-shore signals. Moving northeastward, the depression was central in Vermont on the morning of the 8th; Burlington barometer 0.31 inch below the normal. The barometer had risen in the Upper Lake region and on Lake Erie. Light rain had fallen in the Middle Atlantic states, New England, and Ontario. Heavy rain accompanying a thunderstorm was reported from Boston. At the afternoon report the area was central in Maine; Portland barometer 0.34 inch below the normal. N. to W. winds prevailed in the Lake region and in the Middle Atlantic States, and NW. to SW. winds in New England. The temperature had fallen rapidly, and the barometer had risen in the Lake region, the Middle Atlantic states, the Upper Mississippi and Ohio valleys, and in Tennessee. Cautionary signals were ordered down at New York, at stations on the New England coast, and at Buffalo, Erie, Cleveland and Section Five and Sandusky, having been justified on the lakes by maximum velocities of SW. 28 miles at Buffalo, W. 28 at Erie, W. 26 at Cleveland, and W. 33 at Sandusky. At midnight the storm center was northeast of Eastport; Eastport barometer 0.32 inch below the normal. N. to W. winds prevailed east of the Mississippi river, except in the Gulf and South Atlantic states. Cautionary signals were ordered down at Detroit and Port Huron. On the morning of the 9th the depression was central in New Brunswick, and thence, pursuing a northeasterly course, passed beyond the limit of the Canadian stations, and the pressures in New England rapidly recovered under the influence of the area of high barometer, then in the Lake region. The off-shore signals on the New Jersey coast were ordered down on the afternoon of the 9th, having been justified by maximum velocities of wind, NW. 35 miles at Cape May, W. 32 at Sandy Hook. This storm was quite severe on Lake Erie, vessel captains reporting very rough weather and high winds on the lake.

No. IV.—During the 7th, the barometer fell at stations in Oregon and Washington Territory, and on the morning of the 8th an area of low barometer was present off the coast of Washington Territory; Olympia barometer 0.25 inch below the normal. The temperature rose rapidly during the afternoon in eastern Idaho and Oregon, and in northern Nevada, and fell rapidly in western portions of Washington Territory and Oregon, a fall of 17° in eight hours being reported from Olympia, and one of 18° from Portland. The barometer fell rapidly in Idaho and the eastern portion of Washington Territory, and the depression moving eastward was central northeast of Umatilla on the afternoon of the 8th; Umatilla barometer 0.20 inch below the normal. The barometer rose rapidly in rear of the depression, and light rains were reported from Olympia and Portland. During the evening the temperature rose in Montana, a rise of 20° being reported from Virginia City, and the depression moving southeastward was central, at the midnight report, near Boise City, Idaho barometer 0.21 inch below the normal; thence moving eastward it was central northwest of Virginia City on the morning of the 9th, barometer 0.27 inch below the normal. At the afternoon report it was central in Montana; at this report with the exception of light rains at Olympia, Wash., Portland and Roseburg, Oreg., and local rains in Texas and New England, clear or partly cloudy weather prevailed throughout the United States. So far, no precipitation had taken place in front of the depression. The temperature continued to rise rapidly in advance and fall rapidly in rear of the depression, which, at midnight, was in Dakota, Bismarck barometer 0.21 inch below the normal. Thunder storms were reported from Saint Louis and Cairo; elsewhere, except at a few of the Gulf stations, clear or partly cloudy weather prevailed. Moving southeastward, the depression was central in Kansas on the morning of the 10th; North Platte and Omaha barometers 0.21 inch below the normal. Cloudy weather was reported in the Lower Missouri valley and light rain was falling at Cairo and Saint Louis. East of the Mississippi river, the pressures were above the normal, high area No. II being central in the Lake region. NE. to SE. winds prevailed in the Lower Missouri valley and in Texas, and E. to S. winds in the Upper Mississippi valley and the Upper Lake region, and variable winds in the Lower Lake region; elsewhere east of the Rocky Mountains, NE. to NW. winds prevailed. Moving slowly northeastward the area was central in southern Minnesota on the morning of the 11th. The pressure in the Upper Lake region, although still above the normal, had begun to give way, and the area of high barometer had moved eastward and was central over Lake Ontario. Light southerly winds and clear weather prevailed in the Lake region. Partly cloudy weather, and southerly winds, with light rains, were reported from the Upper Mississippi valley. Thunder storms were reported from Dubuque, Des Moines, and Leavenworth, accompanied by heavy rain at the latter station. In the afternoon the area was central in Eastern Minnesota. East of the Mississippi the pressure had fallen and the area of high barometer was central off the Middle Atlantic coast. West of the Mississippi the pressure had risen rapidly, cloudy weather and light rains were reported from the Upper Mississippi and Lakes Superior and Michigan; elsewhere east of the Mississippi clear or partly cloudy weather prevailed. The winds in the Lower Mississippi valley and the Northwest had veered to NW. and W., and E. to S. winds prevailed on the Upper Lakes. Moving northeastward the depression was central over Lake Michigan on the morning of the 12th; Marquette barometer 0.29 inch below the normal. The winds in the Lower Lake region had veered to southerly; brisk NW. to W. winds prevailed on Lakes Michigan and Superior. The barometer had fallen decidedly in the Lake region and was below the normal in the Upper Lake region and the Upper Mississippi valley; elsewhere, excepting Southern California, the barometer was above the normal. Cautionary signals were ordered for Alpena, Port Huron, Detroit, Section Four, Toledo, Sandusky, Cleveland, Section Five, and Erie. Cloudy weather and rain continued on Lakes Michigan and Superior. The winds in Texas had become northerly and cloudy weather and rain prevailed in that State. At the afternoon report of the 12th the depression was central north of Lake Huron; Alpena barometer 0.20 inch below the normal. The barometer had fallen rapidly over Lake Huron and in Ontario, a fall of 0.21 inch in eight hours being reported from Saugeen, and was rising rapidly in the rear of the center. Cloudy and rainy weather was reported from Lake Erie, Tennessee, and the Ohio valley. A thunder storm, accompanied by heavy rain, was reported from Sandusky, and high westerly winds at Milwaukee and Alpena. At midnight the area was central near Parry Sound. On the morning of the 13th it was northeast of Rockliffe, after which it moved off to the northeast accompanied by light rains in the Saint Lawrence valley and leaving a subsidiary depression in the Lake region.

No. V was a subsidiary area which formed in rear of the area just described. While area No. IV was moving off to the northeast, the barometer continued falling over Lakes Huron and Erie, and on the afternoon of the 13th an area of low barometer was formed, central to the west of Detroit, Mich. Partly cloudy or cloudy weather and light local rains prevailed east of the Mississippi river. Fresh southerly winds prevailed on the Atlantic coast, and NW. winds with rising barometer in the Upper Mississippi valley. The pressures were below the normal over Lakes Michigan and Huron, the Lower Lake region, the Saint Lawrence valley, the Middle Atlantic states, the Ohio valley, and the western portion of New England. The cautionary signals ordered in advance of area No. IV remained, and signals were ordered for Cape May, Lewes, Atlantic City, Barnegat, and Sandy Hook on the New Jersey coast. At midnight the area was central over Lake Erie. High winds and squally weather were reported from Sandusky and Cleveland. Cloudy weather and rain continued in the Lower Lake region, in New England, and in the Middle and South Atlantic states. Rain had fallen during the preceding eight hours in Tennessee and the Ohio valley, but it had ceased raining at the time of the report, and clear and cooler weather was reported. The temperature had risen in New England and the eastern portion of the Middle Atlantic states; elsewhere it had fallen. Cautionary signals were ordered down at Toledo, Detroit, Section Four, Port Huron, and Alpena. On the morning of the 14th the depression was central near Buffalo. Cloudy weather continued in the Lower Lake region, the Saint Lawrence valley, and the Middle Atlantic states. A thunder storm with heavy rain was reported from Sandusky. The pressures in the Northwest were falling rapidly. High northerly winds were reported from Lake Huron. An area of high barometer was central near Cairo, and moving slowly eastward. The cautionary signal at Cape May was changed to off-shore. At the afternoon report of the 14th, the area was central in New Hampshire. The barometer had risen in the Lake region and had fallen in New England and the Northwest. The cautionary signals at Sandusky, Cleveland, and Section Four were ordered down, and the cautionary signals at Barnegat, Sandy Hook, and Atlantic City were changed to off-shore signals. The signals displayed on the lakes were justified by velocities of SW. 27 miles at Cleveland, NW. 32 miles at Sandusky, and 25 miles at Alpena, but were lowered too soon at Port Huron. Cloudy and rainy weather continued in the Saint Lawrence valley, on Lake Ontario, and in New England. The weather in the Lower Lake region and the Middle and South Atlantic states rapidly cleared under the influence of the area of high barometer then advancing from the west. On the morning of the 15th the area was central in New Brunswick, northwest of Chatham. On the afternoon it had disappeared. The off-shore signals at Sandy Hook, Cape May, Atlantic City, and Barnegat were lowered, having been justified at all stations except Sandy Hook.

No. VI.—During the 13th the barometer fell in the Northern and Middle Plateau districts, the Northern and Middle Eastern Rocky Mountain slopes, and in the Northwest, and on the morning of the 14th an area of low pressure was central in Northern Montana. Low area No. V was still in the Lower Lake region, and an area of high barometer was central near Cairo, Ill. Moving eastward, area No. VI was central in Northeastern Dakota in the afternoon. South to east winds, with clear or partly cloudy weather, prevailed on Lakes Michigan and Superior and in the Upper Mississippi valley. The winds on Lake Huron and the Lower Lakes were still under the influence of area No. V, and cloudy and rainy weather prevailed in these districts. Since last preceding report the barometer had fallen rapidly in the Northwest, and had risen rapidly in the rear of the center. Cautionary signals were ordered for Duluth, Marquette, and Escanaba. At midnight, signals were also ordered for Milwaukee, Section One, Chicago, Grand Haven, and Section Three. During the night of the 14th, the barometer fell rapidly in the Upper Mississippi Valley and over the Upper Lakes, the most rapid fall, 0.30 inch in eight hours, occurring at Marquette. On the morning of the 15th the area was central over Lake Superior; Duluth and Marquette barometers 0.33 inch and 0.30 below the normals respectively. Low area No. V had moved to the northeast and was passing over the Canadian maritime stations. The area of high barometer had moved eastward and was central in the Middle Atlantic states. The winds in the Lower Lake region had become southerly. The winds were still southerly in the Upper Lake region and the Upper Mississippi valley, with the exception of those at Duluth and Saint Paul, which had shifted to NW. Northwest winds prevailed in the Lower Missouri valley and the Northwest, in which districts the pressure had rapidly increased and the temperature fallen slightly. Cloudy weather was reported in the Upper Lake region and light rains had fallen at Escanaba and Marquette, the rain at latter station accompanying a thunder storm. Cautionary signals were ordered for Alpena, Detroit, and Section Four, Port Huron, Toledo, Sandusky, Cleveland, and Section Five. The winds on Lake Michigan were veering to westerly, and high winds, velocities equaling or exceeding 25 miles per hour, were reported from Escanaba, Milwaukee, Grand Haven, and Alpena. At midnight the area was central over the eastern portion of Lake Superior. Clear or partly cloudy weather prevailed on the Upper Lakes, except on Lake Huron, where cloudy and rainy weather continued. Cautionary signals were ordered down at Grand Haven and Section Three. Continuing to move eastward, the storm was central, on the morning of the 16th, in Western Ontario, and at midnight was still in Ontario, its center being northwest of Parry Sound. In the afternoon cautionary signals were ordered down at Chicago, Milwaukee, Section One, Escanaba, Marquette, Duluth, Sandusky, Toledo, Cleveland, and Section Five, too soon for stations on the Lower Lakes, as high winds were subsequently reported from Sandusky and Cleveland. On the morning of the 17th the area was central north of Quebec; barometer 0.51 inch below the normal. Cloudy weather continued in New England, the Saint Lawrence valley, and on Lake Huron. Light rains had fallen in these districts during the night of the 16th. The area moved northeastward, accompanied by cloudy weather and light rains, and disappeared on the afternoon of the 18th.

No. VII.—During the night of the 19th and morning of the 20th the barometer fell in Dakota and Montana, and at the afternoon report of the latter date, an area of low pressure was central in Northwestern Dakota. Cloudy and rainy weather prevailed in the South Atlantic states, the weather in New England and the Middle Atlantic states was rapidly clearing, and in all other districts clear or partly cloudy weather prevailed. An area of high pressure was central in the Lake region. The temperature in the Upper Lake region and the Upper Mississippi valley had risen rapidly during the past eight hours. E. to S. winds prevailed in the Upper Mississippi and Lower Missouri valleys, and N. to W. winds in Montana. Cautionary signals were ordered for Duluth, Milwaukee, and Section One. At midnight, the area was central south of Bismarck, at which station the barometer had fallen 0.19 inch within eight hours. Light rain was reported from Duluth. The barometer continued falling in Dakota during the night of the 20th, and the depression moving eastward was central southeast of Breckenridge on the morning of the 21st, and at midnight of the same date was in Southern Minnesota The morning map of the 22d showed a shallow trough of low pressure extending southwestwardly from Lake Superior to Texas. The barometer continued to fall most rapidly in the Upper Lake region, in which district cloudy weather continued with light rains. Cautionary signals were ordered down at Duluth. During the 22d the barometer rose in the Northwest, the Upper Mississippi, the Lower Missouri and Ohio valleys, in Tennessee and the Eastern Gulf states, and the trough was divided into two weak areas of low barometer, one of which was central in Ontario northeast of Alpena, and the other, central in northern Texas, rapidly filled up and disappeared. The cautionary signals at Milwaukee and Section One were ordered down; they were not justified. Moving eastward, the depression was central north of Parry Sound on the morning of the 23d S. to W. winds prevailed on the Lower Lakes and in the Saint Lawrence valley.

Cloudy weather and light rains continued in the latter district. Since the morning of the 21st the barometer had been slowly rising in the extreme Northwest, and on the afternoon of the 23d an area of high barometer was advancing to the southeast over Manitoba; Pembina, barometer 0.30 inch above the normal. High northwest winds were reported from Marquette and Escanaba. Cautionary signals were ordered for Milwaukee, Section One, Chicago, Alpena, Grand Haven, and Section Three. N. to NW. winds were reported from the Upper Lakes and S. to W. winds from the Lower Lakes, Middle Atlantic states, and New England. At midnight the low area was central near Father Point, barometer 0.19 below the normal. High NW. winds, maximum velocity 30 miles, were reported from Sandusky. The temperature had fallen and the barometer risen during the past 24 hours in the Northwest, the Upper Lake region, and the Upper Mississippi valley, and light rains were reported from the Canadian maritime stations, the Saint Lawrence valley, the Lower Lake region, Lake Huron, and the Ohio valley. Cautionary signals were ordered up at Cape May and Sandy Hook, on the New Jersey coast, at Buffalo, Rochester, and Erie on the lakes. Moving nearly due south the depression was central west of Chatham on the morning of the 24th. The area of high barometer in the Northwest had advanced southeastward, and was central in the Lower Missouri valley. The cautionary signals at Cape May and Sandy Hook were changed to off-shore, and off-shore signals were also ordered for Atlantic City and Barnegat. The area was central south of Chatham at the afternoon observation, at which time cautionary signals were ordered up at Oswego and Section Six. At midnight the depression was central over the Gulf of Saint Lawrence. Cautionary signals were ordered down at Chicago, Milwaukee, Section One, Sandusky, Toledo, Alpena, Grand Haven, and Section Three. The morning report of the 25th showed that the depression had passed northeastward beyond the Canadian maritime stations, and cautionary signals were ordered down at Cape May, Sandy Hook, Atlantic City, Barnegat, and at the lake stations, and off-shore signals were ordered up for Newport, Wood's Holl, Boston, Section Eight, Portland, Section Seven, and Eastport. The signals displayed on the Lakes were justified at Detroit, Section Four, Toledo, Sandusky, and Cleveland. Maximum velocity of wind NW. 36 miles at Sandusky. The off-shore signals on the New England coast were lowered at the afternoon observation; they were not justified.

No. VIII.—During the 23d, 24th, and 25th a depression advanced eastward from the Pacific coast, but its path was not well enough defined to be accurately charted. On the morning of the 26th it was central in Eastern Dakota. Generally clear weather prevailed throughout the United States. East of the Mississippi river, in the Northwest and in the Lower Mississippi valley, the temperatures were below the normal, and frosts were reported from the Middle and South Atlantic states. From the 26th to the end of the month the pressure remained low in the Northwest and severe local storms were reported from that district. Niles, Mich., was visited on the 26th by a very severe thunder storm; houses, barns, hay-ricks, and trees were struck by lightning; the telegraph operators were driven from their offices and the instruments detroyed; a number of barns were burned and many cattle and horses killed. The area remained nearly stationary in the Northwest, and at midnight of the 30th was still central in that district. Cautionary signals were ordered up at Chicago, Milwaukee, Section One, Escanaba, Marquette, Duluth, Alpena, Grand Haven, and Section Three on the afternoon of the 25th, and at Erie, Cleveland, Section Five, Sandusky, Toledo, Detroit, Section Four, and Port Huron on the morning of the 27th. These signals were lowered on the afternoon of the 30th, having been fully justified on the Upper Lakes by velocities of SW. 25 miles at Alpena, SW. 36 miles at Grand Haven, NE. 36 miles at Duluth, and SW. 34 miles at Milwaukee. Rough weather prevailed on the Upper Lakes during the display of the signals. The signals were not justified on the Lower Lakes.

No. IX.—Between midnight of the 29th and the morning observation of the 30th the barometer fell rapidly in Oregon and Washington Territory, and on the morning of the 30th an area of low pressure was central off the west coast of Washington Territory; Portland barometer 0.25 inch below the normal, a fall of 0.26 inch in 8 hours. The barometer continued to fall rapidly in Oregon and Washington Territory, a fall of 0.32 inch in 8 hours being reported from Olympia at the afternoon observation. The depression extended itself rapidly to the eastward, and at the midnight report the barometer at Virginia City, Montana, was 0.39 inch below the normal.

INTERNATIONAL METEOROLOGY.

Three international charts, Nos. IV, V, and VI, accompany the present REVIEW. No. IV indicates the probable course of low pressure areas over the North Atlantic Ocean and neighboring waters and continents from the latter part of July to the end of August, 1879, and is based upon data received at this Office up to September 30, 1879. As the title implies, it is not intended for this chart to be considered as anything more than approximately correct, and it is probable that fuller data will change portions of it. Nos. V and VI are based upon the international simultaneous observations as described in the REVIEW for July, 1879, supplemented by such other observations as have been considered sufficiently trustworthy. Among the latter may be mentioned the observations made on board vessels over the North Atlantic Ocean and published in the Monthly Weather Review of the German Naval Observatory, which have been specially valuable in the tracing of tracks on chart No. VI.

On chart No. IV. the tracks of twelve areas of low pressure are traced, and in the upper right-hand corner is a small index giving the first and last dates of each area. Areas No. I, IV, VI, X, and XI are prolonged tracks of areas that have already appeared on charts No. 1 of July and August REVIEWS, and should, in accordance with the explanatory note at the foot of map, have been printed partly in black, but owing to an oversight have been printed wholly in red. Three of these, Nos. I, VI, and XI, probably crossed the Atlantic as indicated and materially affected the weather of northwestern Europe during the month of August. Nos. II, III, VIII, IX cannot at present be traced further than shown on map. No. V probably existed on the North Carolina coast on August 9, and moving northeastward produced hurricane winds off the coast of Nova Scotia on the 10th and 11th. No. VI is identical with area No. VII, chart I, August REVIEW; reports already received indicate that this storm existed on the 13th, about in the position shown. On this day (13th) a vessel in 20° N., 60° W., reported rapidly falling pressure, easterly winds, thunder, lightning and rain, the day ending with heavy squalls, torrents of rain, and severe lightning. At Saint Thomas during the 13th, cirrus clouds moved rapidly from the east, and at 1 a. m. of the 14th, heavy rain, thunder and lightning occurred. Observations made on the island of Grand Turk (21° 32′ N., 71° 10′ W.) at 10 a. m. give the lowest barometric pressure (29.75) of the month on the 15th, accompanied by a strong NE. wind and heavy rains; the latter ranging from 2.10 to 2.23 inches, or about one-half of the entire rainfall of the month, at Cockburn Harbor, Salt Cay and Grand Turk. During the day the wind changed to a heavy SE. gale, during which the brig *Helen*, lying at East Harbor, Turk's Island, loaded and ready for sea, was obliged to slip her chains, after which she drifted ashore. At Santiago de Cuba, heavy showers fell during the night of the 15th and on the 16th, with SE. squalls. On the 16th, brig *Dashaway* had a severe hurricane, lasting 10 hours, when 20 miles east of Watling's Island, and steamer *Pomona* (from Jamaica to New York, and on the 14th, in 19° 45′ N., 75° 50′ W.) reports, 16th, had hurricane from NE. to SSW., blowing with great violence, and a very heavy cross sea, lasting 13 hours. From the 17th to the 19th, this storm was fully described in the August REVIEW; it has not been traced after the 20th, on which day it was over Newfoundland. Nos. VII and XII are based upon the reports of severe storms on the dates and in the positions indicated. No. X is a prolongation of area No. IX, chart I, August REVIEW. It was encountered by bark *Elvira*, when 50 miles east of the Alacran Reefs. This vessel reports a severe cyclone from ENE. on the 20th, which ended next day at 4 p. m. with wind SSE.; it was attended by very high seas and terrific squalls. The heavy rains, reported to have ruined the corn crop, in the state of Tabasco, Mexico, may have accompanied this storm. From the 22d to the 26th, this storm is fully described in the August REVIEW, and, as there indicated, it probably continued off the Atlantic coast during the 27th. From the 28th to 31st, it passed northeastward, but does not appear to have been accompanied by very severe winds; on the 29th, the brig *Casarina*, 41° N., 66° W., was struck by a "whirlwind, commencing at N. and veering to W. and NE., lasting one hour."

Southern Hemisphere.—Since the publication of the August REVIEW the following reports of severe storms in the Southern Hemisphere have been received: *South Atlantic Ocean:* From June 23 to 28, severe storms prevailed along the coast of South America from Montevideo to Cape Horn; at Montevideo the direction of the wind at first (on the evening of the 23d) was S. by W., hauling to SSE. on the 24th, and backing to SSW. on the 25th; greatest force of wind, estimated, 11 to 12 from the SSE.; barometer fell to 29.78 on the 23d and to 29.86 on the 25th, and heavy rains, with thunder and lightning, fell on the 24th and 25th. It is reported as the heaviest southeaster experienced at Montevideo for years, and much damage resulted to the city and to small craft in the inner harbor; bark *Syra* was driven ashore and lost. Bark *Balmore* from England to San Francisco had a strong gale on June 25, during which a heavy sea threw the vessel on her beam ends, in which position she remained until the 28th, when she was in 57° 54′ S., 68° 38′ W. June 26, 1879, ship *Frank T. Curling*, from Liverpool to Callao, encountered heavy gales when off Cape Horn, and, on the 27th, during a lull in the storm the crew abandoned the vessel, and, on the morning of the 28th, were taken on board ship *John D. Costa*, barely in time to escape a renewal of storm; the abandoned vessel foundered on the 28th 250 miles southwest of Cape Horn. *South Pacific Ocean;* On June 29, 1879, severe SE. gales prevailed on the coast of New Zealand, during which ship B. L. and brig Akbar were driven ashore. *Indian Ocean:* On June 19, 1879, ship St. Charles, while off south end of Madagascar, had cyclone lasting 12 hours, during which the wind veered from ENE. to SSE. From June 30 to July 7, severe westerly gales and high seas were experienced off the Cape of Good Hope.

TEMPERATURE OF THE AIR.

The isothermal lines upon chart No. II show the general distribution of the temperature for the month of September, 1879, accompanying which is a table of comparative temperatures. The temperature has been decidedly below the normal over the eastern section of the country. This deviation has been least along the immediate Atlantic coast, from Cape May to Eastport, while over Nova Scotia and Cape Breton the temperature has been slightly in excess. Over the Southern states east of the Mississippi and in Arkansas, Missouri, Iowa, Dakota, and Northern Michigan, the deviation has ranged from 1° to 2°, while over the Upper Mississippi and Ohio valleys and larger part of the Lake region the mean temperature of the month has been from 3° to 4° below the average of the past seven or eight years. Over the northern portion of Texas and Indian Territory and over the Rocky Mountain region and Western Plateau a decided excess in temperature has occurred, amounting to 5° at Corsicana and on the summit of Pike's Peak; 4°.7 at Salt Lake City; 6°.2 at Virginia City; and 6°.8 at Boise City. The highest and lowest temperatures, as recorded during the month, by the maximum and minimum thermometers in use at the Signal Service stations, show the temperature to have risen above 100° over the interior of California, southern portion of Arizona, and interior of Texas; over 90° at stations on the Western Plateau (except Pioche, 88°), in New Mexico, over the eastern slope of the Rocky Mountains as far north as Nebraska, as well as over portions of Montana and Dakota, along the Gulf and Atlantic coasts and over the western portions of Pennsylvania and New York; to or over 80° at all other stations except Breckenridge, Duluth, Saint Paul, Marquette, Escanaba, Grand Haven, and outlying stations on the immediate coast of New England. The highest temperatures occurred in California from the 11th to the 16th; in the Lower Missouri, Upper Mississippi, and Lower Ohio Valleys, and Upper Lake region from the 26th to the 30th; elsewhere very generally from the 1st to the 10th. The highest recorded was 113° at Yuma, Ariz. The minima show the temperature to have fallen below 30° from Montana and Wyoming to Northern Minnesota and over the northern part of Lower Michigan; below 40° over Northern Nevada, Idaho, and from Northern Colorado to the interior of the Middle states and New England, except along the southern shore of Lake Erie; below 50° at elevated stations in California, and from Nevada to New Mexico, Missouri, and northern portions of Georgia and South Carolina; and below 60° at all stations except those in the Lower Rio Grande valley, along the immediate Gulf coast, and at Jacksonville, Fla. From the Northwest to the Atlantic coast the lowest temperatures were experienced from the 23d to the 27th; over the Southwest from the 13th to the 20th, and over California and the Western Plateau from the 23d to the 30th. The three lowest recorded were 20° on summit of Pike's Peak; 19° at Pembina; and 11° on the summit of Mount Washington. Below are given the highest and lowest temperatures observed by Signal Service and voluntary observers, arranged by states, those by voluntary observers being marked with a (*) star.

Minimum temperatures.—Maine: 26° at *Orono and 37° at Eastport. *New Hampshire:* 11° at Mount Washington. *Vermont:* 30° at *Lunenburg and *Strafford. *Massachusetts:* 30° at *Amherst, *Rowe, *Waltham, and 31° at Springfield. *Rhode Island:* 41° at Newport. *Connecticut:* 34° at *Southington. *New York:* 26° at *Nile and 33° at Albany. *Pennsylvania:* 22° at *Wellsboro and 35° at Pittsburgh. *Delaware:* 48° at *Dover. *Maryland:* 34° at *Woodstock, *New Market, *Emmitsburg, and 40° at Baltimore. *District of Columbia:* 38° at Washington. *Virginia:* 32° at *Snowville, and 38° at Fort Whipple. *West Virginia:* 39° at Morgantown. *North Carolina:* 36° at *Asheville, *Franklin, and 43° at Charlotte. *South Carolina:* 46° at *Spartanburg, and 54° at Charleston. *Georgia:* 44° at Atlanta. *Florida:* 60° at Saint Mark's. *Alabama:* 46° at *Wilsonville and 53° at Montgomery. *Mississippi:* 57° at Vicksburg. *Louisiana:* 55° at Shreveport. *Texas:* 45° at Davis. *Ohio:* 31° at Westerville and 37° at Columbus. *Kentucky:* 44° at Louisville. *Tennessee:* 42° at Nashville and *Ashwood. *Arkansas:* 45° at *Mount Ida. *Michigan:* 30° at *Thornsville, *Lansing, Grand Haven, and Alpena. *Indiana:* 34° at *Logansport and *Wabash. *Illinois:* 30° at *Elmira and 39° at Chicago. *Missouri:* 38° at *Corning and 41° at Saint Louis. *Kansas:* 32° at *Holton and 43° at Leavenworth. *Wisconsin:* 23° at *Neilsville and 35° at Milwaukee. *Iowa:* 24° at *Ames and 34° at Des Moines. *Nebraska:* 28° at *De Soto and 34° at North Platte. *Indian Territory:* 46° at Fort Sill. *Minnesota:* 24° at Breckenridge. *Dakota:* 19° at Pembina. *Colorado:* 20° at Pike's Peak and 38° at Denver. *New Mexico:* 42° at Santa Fé and La Mesilla. *Wyoming:* 30° at Cheyenne. *Utah:* 33° at *Coalville. *Nevada:* 33° at Winnemucca. *Arizona:* 44° at Prescott. *Idaho:* 36° at Boise City. *California:* 32° at Campo, 47° at Los Angeles, 52° at San Francisco and Sacramento. *Oregon:* 39° at Roseburg.

Maximum temperatures.—Maine: 85° at Portland. *New Hampshire:* 89° at *Grafton. *Vermont:* 85° at Burlington. *Massachusetts:* 89° at Boston. *Rhode Island:* 76° at Newport. *Connecticut:* 82° at New Haven. *New York:* 90° at Rochester and 95° at *Waterburg. *Pennsylvania:* 90° at Pittsburgh and 94° at *Wellsboro. *Delaware:* 82° at

*Dover. *Maryland:* 85° at Baltimore. *District of Columbia:* 87° at Washington. *Virginia:* 90° at Norfolk. *West Virginia:* 84° at Morgantown. *North Carolina:* 92° at Wilmington. *South Carolina:* 89° at Charleston. *Georgia:* 91° at Augusta. *Florida:* 90° at Jacksonville and 91° at Key West. *Alabama:* 91° at Mobile. *Mississippi:* 93° at Vicksburg. *Louisiana:* 95° at *Okalooska. *Texas:* 104° at *Mesilla. *Ohio:* 88° at Bellefontaine, *Ruggles, and *Ringgold. *Kentucky:* 83° at Louisville. *Tennessee:* 88° at Knoxville. *Arkansas:* 88° at Little Rock. *Michigan:* 85° at Alpena. *Indiana:* 80° at Indianapolis and 84° at *Laconia. *Illinois:* 86° at *Peoria and *Anna. *Missouri:* 93° at *Independence. *Kansas:* 97° at *Holton. *Wisconsin:* 82° at *Beloit. *Iowa:* 90° at *Vail. *Nebraska:* 93° at *Howard. *Indian Territory:* 95° at Fort Sill. *Minnesota:* 78° at Saint Paul. *Dakota:* 95° at Fort Buford. *Colorado:* 89° at Denver. *New Mexico:* 105° at La Mesilla. *Wyoming:* 87° at Cheyenne. *Utah:* 91° at Salt Lake City. *Nevada:* 97° at *Carson City. *Arizona:* 113° at Yuma. *Idaho:* 92° at Boise City. *California:* 92° at San Diego and 105° at Red Bluff. *Oregon:* 90° at Roseburg.

Ranges of temperature at Signal Service stations.—The *monthly ranges* will appear from an examination of the maxima and minima just given. The greatest *daily ranges* vary in New England from 16° at Wood's Holl to 19° on Mount Washington and 29° at Boston; Middle Atlantic States, from 20° at Barnegat to 33° at Washington; South Atlantic States, from 13° at Portsmouth, N. C., to 25° at Jacksonville, and 31° at Charlotte; Gulf States, from 13° at Key West to 17° at New Orleans and 33° at Corsicana; Ohio Valley and Tennessee, from 25° at Cairo, Louisville, and Cincinnati to 37° at Pittsburgh and Knoxville; Lower Lake region, from 20° at Toledo to 30° at Rochester; Upper Lake region, from 23° at Madison to 30° at Chicago and Duluth and 33° at Alpena; Upper Mississippi valley, from 24° at Springfield, Ill., to 31° at Saint Paul and 33° at Des Moines; Lower Missouri valley, from 30° at Leavenworth to 38° at Yankton; Northwest, from 41° at Bismarck to 46° at Pembina; Eastern Rocky Mountain slope, from 31° at Denison, 38° at Fort Sill, to 35° at Deadwood and 46° at North Platte; Rocky Mountains, from 26° on Pike's Peak to 40° at Santa Fé and 44° at Cheyenne; Plateau districts, from 34° at Pioche to 39° at Boise City and 54° at Winnemucca; California, from 26° at San Francisco to 36° at Los Angeles and 40° at Red Bluff and Visalia.

Frosts were quite frequent over the northern portions of the country, and during the latter part of the month very generally destructive to vegetation, as will be seen from the following summary: On the 26th and 27th, they were experienced as far south as Tennessee, Georgia, and South Carolina. In New England frosts occurred on the 5th, 7th, 10th, and from the 20th to the 27th, and were destructive to vegetation on the 21st, 25th, 26th, and 27th. In New York and Pennsylvania, from the 4th to the 28th; destructive 11th, 12th, 21st, 25th, 26th, 27th. Maryland, Virginia, and West Virginia, 10th, 11th, 25th, 26th, 27th. North Carolina, 24th, 25th, 26th, 27th, 28th. South Carolina and Georgia, 26th and 27th. Tennessee, 14th and 26th. Ohio valley, 5th, 9th, 10th, 11th, 15th, 19th, 21st, 25th, 26th; destructive, 15th, 25th and 26th. Lower Lakes, 4th to 29th; destructive, 11th, 12th, 24th, and 25th. Upper Lake region, 5th, 7th, 8th, 9th, 10th, 11th, 15th, 17th to 26th; destructive, 5th, 7th, 19th, 20th, 21st, 24th, 25th. Upper Mississippi valley, 4th to 26th; destructive, 14th, 19th, 20th, 24th, 25th, and 26th. Lower Missouri valley, 6th, 8th, 12th, 13th, 17th, 18th, 20th, 24th; destructive, 20th and 24th. Extreme Northwest, 3d, 4th, 5th, 7th, 8th, 12th, 18th, 19th, 20th, 22d, 23d, 24th, 29th, 30th. Colorado, at Summit, every night; summit of Pike's Peak, 3d, 12th, 13th, 20th, 25th. Idaho, 11th, 12th, 30th. Utah, 26th, 27th. Nevada, 11th, 12th, 13th, 27th, 30th.

Ice occurred as follows: On the 9th, at Neilsville, Wis., $\frac{1}{8}$ of an inch in thickness. 12th, Winnemucca, Nev. On the 13th, at Pembina, on pools. 14th, Cresco, Iowa, $\frac{1}{10}$ inch, and at Fort Madison, Iowa, $\frac{1}{8}$ inch. 17th, Idaho City, Idaho. 19th, Cresco, Iowa, $\frac{1}{4}$ inch; Nora Springs, Iowa, and Litchfield, Mich. 20th, Belvidere, Ill., Litchfield, Mich., Plattsmouth and Genoa, Nebr., and Burlington, Iowa. 21st, Litchfield, Mich., and Waterburg, N. Y. 23d, Logansport, Ind.; Pembina, 1 inch; Clear Creek, Nebr. 24th, Muscatine and Burlington, Iowa; Independence, Iowa, $\frac{1}{8}$ inch.; Niles, Mich., $\frac{1}{4}$ inch; Litchfield and Ypsilanti, Mich.; Howard, Genoa, and Clear Creek, Nebr.; Pembina; Hanover, N. H. 25th, Elmira, Ill.; Belvidere, Ill., $\frac{1}{5}$ inch; Wabash, Ind.; Litchfield and Hudson, Mich.; Ashley, Mo.; Ithaca, N. Y., $\frac{1}{4}$ inch; Nile, N. Y., $\frac{1}{8}$ inch.; Urbana, Ohio; Pittsburg, $\frac{1}{16}$ inch; Burlington, Vt. 26th, Gardiner, Me.; Eastport, $\frac{1}{8}$ inch; Westborough, Mass., $\frac{1}{8}$ inch.; Linden and Somerville, N. J.; Waterburg and Palermo, N. Y.; Hulmesville, Pa.; Woodstock and Burlington, Vt., $\frac{1}{4}$ inch; Contoocookville, N. H., $\frac{1}{2}$ inch. 27th, Coalville, Utah, $\frac{1}{4}$ inch. 30th, Winnemucca.

Ground was frozen on the 24th at Litchfield, Mich.; on the 25th, at Contoocookville, N. H., Williston, Vt., and Litchfield, Mich.; 26th, at Strafford, Vt.; Dyberry, Pa., to a depth of 1 inch.

PRECIPITATION.

The general distribution of rainfall for the month is illustrated as accurately as possible on chart No. III, from about 500 Signal Service and voluntary reports; it is accompanied by a table giving the average precipitation for the month of September by districts, which shows the rainfall for the month to have been in excess in the South Atlantic and Eastern Gulf states, and on the coast of Oregon. In the Northwest and the Middle Atlantic states, this table shows a decided deficiency, but by reference to the chart other extensive areas, not included in these districts, will be found to have experienced a great want of rain, which, however, in taking an average of the district, have been compensated for by heavy rains in some other portions of the same district. Thus in the Eastern Gulf states, while a large part of Mississippi had over six inches, portions of Alabama and Georgia had less than one inch, and this applies to nearly all the different sections. In consequence of this uneven distribution of rain, severe droughts have occurred and great loss has resulted to stock and crops. This is especially the case in portions of Pennsylvania, Virginia, and North Carolina; in Illinois, Missouri, Indian Territory, and Texas, and in Utah. Special reference to these will be found under the proper heading.

Special heavy rains.—On the 1st and 2d, at Vicksburg, Miss., 3.99 inches; Ashwood Tenn., 4 inches; Brookhaven, Miss., from 5 a. m. of the 1st to 4 a. m. of the 2d, 6.05 inches; Saint Mark's, Fla., 4.08 inches. 1st to 3d Arlington, Ind., 3.85 inches; Laconia, Ind., 4.80 inches; Saint Meinrad, Ind., 5.35 inches; Fort Wayne, Ind., 4.30 inches; Margaretta, Ohio, 3.19 inches; Nashville, Tenn., 3.83 inches; Indianapolis, Ind., 5.09 inches; Louisville, Ky., 3.55 inches. 2d and 3d Detroit, Mich., 3.88 inches. 5th, Waterville, Kans., 1.94 inches in 2½ hours. 7th and 8th, Alpena, Mich., 3.68 inches. 8th, Saint Mark's, Fla., 1.98 inch in 2 hours and 40 minutes. 9th, San Antonio, Tex., 2.40 inches. 10th, Booneville, Mo., 2.55 inches. 11th, Corning, Mo., 3.30 inches; Indianola, Tex., 3.79 inches. 11th to 13th, Brookhaven, Miss., 3.90 inches; Saint Augustine, Fla., 3.32 inches. 13th and 14th, Gulf Hammock, Fla, 4.25 inches. 18th and 19th, Key West, Fla., 4.20 inches. 20th and 21st, Cape Hatteras, N. C., 5.25 inches; Cape Lookout, N. C., 5.06 inches; Wilmington, N. C., 4.26 inches; Charleston, S. C., 4.42 inches. 24th, Brownsville, Tex., 4.02 inches. 25th, Daytona, Fla., 2.98 inches. Rio Grande City, Tex., 1.93 inches in 35 minutes. 26th and 27th, Niles, Mich., 3.10 inches. 28th and 29th, Socorro, N. Mex., 1.94 inches.

Largest monthly rainfalls.—Punta Rassa and Daytona, Fla., 13.78 inches; Brownsville, Tex., and Cape Hatteras, N. C., 11.64; Mayport, Fla., 11.51; Okahumpka, Fla., 10.50; Brookhaven, Miss., 9.95; Saint Mark's, Fla., 9.82; Key West, Fla., 9.71; Fayette, Miss., 9.00; Gulf Hammock, Fla., 8.97; Cape Lookout, N. C., 8.82; Jacksonville, Tenn., 8.24; Alpena, Mich., 8.00; Fayetteville, N. C., 7.75; Indianola, Tex., 7.27.

Smallest monthly rainfalls.—Within the limits of the lines marked zero upon chart No. III, and embracing portions of California, Nevada, Colorado, and Wyoming, only one station (Truckee in the Sierra Nevadas) reports any rainfall. The following stations report very small monthly rainfalls: San Francisco and Red Bluff, Cal., Pioche, Nev., and Fort Buford, a trace; Winnemucca and Salt Lake City, 0.01; Denver, Colo., 0.02; Hermosa, Colo., Fort Custer, Mont., and Pilot Point, Tex., 0.03; Fort Stevenson, Dak., 0.06; Bismarck, Dak., 0.07; Battle Mountain, Nev., 0.08; Graham, Tex., 0.09; Stockton, Tex., Beowawe and Carlin, Nev., 0.10; Yuma, Ariz., 0.11; Clarksville, Tex., 0.13; Boise City, Idaho, 0.14; Albuquerque, N. M., 0.20; Knoxville, Tenn., 0.22; Henrietta, Tex., 0.24; Melissa, Tex., 0.25; Forsythe, Mo., 0.30; Deadwood, Dak., 0.32; Coleman, Tex., 0.37; Little Rock, Ark., 0.39; Dover, Del., Rockford, Ill., Mount Ida, Ark., and North Platte, Nebr., 0.40; Fort Keogh, Mont., 0.44; Accotink, Va., 0.45; Fort Sill, Dak., 0.47; Snowville, Va., and Bolivar, Mo., 0.50; Virginia City, Mont., 0.51; McKavett, Tex., and Fort Warren, Mass., 0.52; Charlotte, N. C., 0.53; Okalooska, La., 0.55; Fort Gibson, Ind. T., 0.60; Prescott, Ariz., and Springfield, Mo., 0.68; Webster and Asheville, N. C., 0.70; Fort McPherson, Nebr., 0.72; Tucson, Ariz., 0.74; Ringgold, Ohio, 0.81; Greensborough, N. C., 0.85; West Point, N. Y., and Corsicana, Tex., 0.88; Cairo, Ill., 0.93.

Rainy days.—The number of days on which rain or snow has fallen varies as follows: New England, from 8 to 16; Middle Atlantic states, 6 to 10; South Atlantic states, 6 to 19; Eastern Gulf states, 7 to 22; Western Gulf states, 1 to 10; Ohio valley and Tennessee, 4 to 9; Lower Lake region, 12 to 18; Upper Lake region, 11 to 20; Upper Mississippi valley, 6 to 13; Missouri valley, 1 to 8; Red River of the North valley, 7 to 9; Eastern Rocky Mountain slope, 1 to 9 in Texas, 1 to 3 in Indian Territory, and 1 to 4 thence northward to Dakota; Rocky Mountains, 0 to 4; Plateau districts, 1 to 2; California, 0 to 1; coast of Oregon and Washington Territory, 5 to 10.

Cloudy days.—The number varies in New England from 2 to 18; Middle Atlantic states, 4 to 8; South Atlantic states, 7 to 16; Eastern Gulf states, 5 to 13; Western Gulf states, 0 to 9; Lower Lake region, 8 to 11; Upper Lake region, 5 to 11; Ohio valley and Tennessee, 2 to 10; Upper Mississippi valley, 3 to 7; Missouri valley, 0 to 8; Red River of the North valley, 4 to 5; Eastern Rocky Mountain slope, 0 to 8 in Texas, 0 to 3 in Indian Territory, and 1 to 4 northward to Dakota; Rocky Mountains, 0 to 4; Plateau districts, 0 to 2; California, 0 to 3; coast of Oregon and Washington Territory, 7 to 9.

Hail fell on Pike's Peak on the 3d, 10th, and 19th; at Fort Davis, Tex., 30th; Logansport, Ind., 18th; Madison, Wis., 16th; Alpena, 7th; New Haven, 8th; Fort Brady, Mich., 17th and 20th; Summit, Colo., 18th; Belvidere, Ill., 27th; Anna, Ill., 7th; Cresco, Iowa, 11th and 28th; Halton, Independence, and Wellington, Kans., 11th; Fall River, Mass., 11th; Detroit, Ypsilanti, and Kalamazoo, Mich., 13th; Kansas City, Mo., 12th; De Soto, Nebr., 11th; Grafton, N. H., 17th; Princeton, N. J., 14th; Argyle, N. Y., 17th; Norwalk, Ohio, 13th; Lunenburgh, Vt., 17th; Helvetia, W. Va., 7th; Portland, Oreg., 29th; Virginia City, 28th; Albany, Oreg., 9th.

Snow fell on the summit of Mount Washington on the 20th and 24th; 25th, snow squalls, during which two inches of snow fell, occurred on the mountains near Strafford, Vt., and on the 29th snow fell on the mountains near Burlington, Vt.; on the summit of Pike's Peak, 8th, 23d, 24th, 27th (very heavy snow storm), 28th, and 29th; Colorado Springs, Colo., 27th; near Fort Garland, Colo., 27th on the summits of Sierra Blanco and Baldy; Virginia City, Mont., 10th.

Depth of snow on ground at end of month.—On the summit of Pike's Peak 1 to 6 inches.

Droughts were severe and extensive. The observer at Litchfield, Pa., reports a severe drought throughout the month; at Wellsborough, Pa., on the 30th, wells and streams were exhausted, pasturage a failure, and farmers were already compelled to feed their stock with hay; at Mount Solon, Va., dryest season experienced for thirty years, water transported from distant points. The observer at Belvidere, Ill., reports on the 30th that since August 10 there has been a continued scarcity of water, and crops and pastures are drying up. The Missouri Weather Service reports an unusual drought over a tract of country within a radius of 50 miles of Springfield, resulting in the drying up of streams and wells, causing great inconvenience to stock raisers. At Fort Gibson, Ind. T., on the 10th, late vegetation was withering and becoming parched; streams and wells dry; on the 30th the long-continued drought was assuming very serious proportions. At Clarksville, Tex., it was the warmest September for the past ten years, and resulted in a very severe drought; only 0.13 inch of rain has fallen since the 9th of August. At Melissa, Tex., it was dry, dusty, and smoky from the 14th to 29th, and wells, streams, and cisterns became exhausted. At Corsicana, on the 30th, the severe drought still continued. At Kanab, Utah, from 1st to 27th, drought was very severe; cattle are dying for want of water and food. Many streams exhausted which have not failed before since the country has been settled; the ground is very dry, and when plowed up appears like ashes. At Coalville, Utah, 30th, excessive drought throughout the month; all crops a failure; everything suffering for water.

Floods.—Brookhaven, Miss., 1st and 2d, heavy freshets, doing great damage to crops, fences, &c.; the loss of stock was very great; sheep, hogs, and cattle were seen floating past Monticello, on Pearl River, for three or four days, at which place the water rose 19 feet in ten hours. Saint Mienrad, Ind., 1st to 3d, high water in creeks causing great damage to fences, cord-wood, lumber, &c. Frankfort, Ky., 2d, heavy rain at night, doing much damage by flooding. Bardstown, Ky., 5th, heavy floods, doing much damage.

Waterspouts.—At Newport, R. I., on the 11th, about 11 a. m., a waterspout was observed over the sea about 8 miles from shore, followed, at 11.40 a. m., by a thunderstorm at station, and at New Haven, Conn., also on the 11th, about 6 p. m., a waterspout was observed over the Sound, about 6 miles from the mouth of the harbor. It was plainly visible for half an hour, and appeared to move very slowly, when the approaching darkness shut it out from view. At Key West, on the 24th, between 2 and 3 p. m., a waterspout was observed in the harbor about 3 miles from shore.

RELATIVE HUMIDITY.

The percentages of mean relative humidity for the month range as follows: New England, 67 to 68; Middle Atlantic states, 66 to 83; South Atlantic states, 65 to 80; Eastern Gulf states, 69 to 83; Western Gulf states, 54 to 82; Ohio valley and Tennessee, 62 to 74; Lower Lakes, 67 to 73; Upper Lakes, 63 to 73; Upper Mississippi valley, 59 to 68; Lower Missouri valley, 51 to 59; Red River of the North valley, 66 to 73; Rocky Mountain slope, 21 at Stockton, Tex., 72 at Boerne, Tex., 52 at Fort Sill, 46 at Deadwood, and 49 at Fort Keogh; Plateau districts, 13 to 39; California, 34 to 79; Oregon, 68 to 70. *High stations* report the following averages, not corrected for altitude: Mount Washington, 90.8; Pike's Peak, 46.5; Denver, 34.6; Santa Fé, 27.2; Cheyenne, 29.3.

WINDS.

The prevailing winds at the Signal Service stations are shown by the arrows flying with the wind on chart No. II. The prevailing direction is from the area of highest pressure; thus, over the South Atlantic states it is decidedly northeast, over the Gulf states easterly, and over the Lower Lakes, Middle states, and New England southerly.

In the Ohio valley and Upper Lake region, and over the Northwest and western Plateau, southerly and westerly or northwesterly winds predominated. In the Pacific states, except in the Sacramento Valley, the direction is westerly.

Total movements of the air.—The following were the *largest* monthly movements in miles, recorded at the Signal Service stations: Cape Lookout, 11,258 miles; Portsmouth, N. C., 11,198; Kittyhawk, 10,430; Cape May, 9,063; Sandusky, 8,879; Cape Hatteras, 8,819; Sandy Hook, 8,574; Milwaukee, 8,401; Breckenridge, 8,248; Barnegat, 8,207; Indianola, 8,090; Stockton, 7,910; North Platte, 7,863. The *smallest* movements were: Laredo, Tex., 1,500; Visalia, Cal., 1,707; Nashville, 1,745; Deadwood, 1,754; Tucson, Ariz., 2,844; Lynchburg, Va., and Fredericksburg, Tex., 1,968; Uvalde, Tex., 2,037; Indianapolis, 2,314; Shreveport, 2,358; San Antonio, Tex., 2,389; Graham, Tex., 2,390.

Local storms.—At Sandy Springs, Md., on the 3d, "a tornado occurred shortly before 6 p. m., after a light shower of rain—sun shining at the time—a dark cloud was first noticed coming from the SSW., shaped like a funnel, and of a color which varied from copper and reddish to black, whirling with great rapidity, and advancing at the rate of 15 to 20 miles per hour. At frequent intervals a column appeared to rise from the earth, at first white like steam, but on connecting with the funnel exhibited many hues, as if illuminated in the interior by electricity. The noise as the tornado advanced was compared to that of an immense fire, or heavy freight trains passing over a bridge. The damage was confined to the destruction of trees, fences, &c., for a length of about 6 miles, and from 30 to 100 yards in width. Large trees were snapped and twisted off, or torn up by the roots, and the branches whirled 600 feet into the air and scattered over neighboring fields. The oldest inhabitant of this vicinity can recall no parallel." At Gettysburg, Pa., on the 4th, "a tornado demolishing a church and unroofing other buildings; path of storm, about 60 feet wide and extending in an irregular direction from south to north; cloud funnel-shaped." On the night of the 7th a severe thunder-storm passed over New Jersey, traveling in a general direction toward the northeast; in Morris County glass was broken, corn and buckwheat crops damaged, several barns struck by lightning and burned.

Sand storms occurred at Fort Garland, Colo., 11th; Las Cruces, N. Mex., 17th; Yuma and Phœnix, Ariz., 26th; Burkes, Ariz., 24th.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily weather indications for September with the telegraphic reports for the succeeding twenty-four hours shows the general percentage of omissions to be 0.62 per cent. and of verifications to be 89.3 per cent. The percentages for the four elements have been, weather, 92.6; direction of the wind, 90.6; temperature, 88.0; barometer, 85.6. The percentages of verifications by geographical districts, have been: New England, 87.7; Middle states, 90.3; South Atlantic states, 88.8; Eastern Gulf states, 89.2; Western Gulf states, 88.9; Lower Lake region, 88.3; Upper Lake region, 90.8; Tennessee and the Ohio valley, 89.9; Upper Mississippi valley, 89.8; Lower Missouri valley, 87.5; Northern Pacific coast region, 89.3; Central Pacific coast region, 100.0; Southern Pacific coast region, 100.0. Of the 3,667 predictions that have been made, 82, or 2.24 per cent., are considered to have entirely failed; 76, or 2.07 per cent., were one-fourth verified; 325, or 8.86 per cent., were one-half verified; 366, or 9.98 per cent., were three-fourths verified; 2,818, or 76.85 per cent., were fully verified, so far as can be judged from the tri-daily weather maps.

Cautionary signals.—170 cautionary signals were displayed during the month, of which 117, or 68.8 per cent., were justified by winds of 25 miles per hour or over at, or within a radius of 100 miles of, the station; 29 cautionary off-shore signals were displayed, of which 1 was not justified either as to direction or velocity; 28, or 96.5 per cent., were justified as to direction, of which 19, or 65.5 per cent., were justified also as to velocity; of the cautionary off-shore signals, 16 were changed from cautionary; 199 signals of both kinds were displayed, of which 136, or 67.3 per cent., were fully justified. The above does not include signals ordered at 52 display stations where the velocity is only estimated. 35 cases were reported of winds of 25 miles or over where signals were not ordered.

NAVIGATION.

In the table on the right-hand side of chart No. III are given the highest and lowest readings on the Signal Service river-gauges for the month, with the dates. From this table it will be seen that the rivers have continued very low and generally falling throughout the entire month. The highest readings, with four exceptions, occurred during the first half, and the lowest readings, with only one exception (New Orleans), from the 26th to the 30th. The total monthly range at the Signal Service stations has averaged about 2 feet in the Red, Arkansas, Missouri, Upper Mississippi, Upper Ohio, and Tennessee Rivers. In the Lower Ohio, at Cincinnati, 13, at Louisville 7, and Cairo 15; in the Cumberland and at Nashville 9, and in the Lower Mississippi, at Memphis, 10, and at Vicksburg 11 feet. The low stage of water has caused an entire suspension of navigation in many of the navigable streams. On the 29th navigation was completely suspended on the Tennessee at Chattanooga, where the water was lower than since 1839. At Pittsburgh one-half the bed of the Monongahela was perfectly dry on the 30th, and the Allegheny was so low as to threaten the cities along its banks with a great scarcity of water.

High tides.—Atlantic City, 22d; Cape Lookout, 18th, very heavy NE. swell and full tide; 25th, p. m., very high; Indianola, 22d and 24th very high, 30th flooding streets.

TEMPERATURE OF WATER.

The *temperatures of water*, as observed in rivers and harbors, with average depth at which the observations were taken, are given on chart No. II. At the following stations, on account of breakage of thermometer, no observations were made on the dates indicated: Augusta, from the 11th to 23d; at Portland, Me., 11th to 25th, and at San Francisco, 11th to 25th, all inclusive.

ATMOSPHERIC ELECTRICITY.

Thunder-storms occurred on the following days: In New England, 2d, 3d, 4th, 7th, 8th, 10th, 11th, 14th, 17th, 19th, 24th, and 28th. Middle states, 2d, 3d, 5th, 7th, 8th, 13th, 14th, 16th, 17th, 24th, and 28th. North Carolina, 8th, 19th. Florida, 2d, 3d, 5th, 7th, 9th, 11th, 16th, 17th, 18th, 21st, 22d, 23d, 24th, and 29th. Alabama, 1st. Mississippi, 1st, 2d, 12th and 15th. Arkansas, 12th. Texas, 8th, 9th, 10th, 11th, 19th, 20th, 24th, and 30th. Ohio valley and Tennessee, 1st, 4th, 7th, 8th, 12th, 13th, 14th, 27th, and 28th. Upper Lakes, 1st, 2d, 3d, 4th, 7th, 11th, 12th, 13th, 15th, 16th, 18th, 23d, 26th, 27th, and 28th. Upper Mississippi valley, 1st, 5th, 6th, 7th, 9th to 15th, 18th, 21st, 22d, 23d, 26th to 30th. Lower Missouri valley, 5th to 13th, 20th, 21st, 23d, 27th, 28th, 29th, and 30th. Northwest, 27th and 28th. Colorado, 3d and 18th. New Mexico, 4th, 17th, 18th, 27th, 29th. Idaho, 25th. Oregon, 8th. Lightning was observed at Calistogo and Princeton, Cal., on the 24th.

Auroras.—From the 9th to the 11th an extensive aurora was observed in all the states from New England to Dakota. Auroras were also observed on the dates named at scattered stations over the same tract of country, as follows: On the first at Starkey, N. Y.; 12th, Eastport and Bangor, Me., Breckenridge; 15th, Vevay, Ind., and Monticello, Iowa, Eastport and Bangor, Me.; 17th, Starkey, N. Y.; 18th, New Corydon, Ind.; 19th, Wellsboro, Pa., Pembina; 20th, New Corydon, Ind., Eastport; 21st, Pembina, Burlington, Vt.; 22d, Eastport; 23d, Starkey, N. Y.; 24th, Springfield, Mass., Woodstock, Vt.; 25th, Fall River, Mass., Starkey, N. Y., Woodstock, Vt.

Atmospheric electricity interfering with telegraphic communication.—At Santa Fé, on the 4th, 5th, and 9th; Pilot Point, Tex., 5th; Mason, Tex., 11th; Jacksboro, Tex., 5th; Castroville, Tex., 8th and 9th; Eagle Pass, Tex., 20th; Socorro, N. M., 4th.

OPTICAL PHENOMENA.

Solar halos were observed on the following dates in the different districts: New England, 1st, 21st, 24th, 25th, and 29th; Middle Atlantic states, 1st, 2d, 3d, 7th, 21st, 23d, 25th, 28th, 29th, and 30th; Florida, 18th and 20th; Western Gulf states, 10th, 14th, 24th, 28th, and 29th; Ohio valley, 7th, 9th, 12th, 13th, 15th, 19th, 27th, 28th, 29th, and 30th; Michigan, 17th and 22d; Upper Mississippi valley, 4th, 5th, 10th, 11th, 14th, 15th, 28th, and 29th; Lower Missouri valley, 8th, 12th, 14th, 15th, 18th, 24th, and 27th; Northwest, 3d, 4th, 9th, and 28th; Utah, 7th, 8th, and 26th; California, 25th and 27th; Oregon, 1st.

Lunar halos were observed on the following dates in the different districts: New England, 1st, 2d, 23d, 24th to 30th; Middle states, 1st, 2d, 12th, 22d, 23d, 25th, 28th to 30th; South Atlantic states, 2d, 3d, 22d to 29th; Gulf states, 2d, 22d, 23d, 24th, 27th to 30th; Ohio valley and Tennessee, 10th, 24th, 26th to 30th; Lower Lakes, 1st, 2d, 12th, 25th, 27th, 28th; Upper Lakes, 11th, 24th, 28th, 29th; Upper Mississippi valley, 1st, 2d, 5th, 15th, 23d, 26th to 30th; Lower Missouri valley, 26th to 30th; Northwest, 7th; Utah, 22d, 25th, 26th; Nevada, 29th; California, 25th; Oregon, 28th.

MISCELLANEOUS PHENOMENA.

Prairie and forest fires.—Fort Sill, 2d, 7th, 8th, 9th, 10th, 15th, 20th, 27th; Bismarck, 2d, 25th; Pembina, 29th, 30th; Fort Gibson, 7th, 8th, 9th, 17th, 23d, 26th, 30th; Cheyenne, 7th, 8th; Colorado Springs, Colo., 13th, in mountains; Pike's Peak, 5th, in mountains; Santa Fé, 12th, 13th, 15th, 16th, 17th, 18th, in mountains; Salt Lake City, 16th, in mountains; Burlington, Vt., 1st, 2d, in mountains; Hermosa, Colo., 15th, 16th, 17th, 18th; Morristown, Dak., 21st; Los Angeles, Cal., 12th, 13th, 14th, and 15th, in mountains, destroying large tracts of timber; Fort Stevenson, Dak., 25th and 26th; Breckenridge, 8th; Fort Garland, Colo., 8th and 9th, on mountains; Boise City, 13th, in mountains; Creswell, Kans., 14th, 15th, 16th; Clear Creek, Nebr., 7th.

Mirage.—New Haven, Conn., 12th.

Meteors.—On the 5th a very brilliant meteor was observed in Nevada and Utah, of which the following reports are at hand: Salt Lake City, 7.10 p. m., brilliant meteor appeared a few degrees south of west, and shot across the sky in a northwesterly direction, leaving behind it a bright silvery streak 7° in length, and resembling a cloud. One striking peculiarity of this streak was its resemblance to certain letters of the alphabet, two W's being plainly visible and followed by a succession of N's. It disappeared at 7.25 p. m., having at that time a pinkish color, the sky, during the whole time, being perfectly clear. The meteor did not appear much larger than an ordinary star. Pioche, Nev., 6.40 p. m., brilliant meteor, at from 35° to 40° above the western horizon. Motion, at first, from east to west, when it turned rapidly to the northwest, and with a hissing noise fell to the earth, about 40 miles from the station. It left a train, which was visible for 45 minutes; sky perfectly clear. Deep Creek, Utah, 7.30 p. m., brilliant meteor, passing from SE. to SW., leaving a silver streak in its wake, lasting fully 20 minutes. It was also observed at Austin, Nev. At Chattanooga, on the 15th, 11 p. m., a very bright meteor, passing from zenith to NW. horizon, leaving in its wake a pale yellow cloud.

Sunsets.—The characteristics of the sky at sunset, as indicative of fair or foul weather, for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from 140 stations show 4,195 observations to have been made, of which 30 were reported doubtful; of the remainder 3,575, or 85.2 per cent., were followed by the expected weather.

Zodiacal light.—New Corydon, Ind., 17th, 19th, 21st, 25th, 26th; Palermo, N. Y., 16th, 20th; Fayetteville, N. C., 15th; Lynchburg, Va., 5th, 15th.

Earthquakes.—At Memphis, Tenn., on the 25th, at 9.10 p. m. a very perceptible shock; duration, 6 seconds; direction, from NW. to SE.

Polar bands.—New Corydon, Ind., 6th, 7th, 11th, 19th, 29th; Guttenburg, Iowa, 19th; Tabor, Iowa, 15th; Waterburg, N. Y., 10th, 11th; Portland, Oreg., 20th; Clear Creek, Nebr., 18th and 19th.

Sun spots.—The following record of observations, made by D. P. Todd, Assistant, has been forwarded by Prof. S. Newcomb, U. S. Navy, Superintendent Nautical Almanac, Washington, D. C.:

Date.	No. of New—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	
Sept., 1879.									
1st, 5 p. m..	0	0	0	0	0	0	1	3	
3d, 3 p. m..	0	0	0	0	0	0	1	1	
4th, 4 p. m..	0	0	0	0	0	0	1	1	
5th, 3 p. m..	0	0	0	0	0	0	1	1	Faculæ.
6th, 3 p. m..	0	0	0	0	0	0	1	1	Faculæ.
7th, 5 p. m..	0	0	1	1	0	0	0	0	
8th, 4 p. m..	0	0	0	0	0	0	0	0	Faculæ.
9th, 3 p. m..	0	0	0	0	0	0	0	0	Faculæ.
16th, 3 p. m..	1	3	0	0	0	0	1	3	
17th, 4 p. m..	0	0	1	3	0	0	0	0	Faculæ.
17th, 5 p. m..	0	0	0	0	0	0	0	0	
24th, 3 p. m..	1	1	0	0	0	0	1	1	Faculæ.
25th, 3 p. m..	0	0	0	0	0	0	1	1	Faculæ,
26th, 3 p. m..	0	0	0	0	0	0	1	1	Faculæ.
26th, 4 p. m..	0	0	0	0	0	0	1	1	
27th, 3 p. m..	0	1	0	0	0	0	1	2	
29th, 4 p. m..	0	0	0	0	0	0	1	2	
30th, 1 p. m..	0	0	0	0	0	0	1	2	
30th, 3 p. m..	0	0	0	0	0	0	1	2	

Observations were also made on the 10th, 12th, 18th, and 23d at 3 p. m., on the 11th at 9 a. m. and 4 p. m., and on the 15th, 19th, and 22d at 4 p. m., but no spots seen at these hours. Mr. David Trowbridge, at Waterburg, N. Y., examined the sun on the 8th, 10th, 11th, 12th, 14th, 16th, 17th, 19th, 20th, 21st, 22d, 23d, 30th, but observed no spots. On the 1st, 4th, 5th, 6th, 7th, 25th, 26th, 27th "spots re-appeared by solar rotation." Mr. H. D. Gowey, at North Lewisburg, Ohio, reported as follows: 4th, 7.30 a. m., one spot; never observed a spot as far north of the sun's equator before. Observations were also made at Fort Whipple throughout the month, but no spots seen.

Locusts.—Genoa, Nebr., 1st, 7th, and 12th, flying southeast; Fort Sill, Ind. T., 11th, moving south in great swarms, very few alighted; Leavenworth, Kans., 12th, p. m., large numbers observed flying too high to distinguish direction, very few alighted; Weatherford, Tex., 23d, large numbers have disappeared in the Keachi Valley to the southward; Jacksborough, Tex., 13th, 14th, and 15th in large numbers, doing great damage to cotton plants, 16th disappeared; Henrietta, Tex., 10th and 15th, large numbers passed over station from northwest to southeast, no damage done; Graham, Tex., 14th, vast numbers seen moving to the southward; Creswell, Kans., 1st, 2d, and 3d, flying south, very few alighting. 7th, southwest, 12th and 13th, south; Clear Creek, Nebr., 2d, flying south; Walla Walla, Wash. Ty., 3d, very large numbers flying high in the air, very few alighting; for the past two weeks they have been appearing in variable numbers.

Geese.—Princeton, Cal., 14th, first appearance; Genoa, Nebr., 23d, flying south; Pembina, 14th, flying north; Keokuk, 13th, flying south; Creswell, Kans., 14th, flying south; Clear Creek, Nebr., south, 16th, 20th, 23d.

NOTES AND EXTRACTS.

[From London Quarterly Journal, January, 1879.]

"*Meteorology of Bangkok, Siam.*—By J. CAMPBELL, staff surgeon, R. N.—The following observations were made at Bangkok, the capital of Siam, during the years 1858–1868, omitting 1862. A glance at a map of Indo-China will show that that kingdom Muang Thai, the Land of the Free, has a geographical position such as to preserve it from the heat, deluges of rain, and devastating cyclones so common to adjoining countries; the elevated land of the Malayan Peninsula, Burmah and the Gulf of Siam, contributing largely to an anomalous state of things, and which meteorologically considered will be apparent in the tables herein given.

"The instruments employed were partly private during the first four years, but they were compared at Kew with standards. The last six years' records were entirely from those supplied by the Meteorological Department of the Board of Trade. The rain-gauge during the first four years was of my own construction. Up to April, 1859, the barometer was a mercurial one—Government—but it got out of order, and till 1863 I depended on an aneroid. This instrument evidently deteriorated yearly, though slightly. It is, however, evident that the first two instruments were originally at a less height than the barometer of the last six years. Up to May, 1859, the instruments were placed in the north verandah of a floating house, 7 feet above tidal influence, the rain-gauge 20 feet above the river, so as to be higher than the houses and completely secluded from the sun; after the above date they were placed for a time in a large airy room of my house on land, and subsequently in its north verandah, at an elevation of 21 feet above high-water level. The rain-gauge was at an elevation of about 45 feet, but for the last two years it was only 3 feet above high water. These changes of elevation ought, theoretically considered, to have a disturbing influence on the regularity of the items recorded, excepting the barometer; but such does not appear to have ensued to any appreciable extent.

"*Barometer.*—The pressure of the atmosphere attains its maximum in December, sometimes in January, and then falls till June, July, or August, when its maximum is reached; these are uninfluenced by any local causes, an unusual inundation, much rain, drought, or heat having no observable effect upon the height of the mercurial column of its daily tides, which takes place about 3½ a. m. and p. m. for minima, and 9½ a. m. and p. m. maxima. The range is about 0.110 inch, but occasionally it amounts to 0.180 inch.

"*Temperature.*—The lowest temperature of the year occurs in December, though sometimes it may be in November, January, or February, and the highest usually takes place in April, but it may be noticed in the preceding or subsequent month. In this record the minimum, 57°, took place in December, and the maximum, 97°.5, in May. The monthly means make the extremes in December and April. The *tension of vapor* follows a similar rule, viz, the lowest in December and highest in May, but the tables of *humidity* and *rainfall* are different; these agree in making December the minimum and September the maximum of the year. The years 1859 and 1864 were remarkable for little rain, years of drought; in 1865 rice was imported, while 1860 and 1868 were the years of greatest rainfall.

"*Hail* occurred only once, one afternoon, during my residence of fifteen years.

"*Winds.*—In September the SW. monsoon becomes weak; early in October N. breezes set in, varying from W. to E. by the northern segment, and during this month or November the NE. monsoon is quite established. Throughout December it continues strong, but in January it has lost half of its last month's vigor, and in February retains only a fifth of its original force; the deficiency being in part made up by an increase of wind varying from SSE. to SW. By the end of the month or early in March the N. winds have ceased and strong breezes from S. and SSW. prevail, locally termed the Kite and Junk winds. It is in April that the greatest heat takes place, and for two or three nights in succession, if no breeze stirs the air, the plight of foreigners, ay, even of natives, is not to be envied. During the months of May, June, July, and August the SW. winds are strong and constant, sometimes boisterous, the direction being chiefly S. and SSW. till June, and thence SW. to September, when light variable winds are the rule, and foretell a breaking up of the SW. monsoon."

[From Nature, August 7, 1879.]

"On the morning of Sunday, August 3, a little before two o'clock, a. m., the Royal Gardens at Kew were devastated by a hail-storm, which in the space of about ten minutes inflicted more damage than the gardens have sustained since their existence as a national institution. After a rapid survey of the houses the following day it was found that the number of broken squares of glass could not be estimated at less than 16,000. In the great temperate house alone 3,000 squares were shattered. The storm, which was accompanied by violent thunder and lightning, drove over the garden from the northeast, and expended its greatest fury in the direction of Richmond. The temperate house suffered the full effects, while the palm house, being apparently a little to the west of its course, escaped with the destruction of 700 panes. The hailstones were found to average 1½ inches in diameter and to weigh three-quarters of an ounce. They came down with sufficient force to bury themselves in the bare earth of the flower borders and even penetrate the turf to the depth of an inch. In some cases perfectly circular holes were cut out of the glass panes, while the hailstones went through the succulent leaves of the echeverirs planted out in the beds with as clean an outline as if it had been made with a punch. On account of the confusion produced by the damage and the danger from falling splinters of glass, it has been necessary to close all the houses to the public. The present night-temperature, and the probability of heavy showers, are grounds for the gravest anxiety as to the preservation of the collections, which, however speedy the repairs to the houses, cannot fail to suffer considerable injury. The damage is estimated at not less than £2,000, as many of the houses, being a great deal dilapidated, cannot be put in order without entire reglazing, repainting, and partial renewal, and application will have to be made to Parliament for a supplementary vote to defray the cost."

"On August 30, M. Gaston Tissandier made an ascent from La Villette gas-works with his wife and his brother. The travelers started at 5h. and landed at 7h. 50 at Dawmartin. The observations were highly interesting. When the National left ground the wind was blowing southwesterly, but at about 7h. the direction changed abruptly, and an instantaneous change took place in the direction of the balloon. It was caused by the *brise de mer* setting in after a hot day. The sky was covered with cumulus, intermixed with a few cirrus of small dimensions. When at an altitude of 600 meters, M. Tissandier passed through a cloud which was very cold indeed, as proved by the sensation which the travelers experienced, but the duration of the passage was so short that it was not possible to observe the temperature at the thermometer. When at a higher altitude M. Tissandier observed the refraction of the rays of the sun on icy particles, and at the same moment on the western sky splendid rainbows. At the same time a very large halo had been observed at Paris by the Temps meteorological editor, and noted by him."

"Dr. Dunant publishes in the Journal de Geneve a note on the low temperature of this summer. While the mean temperature for the years 1873 to 1878 was 18°.9 Celsius in June and 21°.0 during the first half of July, in 1879 it was only 18°.8 and 16°.7."

"A shock of earthquake was felt on July 20, 3.30 a. m. at Vulpera, in the Engadine (Switzerland). It was accompanied by a rather strong rumbling."

An earthquake consisting of three moderately violent shocks is reported from Cairo. The phenomenon was observed in the night of July 11–12. In the quarter of Bab-en-Nasr, which is at some distance from the modern portion of the city, some isolated walls fell in, and an old and somewhat dilapidated minaret has suffered so severely that it must be taken down. During the last decades earthquakes have been extremely rare at Cairo and indeed in Egypt generally, and since the great earthquake of 1857, which caused so much damage amongst the shaky old buildings in which the Caliph city abounds, and though several lives were lost, no earthquake of importance has occurred. The phenomena of July 11–12 is said to have been noticed also at Gizeh, near the great pyramids."

The Manila papers state that a terrible thunder-storm passed over that city on May 31. It was preceded by an almost suffocating warm atmosphere and rain, and lasted about an hour. The lightning struck the Binondo Tower, damaging the crystal shade of the clock, but not injuring the mechanism, though the stone work forming the arch was much damaged. Out of several persons in the tower at the time four appear to have been killed. Several other places in the city were more or less injured.

"The month of July, 1878, was one of the coldest ever experienced at Paris. At the Parc de Saint Maur, where hourly observations are made, except at 2 and 3 a. m., we have found as a mean of the daily extremes 16°.18, and for the mean of 24 hours 15°.59. The maximum temperature, 28°, occurred on the 30th."—*Comptes Rendus hebdomaires des séances de l' Académie des Sciences, tome* 89, *page* 382."

Published by order of the Secretary of War.

ALBERT J. MYER,
Brigadier General (*Brevet Assigned*), *Chief Signal Officer, U. S. A.*

PAPER 36.

MONTHLY WEATHER REVIEW, OCTOBER, 1879.

INTRODUCTION.

In preparing this review the following data, received up to October 14, have been used, viz: The regular tri-daily weather charts, containing the data of simultaneous observations taken at 157 Signal Service stations and 12 Canadian stations, as telegraphed to this Office; monthly journals and means 133 and 132 respectively, from the former; reports from 29 sunset stations; 249 monthly registers from voluntary observers; 52 monthly registers from United States Army post surgeons; marine records; international simultaneous observations; monthly reports from voluntary observers in, and the local weather service of, Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

Upon chart No. II is shown by the isobaric lines the general distribution of atmospheric pressure, as reduced to the sea-level, for the month. The variations from the average pressure for the past seven years have been marked and general. East of the Mississippi river the pressure has been decidedly in excess save in the Gulf states. The excess in New England has ranged from 0.04 inch to 0.08 inch, except on Mount Washington, where it was 0.11. The greatest excess was in the Middle Atlantic states and the Lower Lake region, where it varied only from 0.09 inch to 0.11 inch. The deficiencies have been greatest in the Red river of the North valley, ranging from 0.08 to 0.11 inch, and in southern Florida from 0.04 to 0.06 inch. Deficiencies are reported in the Plateau district from Salt Lake of 0.03 inch, and from Virginia City of 0.04 inch, these being the only stations therein with seven years means. On the Pacific coast the pressure at San Diego was normal, at San Francisco 0.01 inch in excess, and at Portland there was a deficiency of 0.035 inch.

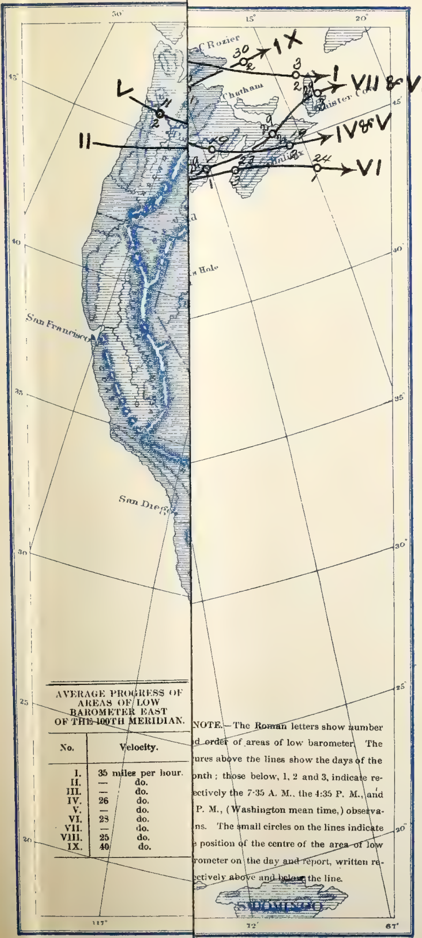
The local barometric ranges have been greatest in New England, over which section the severest storms of the month have passed. The ranges in that district have been unusually great, ranging from 1.38 inches at New Haven to 1.85 inches at Eastport. The range elsewhere of one inch and over includes the Middle Atlantic states, the Lake region, the Northwest, the Lower Missouri valley, North Carolina, the greater part of the Ohio valley, the Mississippi valley from Keokuk northward, and the Northern Plateau district. The range of 0.75 inch and below includes in its limits ten Gulf stations, the southern half of Texas and Georgia, the Southern Plateau district, and Southern California. The only ranges below 0.50 inch have been 0.40 at Los Angeles, 0.44 at Punta Rassa, and 0.49 at Key West.

Areas of high barometer.—Of these, seven have been deemed sufficiently marked to merit description.

No. I.—This area appeared on the Northern Pacific coast the afternoon of the 1st, and moving southeast by the morning of the 2d was in Wyoming. Minimum temperatures of 32° were reported from Virginia City and Fort Custer, and 39° from Cheyenne. Moving northeast on the morning of the 3d it had reached Minnesota, Saint Paul barometer 0.23 above the normal. Its progress thus far had been marked by generally cool, clear weather, with no rainfall. At that time freezing minimum temperatures were reported from Northern Dakota and Minnesota. Moving slowly eastward its center on the morning of the 4th was in Ontario; Toronto barometer 0.25 above the normal. Brisk southerly winds then prevailed on the Middle Atlantic coast, and at noon cautionary signals were displayed at Cape Hatteras and Kittyhawk. They were lowered at midnight; justified by a maximum velocity of NE. 26 miles at Kittyhawk. The midnight report of the 4th showed that the area had moved eastward over the Atlantic Ocean.

No. II.—On the afternoon of the 5th the barometer commenced rising in the lower

No. 1.



AVERAGE PROGRESS OF AREAS OF LOW BAROMETER EAST OF THE 100TH MERIDIAN.

No.	Velocity.
I.	35 miles per hour.
II.	— do.
III.	— do.
IV.	26 do.
V.	— do.
VI.	28 do.
VII.	— do.
VIII.	25 do.
IX.	40 do.

NOTE.—The Roman letters show number d order of areas of low barometer. The ures above the lines show the days of the onth; those below, 1, 2 and 3, indicate re- ectively the 7·35 A. M., the 4:35 P. M., and P. M., (Washington mean time,) observa- ns. The small circles on the lines indicate e position of the centre of the area of low rometer on the day and report, written re- ectively above and below the line.

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BAROMETRIC PRESSURE.

Upon chart No. II is shown by the isobaric lines the general distribution of atmospheric pressure, as reduced to the sea-level, for the month. The variations from the average pressure for the past seven years have been marked and general. East of the Mississippi river the pressure has been decidedly in excess save in the Gulf states. The excess in New England has ranged from 0.04 inch to 0.08 inch, except on Mount Washington, where it was 0.11. The greatest excess was in the Middle Atlantic states and the Lower Lake region, where it varied only from 0.09 inch to 0.11 inch. The deficiencies have been greatest in the Red river of the North valley, ranging from 0.08 to 0.11 inch, and in southern Florida from 0.04 to 0.06 inch. Deficiencies are reported in the Plateau district from Salt Lake of 0.03 inch, and from Virginia City of 0.04 inch, these being the only stations therein with seven years means. On the Pacific coast the pressure at San Diego was normal, at San Francisco 0.01 inch in excess, and at Portland there was a deficiency of 0.035 inch.

The local barometric ranges have been greatest in New England, over which section the severest storms of the month have passed. The ranges in that district have been unusually great, ranging from 1.38 inches at New Haven to 1.85 inches at Eastport. The range elsewhere of one inch and over includes the Middle Atlantic states, the Lake region, the Northwest, the Lower Missouri valley, North Carolina, the greater part of the Ohio valley, the Mississippi valley from Keokuk northward, and the Northern Plateau district. The range of 0.75 inch and below includes in its limits ten Gulf stations, the southern half of Texas and Georgia, the Southern Plateau district, and Southern California. The only ranges below 0.50 inch have been 0.40 at Los Angeles, 0.44 at Punta Rassa, and 0.49 at Key West.

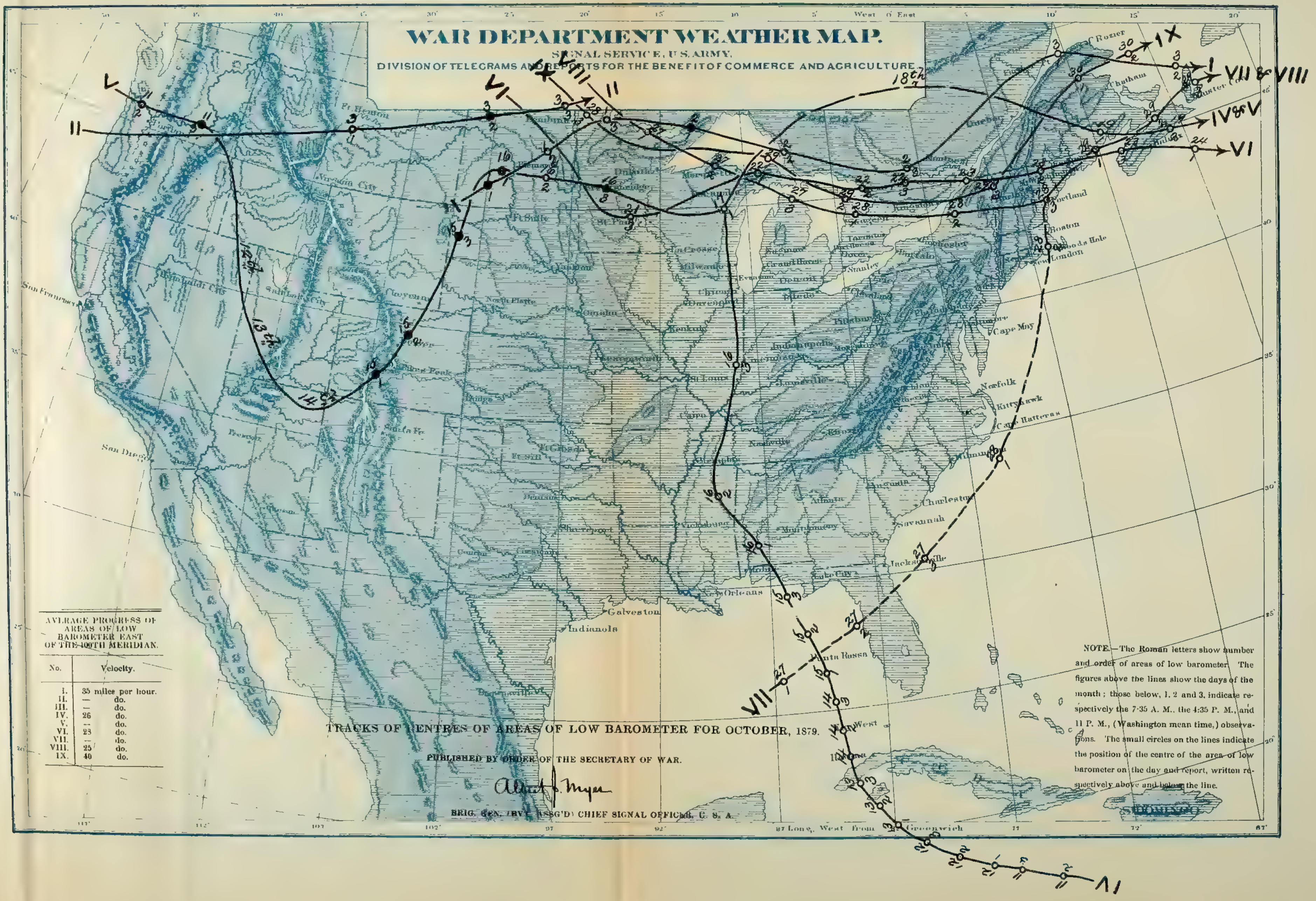
Areas of high barometer.—Of these, seven have been deemed sufficiently marked to merit description.

No. I.—This area appeared on the Northern Pacific coast the afternoon of the 1st, and moving southeast by the morning of the 2d was in Wyoming. Minimum temperatures of 32° were reported from Virginia City and Fort Custer, and 39° from Cheyenne. Moving northeast on the morning of the 3d it had reached Minnesota, Saint Paul barometer 0.23 above the normal. Its progress thus far had been marked by generally cool, clear weather, with no rainfall. At that time freezing minimum temperatures were reported from Northern Dakota and Minnesota. Moving slowly eastward its center on the morning of the 4th was in Ontario; Toronto barometer 0.25 above the normal. Brisk southerly winds then prevailed on the Middle Atlantic coast, and at noon cautionary signals were displayed at Cape Hatteras and Kittyhawk. They were lowered at midnight; justified by a maximum velocity of NE. 26 miles at Kittyhawk. The midnight report of the 4th showed that the area had moved eastward over the Atlantic Ocean.

No. II.—On the afternoon of the 5th the barometer commenced rising in the lower

No. 1.

THE PREPARATION OF CHARTS OF THIS SERIES COMMENCED NOVEMBER 8, 1870



WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

TRACKS OF CENTRES OF AREAS OF LOW BAROMETER FOR OCTOBER, 1879.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

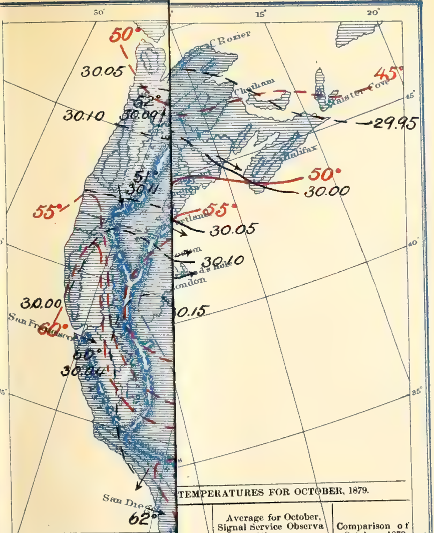
BRIG. GEN. (BVT.) ASSG'D CHIEF SIGNAL OFFICER, U. S. A.

AVERAGE PROGRESS OF AREAS OF LOW BAROMETER EAST OF THE 100TH MERIDIAN.

No.	Velocity.
I.	35 miles per hour.
II.	— do.
III.	— do.
IV.	26 do.
V.	— do.
VI.	23 do.
VII.	— do.
VIII.	25 do.
IX.	40 do.

NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7·35 A. M., the 4:35 P. M., and 11 P. M., (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above and below the line.

No. 11.



TEMPERATURE OF WAT OCTOBER, 1879.

STATIONS.	Temperatures at bottom.	
	Max.	Min.
Alpena	66	44
*Augusta	79	62
Baltimore	70	59
Buffalo	67	50
Burlington, Vt.	61	51
Charleston	77	64
Chicago	68	46
*Cleveland	69	55
Detroit	68	49
Duluth	56.5	40.5
Eastport	50	47
Escanaba	—	—
Galveston	82.5	67
Grand Haven	71	44
Jacksonville	81	70
Key West	84	78
Marquette	57	44.5
Milwaukee	54	44
Mobile	79	65
New London	65	56.5
New York	66	54
*Norfolk	80	58
Portland, Maine	63	48
Punta Rassa	82	74
Sandusky	70	46
San Francisco	61	58
Savannah	75	57
Toledo	73.5	47
Wilmington	79	63
Wood's Holl	67	53

* Observations for only part of mo

TEMPERATURES FOR OCTOBER, 1879.

	Average for October, Signal Service Observations.		Comparison of October, 1879, with the average for several years.
	For several years.	For 1879.	
	51°.9	48°.0	3°.9 below.
	54 .0	52 .0	2°.0 below.
	59 .5	60 .1	0°.6 above.
	63 .3	62 .0	1°.3 below.
	62 .8	61 .0	1°.8 below.
AU.			
	54 .5	52 .0	2°.5 below.
	52 .8	49 .8	3°.0 below.
	51 .9	51 .8	0°.1 below.
he	43 .4	44 .2	0°.8 above.
pe	52 .1	55 .4	3°.3 above.
slope	61 .8	62 .1	0°.3 above.
	46 .9	53 .8	6°.9 above.
Minn.	47 .5	56 .9	9°.4 above.
	46 .4	55 .5	9°.1 above.
	49 .4	57 .6	8°.2 above.
nessee	54 .6	63 .7	9°.1 above.
	73 .1	71 .8	1°.3 below.
	66 .6	70 .2	8°.6 above.
	64 .9	68 .9	4°.0 above.
	74 .1	76 .7	2°.6 above.
	62 .3	67 .9	5°.6 above.
es.	55 .4	61 .8	6°.4 above.
	49 .9	54 .8	4°.9 above.
	45 .3	51 .0	5°.7 above.
tations.	46 .1	46 .0	0°.1 below.
H	29 .8	35 .4	5°.6 above.
	21 .4	26 .3	4°,9 above.

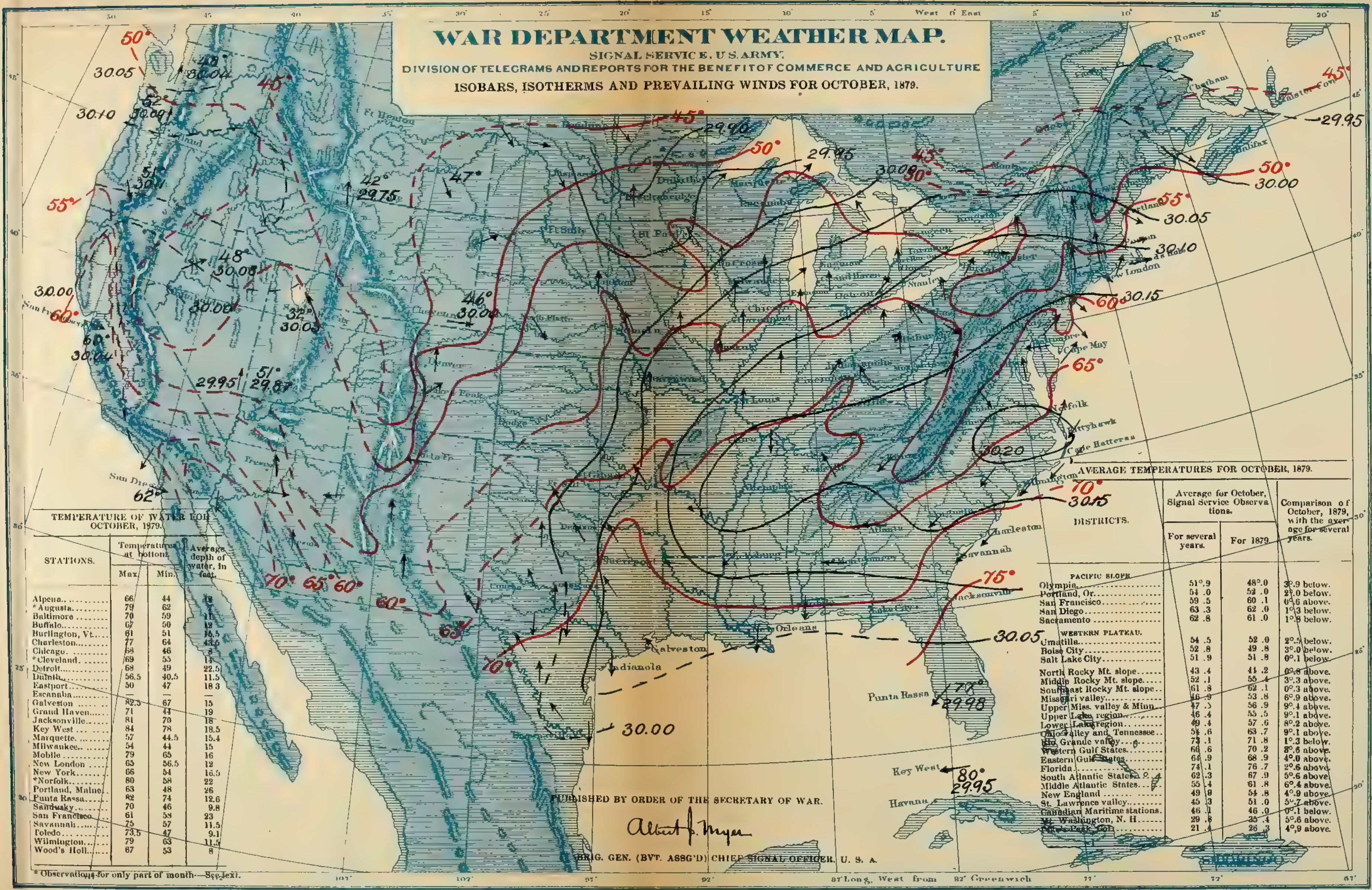
No. 11.

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE

ISOBARS, ISOTHERMS AND PREVAILING WINDS FOR OCTOBER, 1879.



TEMPERATURE OF WATER FOR OCTOBER, 1879.

STATIONS.	Temperature at bottom. Max.	Temperature at bottom. Min.	Average depth of water, in feet.
Alpena	66	44	[illegible]
*Augusta	79	62	7
Baltimore	70	59	11
Buffalo	67	50	12
Burlington, Vt.	61	51	16.5
Charleston	77	64	43.5
Chicago	68	46	8
*Cleveland	69	55	14
Detroit	68	49	22.5
Duluth	56.5	40.5	11.5
Eastport	50	47	18 3
Escanaba	—	—	—
Galveston	82.5	67	15
Grand Haven	71	43	19
Jacksonville	81	70	18
Key West	84	78	18.5
Marquette	57	44.5	15.4
Milwaukee	54	44	15
Mobile	79	65	16
New London	65	56.5	12
New York	66	54	16.5
*Norfolk	80	58	22
Portland, Maine	63	48	26
Punta Rassa	82	74	12.6
Sandusky	70	46	9.8
San Francisco	61	58	23
Savannah	75	57	11.5
Toledo	73.5	47	9.1
Wilmington	79	63	11.5
Wood's Holl	67	53	8

* Observations for only part of month.—See text.

AVERAGE TEMPERATURES FOR OCTOBER, 1879.

DISTRICTS.	Average for October, Signal Service Observations. For several years.	Average for October, Signal Service Observations. For 1879.	Comparison of October, 1879, with the average for several years.
PACIFIC SLOPE.			
Olympia	51°.9	48°.0	3°.9 below.
Portland, Or.	54 .0	52 .0	2°.0 below.
San Francisco	59 .5	60 .1	0°.6 above.
San Diego	63 .3	62 .0	1°.3 below.
Sacramento	62 .8	61 .0	1°.8 below.
WESTERN PLATEAU.			
Umatilla	54 .5	52 .0	2°.5 below.
Boise City	52 .8	49 .8	3°.0 below.
Salt Lake City	51 .9	51 .8	0°.1 below.
North Rocky Mt. slope	43 .4	44 .2	0°.8 above.
Middle Rocky Mt. slope	52 .1	55 .4	3°.3 above.
Southeast Rocky Mt. slope	61 .8	62 .1	0°.3 above.
Missouri valley	46 .9	53 .8	6°.9 above.
Upper Miss. valley & Minn.	47 .5	56 .9	9°.4 above.
Upper Lake region	46 .4	55 .5	9°.1 above.
Lower Lake region	49 .4	57 .6	8°.2 above.
Ohio valley and Tennessee	54 .6	63 .7	9°.1 above.
Rio Grande valley	73 .1	71 .8	1°.3 below.
Western Gulf States	66 .6	70 .2	8°.6 above.
Eastern Gulf States	64 .9	68 .9	4°.0 above.
Florida	74 .1	76 .7	2°.6 above.
South Atlantic States	62 .3	67 .9	5°.6 above.
Middle Atlantic States	55 .4	61 .8	6°.4 above.
New England	49 .9	54 .8	4°.9 above.
St. Lawrence valley	45 .3	51 .0	5°.7 above.
Canadian Maritime stations	46 .1	46 .0	0°.1 below.
Mt. Washington, N. H.	29 .8	35 .4	5°.6 above.
Pike's Peak, Col.	21 .4	26 .3	4°.9 above.

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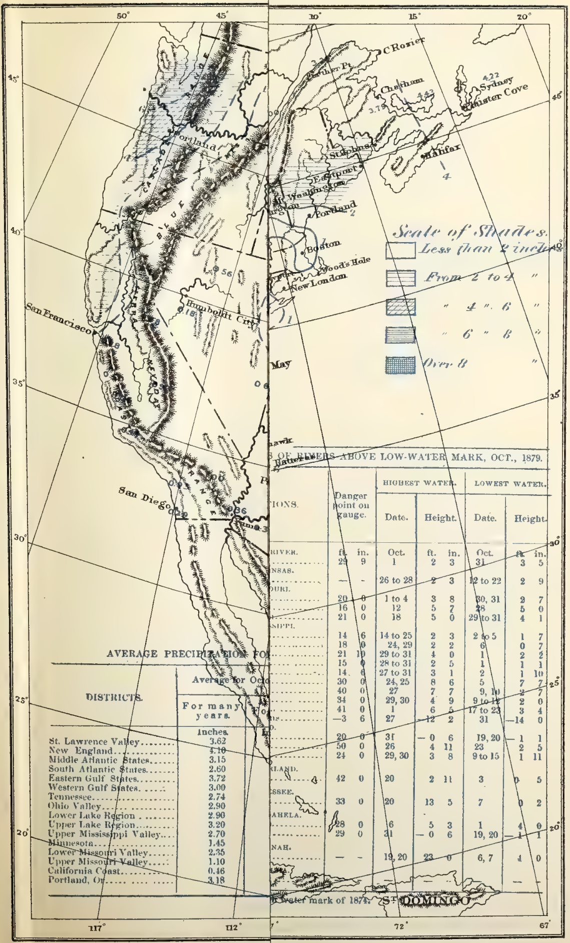
Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

No. III.



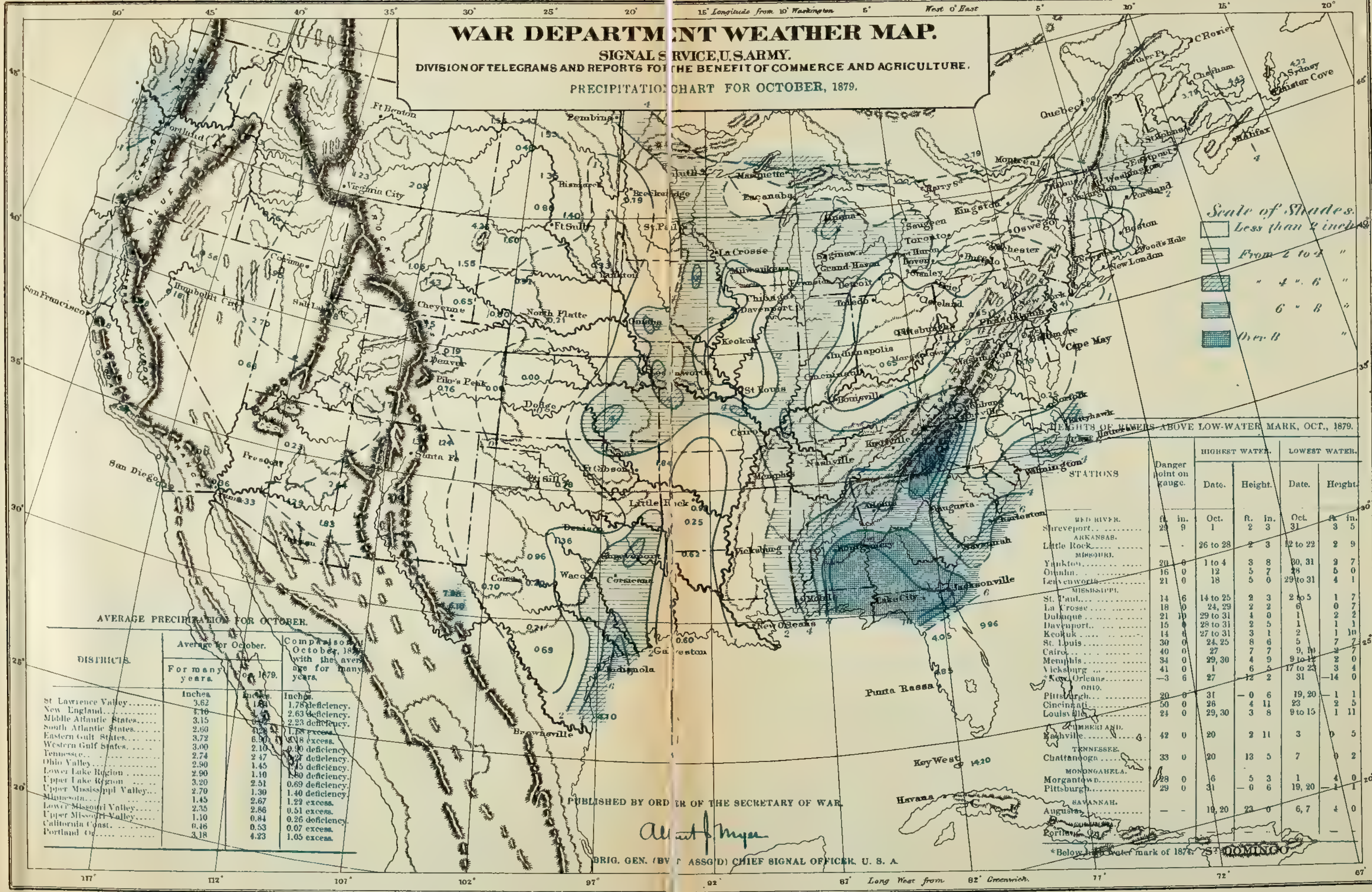
S OF RIVERS ABOVE LOW-WATER MARK, OCT., 1879.

IONS.	Danger point on gauge.		HIGHEST WATER. Date.	Height.		LOWEST WATER. Date.	Height.	
	ft.	in.	Oct.	ft.	in.	Oct.	ft.	in.
RIVER.								
	29	9	1	2	3	31	3	5
NSAS.								
	—	-	26 to 28	2	3	12 to 22	2	9
OURI.								
	20	0	1 to 4	3	8	30, 31	2	7
	16	0	12	5	7	28	5	0
	21	0	18	5	0	29 to 31	4	1
SIPPI.								
	14	6	14 to 25	2	3	2 to 5	1	7
	18	0	24, 29	2	2	6	0	7
	21	10	29 to 31	4	0	1	2	2
	15	0	28 to 31	2	5	1	1	1
	14	6	27 to 31	3	1	2	1	10
	30	0	24, 25	8	6	5	7	7
	40	0	27	7	7	9, 10	2	7
	34	0	29, 30	4	9	9 to 12	2	0
	41	0	1	6	5	17 to 23	3	4
ns	—3	6	27	—12	2	31	—14	0
D.								
	20	0	31	— 0	6	19, 20	— 1	1
	50	0	26	4	11	23	2	5
	24	0	29, 30	3	8	9 to 15	1	11
LAND.								
	42	0	20	2	11	3	0	5
SSEE.								
	33	0	20	13	5	7	0	2
AHELA.								
	28	0	6	5	3	1	4	0
	29	0	31	— 0	6	19, 20	— 1	1
NAH.								
	—	-	19, 20	23	0	6, 7	4	0
			—	—	--	—	—	-

water mark of 1874.

AVERAGE PRECIPITATION FO

DISTRICTS.	Average for Oct For many years.	Fo
	Inches.	
St. Lawrence Valley	3.62	
New England	4.10	
Middle Atlantic States	3.15	
South Atlantic States	2.60	
Eastern Gulf States	3.72	
Western Gulf States	3.00	
Tennessee	2.74	
Ohio Valley	2.90	
Lower Lake Region	2.90	
Upper Lake Region	3.20	
Upper Mississippi Valley	2.70	
Minnesota	1.45	
Lower Missouri Valley	2.35	
Upper Missouri Valley	1.10	
California Coast	0.46	
Portland, Or	3.18	



WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

PRECIPITATION CHART FOR OCTOBER, 1879.

AVERAGE PRECIPITATION FOR OCTOBER.

DISTRICTS.	Average for October. For many years.	Average for October. For 1879.	Comparison of October, 1879, with the average for many years.
	Inches.	Inches.	Inches.
St Lawrence Valley	3.62	1.84	1.78 deficiency.
New England	4.10	[illegible]	2.63 deficiency.
Middle Atlantic States	3.15	[illegible]	2.23 deficiency.
South Atlantic States	2.60	4.28	1.68 excess.
Eastern Gulf States	3.72	6.90	3.18 excess.
Western Gulf States	3.00	2.10	0.90 deficiency.
Tennessee	2.74	2.47	0.27 deficiency.
Ohio Valley	2.90	1.45	1.45 deficiency.
Lower Lake Region	2.90	1.10	1.80 deficiency.
Upper Lake Region	3.20	2.51	0.69 deficiency.
Upper Mississippi Valley	2.70	1.30	1.40 deficiency.
Minnesota	1.45	2.67	1.22 excess.
Lower Missouri Valley	2.35	2.86	0.51 excess.
Upper Missouri Valley	1.10	0.84	0.26 deficiency.
California Coast	0.46	0.53	0.07 excess.
Portland Or.	3.18	4.23	1.05 excess.

HEIGHTS OF RIVERS ABOVE LOW-WATER MARK, OCT., 1879.

STATIONS	Danger point on gauge.		HIGHEST WATER. Date.	HIGHEST WATER. Height.		LOWEST WATER. Date.	LOWEST WATER. Height.	
	ft.	in.	Oct.	ft.	in.	Oct.	ft.	in.
RED RIVER.								
Shreveport	29	9	1	2	3	31	3	5
ARKANSAS.								
Little Rock	—	-	26 to 28	2	3	12 to 22	2	9
MISSOURI.								
Yankton	20	0	1 to 4	3	8	30, 31	2	7
Omaha	16	0	12	5	7	28	5	0
Leavenworth	21	0	18	5	0	29 to 31	4	1
MISSISSIPPI.								
St. Paul	14	6	14 to 25	2	3	2 to 5	1	7
La Crosse	18	0	24, 29	2	2	6	0	7
Dubuque	21	10	29 to 31	4	0	1	2	2
Davenport	15	0	28 to 31	2	5	1	1	1
Keokuk	14	6	27 to 31	3	1	2	1	10
St. Louis	30	0	24, 25	8	6	5	7	7
Cairo	40	0	27	7	7	9, 10	2	7
Memphis	34	0	29, 30	4	9	9 to 12	2	0
Vicksburg	41	0	1	6	5	17 to 23	3	4
*New Orleans	—3	6	27	—12	2	31	—14	0
OHIO.								
Pittsburgh	20	0	31	— 0	6	19, 20	— 1	1
Cincinnati	50	0	26	4	11	23	2	5
Louisville	24	0	29, 30	3	8	9 to 15	1	11
CUMBERLAND.								
Nashville	42	0	20	2	11	3	0	5
TENNESSEE.								
Chattanooga	33	0	20	13	5	7	0	2
MONONGAHELA.								
Morgantown	28	0	6	5	3	1	4	0
Pittsburgh	29	0	31	— 0	6	19, 20	— 1	1
SAVANNAH.								
Augusta	—	-	19, 20	23	0	6, 7	4	0
[illegible]								
Portland, Or.	—		—	—	..		—	

*Below high water mark of 1874.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

Saint Lawrence valley, and at the morning report of the 6th, Chatham barometer was 0.51 above the normal. Generally clear weather, with fresh northerly winds, then prevailed in the Canadian Maritime Provinces and Maine. Minimum temperatures of 25° at Father Point and 30° at Chatham were reported. Signals were displayed during the day on the Middle Atlantic and North Carolina coasts. Those on the New Jersey coast were lowered at midnight, justified by velocities ranging from E. 25 at Cape May to E. 32 miles at Sandy Hook. The signals on the North Carolina coast were not justified. The area moved southward during the 6th and 7th, and on the morning of the 8th the highest pressure was at Cape Hatteras—barometer 0.29 above the normal. The central pressure appeared to move northward during the night of the 8th, and in the morning the highest pressure was over the Canadian Maritime Provinces, where it remained until its final disappearance on the 12th, the highest pressure during that time being at Chatham, where the barometer ranged from 0.29 on the 8th to 0.62 on the 12th above the normal. From the 8th to the morning of the 10th light local rains fell in New England and the Middle Atlantic states. On the afternoon of the 10th brisk northeast winds were reported on the New England coast, and cautionary signals were displayed from Wood's Holl to Eastport. These signals were lowered the morning of the 11th, justified only at Eastport NE. 26 miles. Severe gales, however, prevailed during that time in Newfoundland, doing great damage to property, driving several vessels ashore, and completely wrecking one bark.

No. III.—This area appeared in the Northwest the morning of the 12th, Duluth barometer 0.30 above the normal. At the afternoon report the highest pressure, still increasing, was over Lake Superior, and brisk southerly winds prevailed on Lakes Superior and Michigan. Signals were then ordered for those lakes. Moving slowly eastward with generally clear weather and cool northerly winds, the center the morning of the 13th was in Ontario, Parry Sound barometer 0.40 above the normal. Brisk northerly winds then prevailing on the Maine coast, an off-shore signal was ordered for Eastport, which was lowered at midnight, justified by a NW. wind of 26 miles. The Lake signals were then lowered, not justified except at Duluth, the maximum velocity being N. 21 at Milwaukee. From the 13th to the morning of the 16th the highest pressure remained over Ontario, Parry Sound barometer ranging from 0.18 to 0.38 above the normal. The area on the 16th moved eastward and remained with the highest pressure on the New Brunswick coast until its final disappearance on the 18th over the Atlantic Ocean.

No. IV.—This area appeared on the California coast the morning of the 16th, San Francisco barometer 0.19, abnormally high, it moved eastward during the day and reached the Middle Plateau district, where it remained until the afternoon of the 18th, when the highest pressure was at Denver, 0.49 above the normal. Moving northeastward during the day, on the morning of the 19th it was central over the Upper Lake region, Escanaba barometer 0.45 above the normal. At that time brisk to high northerly winds prevailed in the Lake region, with maximum velocities of 30 miles N. at Cleveland, and 38 N. at Sandusky. Minimum temperatures below or near the freezing point were reported from the entire Upper Lake region and the Northwest. Moving slowly eastward the highest pressure at the morning report of the 20th was over the Lower Lake region, over which section the barometer was quite uniformly 0.29 above the normal. At that time the signals on the Atlantic coast, from Smithville northward to Sandy Hook, and at Eastport, were lowered, having been justified, as shown in connection with low areas Nos. IV and V. Changing its course to the southeast, on the morning of the 21st the area was central with diminished pressure on the New Jersey coast. It thence followed a northeasterly course, and on the 22d passed over the Gulf of Saint Lawrence.

No. V.—This area appeared on the Northern Pacific coast the morning of the 21st, and in the afternoon the Olympia barometer was 0.32 above the normal. Moving eastward the highest pressure was over Western Dakota on the morning of the 22d, and at that time temperatures below or near the freezing point were reported from the Northwest. During the day the pressure rapidly increased from Dakota southward. In the afternoon, in connection with low area No. VI, rainy and threatening weather, with brisk to high winds, prevailed in the Upper Lake region, with a maximum velocity of NW. 35 miles at Milwaukee. Signals were then displayed for Lakes Michigan, Huron, and Erie, which were justified, as shown in description of low area No. VI., and cautionary off-shore signals were also ordered on the Texas coast. On the morning of the 23d the isobar of 30.50 extended from Dakota southward to include Kansas—Bismarck, North Platte, and Dodge City barometers respectively, 0.59, 0.59, and 0.56 above the normal. Brisk to high northerly winds then prevailed in the Upper Lake region and in Texas. The isobar of 30.50 during the day covered the country from Indian Territory southward to Mississippi, but during the night moved slowly eastward, and on the morning of the 24th covered the Upper Mississippi valley, Saint Paul and Duluth barometers 0.57 above the normal. At that time minimum temperatures of 32° and under were reported from Indian Territory and Missouri northward to Manitoba, and from the greater part of the Lake region. Brisk northerly winds then prevailed in the Gulf states with maximum velocities of 26 N. at Galveston, 32 N. at Indianola, and 34 NNE. at Port Eads. Brisk northerly winds with clear weather prevailed during the day in the Middle Atlantic, South Atlantic, and Gulf states, fully justifying the off-shore signals which had been displayed the afternoon of the 23d from New York southward to Smithville. These signals were all lowered at midnight (24th), justified by velocities ranging from NW. 28 at Barnegat to NW. 52 miles at Cape May. The Texas signals were lowered at the same time, having been fully justified by velocities of N. 28 at Galveston and N. 32 at Indianola. Moving slowly eastward the highest abnormal pressure on the morning of the 25th covered the Lower Lake region—Parry Sound barometer 0.75 above the normal. Minimum temperatures, at or below 32°, were then reported from the whole Lake region, New England, and the Middle Atlantic states—Rochester temperature, 19°. The signals on the Atlantic coast were lowered too soon, as during the day severe northeast gales continued on the Middle and South Atlantic coasts, with velocities ranging from 25 to 47 miles, the maximum velocities being NE. 47 at Kittyhawk, and NE. 44 at Tybee Island. During the day the barometer rose rapidly in the Eastern Gulf states, but at midnight a slight fall was reported, and the northeast winds, increasing in force, had reached a maximum velocity of NE. 35 at Key West and ENE. 39 at Port Eads. Severe gales were reported from the Gulf, which are treated in connection with low area No. VII. The area moved slowly eastward, the highest pressure the morning of the 26th being at Baltimore—barometer 0.73 above the normal. Brisk to high northeast winds with partly cloudy weather prevailed during the day on the South Atlantic coast, the maximum velocity being 36 miles NE. at Cape Lookout. By the morning of the 27th, the central area had passed off the Middle Atlantic coast in advance of low areas Nos. VII and VIII. The passage of this area was marked by the minimum temperatures for the country east of the Rocky Mountains, except for the Lower Missouri and Upper Mississippi Valleys, the Northwest, and the Upper Lake region.

No. VI.—This area appeared on the North Pacific coast accompanied by light rain the morning of the 25th and by the morning of the 26th the barometers at Olympia and Virginia City were 0.51 above the normal. At that time the pressure over the whole country was above the normal, being 30.70 in the Middle Atlantic and part of the New England states, 30.50 in Washington Territory and part of Idaho, and a small area of 30.40 in central Nebraska. Slight changes took place in connection with the center of this area during the 27th, but the pressure gradually decreased and it slowly disappeared during that day and the 28th.

No. VII.—This area appeared in the Northwest at midnight of the 29th; Breckenridge and Bismarck barometers 0.22 above the normal. At this time, in connection with low area No. IX, brisk northwest winds, and threatening weather, continued in the Upper Lake region, where signals had been displayed on that afternoon. The pressure increased in the Northwest during the 30th, 30.50 over the greater part of Dakota; it moved slowly eastward, and by midnight was central over Lake Superior; Duluth barometer 0.50 above the normal. On the morning of the 31st minimum temperatures of 10° and under were reported from the Northern Rocky Mountain slope, the Northwest and northern portions of Missouri and Mississippi valleys. The lowest temperatures were 1° at Pembina and —1° at Deadwood, being, with 0° on Mount Washington, the lowest reported during the month. This area was marked by the minimum temperatures for the Missouri and Upper Mississippi valleys, the Northwest and the Upper Lake region.

Areas of low barometer.—On map No. I are charted the tracks of the center of eight areas of low barometer. Nine areas have passed over the country during October, but the path of area No. III was too uncertain to permit its accurate location.

No. I.—This area was a continuation of No. IX of the September REVIEW. Central in Dakota the morning of the 1st, it moved northeastward and reached Manitoba by midnight, its progress marked by light rains and brisk southerly winds in the Northwest and Upper Lake region. Cautionary signals were displayed at Milwaukee and Duluth during the afternoon, and at midnight for Lake Michigan and at Alpena and Marquette. On the morning of the 2d, it was central in northeastern Minnesota, at which time cloudy weather and rain, with brisk southerly winds prevailed in the Upper Mississippi valley and on Lakes Michigan and Superior. By afternoon the center had reached the eastern end of Lake Superior, at which time brisk westerly winds with cloudy weather and rain prevailed, and maximum velocities ranging from 28 to 32 miles were reported, from the Upper Lake region, while partly cloudy weather with fresh to brisk westerly winds prevailed in the Lower Lake region. Cautionary signals were then displayed at Port Huron, Detroit, Toledo, and Sandusky. At midnight the area was central north of the Lower Lake region, while cloudy and rainy weather prevailed with brisk to high southwest winds on Lake Huron and the western part of Lake Erie, with a velocity of SW. 38 miles at Saugeen. Cautionary signals were then displayed for Lake Erie from Cleveland to Buffalo. On the morning of the 3d the center had reached the Lower Saint Lawrence valley. Threatening and rainy weather with brisk to high southwest winds were reported from New England, and the Lower Saint Lawrence valley. Signals were then displayed on the New England coast from Wood's Holl northward to Eastport. In the Lake region, cloudy or partly cloudy weather, with fresh westerly winds were reported, and all signals therein were lowered; these signals were justified by velocities ranging from SW. 25 at Grand Haven to W. 32 at Duluth, and SW. 38 at Saugeen, except at Escanaba, Marquette, Buffalo, Erie, and Port Huron, where velocities ranging from 13 to 20 miles occurred. Changing its course to the southeast with decreased pressure, the area was central on the afternoon of the 3d in the Gulf of Saint Lawrence; Chatham barometer 0.29 below the normal. Signals on the New England coast were continued until the 4th, on account of the rapidly recovering pressure, and were lowered in the afternoon. They were justified except at Eastport, and a maximum velocity of W. 28 miles was reported at Thatcher's Island.

No. II.—On the morning of the 2d this area appeared on the Oregon coast. During the day light rain fell in the North Pacific region, and the center moving eastward was on the morning of the 3d in Montana—Virginia City barometer 0.26 below the normal. During the day brisk to high southerly winds prevailed in the Northwest, and by midnight the center, with decreased pressure, had reached eastern Manitoba. On the morning of the 4th it was north of the Lake Superior region, from which section brisk southerly winds were reported. Signals were then ordered for Lakes Superior and Michigan, except at Chicago. The center moving northward these signals were lowered on the morning of the 5th, not having been justified, a maximum velocity of SW. 24 only being reported from Marquette.

Area No. III.—The track of the centre of this area was too indefinite to permit its accurate charting. On the afternoon of the 3d a new depression, accompanied by fresh southerly winds, threatening weather and light rains, appeared on the North Pacific coast, where, by the afternoon of the 4th, the barometer steadily falling reached at Olympia 0.60 below the normal. The area moving eastward, on the afternoon of the 5th caused an extensive barometric depression ranging from 0.20 to 0.50 inch below the normal, which covered the country from Minnesota and Iowa westward to the Pacific ocean. Slight changes occurred over this region until the midnight of the 5th, when the barometer again fell sharply on the North Pacific coast. On the morning of the 6th the line of normal pressure ran from Lake Superior southeastward to the Georgia coast. The country from Minnesota and Iowa westward to the Pacific coast was then covered by a pressure from 0.20 to 0.50 below the normal, while in the Gulf states the New Orleans barometer read 0.24 below the normal. At noon of the 6th cautionary signals were displayed at New Orleans and Port Eads, and in the afternoon at Mobile and Saint Marks. On the afternoon of the 6th a decided decrease of pressure was reported from Oregon, Dakota, and the Gulf States. Cloudy and rainy weather prevailed in the North and Central Pacific coast regions and in the Gulf states, while from Nebraska and Minnesota southerly gales were reported. Cautionary signals were displayed at Duluth and Alpena. At midnight the Mobile barometer was 0.37 below the normal, while rainy weather, with brisk, variable winds, were reported from the Eastern Gulf states, with a maximum velocity of SE. 25 miles at Saint Mark's, and the tide rose five feet above the mean. But slight changes had taken place from the Upper Lake region westward to the Pacific. The morning report of the 7th showed a sharp barometric rise on the Oregon coast and in the Eastern Gulf states, with the centers of depression apparently located in the central Mississippi valley, Memphis barometer 0.30 below the normal, and in the Middle Plateau district, Salt Lake barometer 0.47 below the normal. During the 7th the depression in the Mississippi valley disappeared while the pressure from the Mississippi valley westward to the Pacific coast gradually recovering, by midnight was in a nearly normal condition, except from Colorado northeastward to Manitoba, where a barometric trough of 0.30 below the normal yet existed. The signal at Alpena was then lowered, the wind having attained a velocity of only SE. 20 miles. The barometric trough moved slowly northeastward and passed into Manitoba the morning of the 10th, when the Duluth signal was lowered, not having been justified.

No. IV.—This area apparently developed in the Carribean Sea, and on the afternoon of the 11th was central southeast of the island of Jamaica. By the morning of the 12th it reached the eastern end of that island, and by midnight of the 13th was central near the island of Cuba, southwest of Havana. From the morning of the 11th until the afternoon of the 14th, 19.80 inches of rainfall were reported from Kingston, Jamaica. In the rest of the island exceedingly severe rains did serious injury to property and crops. Reports state that 13 lives were lost in Kingston. Many bridges, houses, and much stock were swept out to sea, and all communication obstructed, The reports from the Gulf stations showing a steady decrease of pressure, a cautionary signal was displayed at Key West the morning of the 12th. The cyclone moved slowly northeastward, and by the afternoon of the 14th was central in the southeastern part of the Gulf. Signals were then displayed at New Orleans, Port Eads, Mobile, and Saint Mark's. At this time Key West barometer was 0.31 below the normal, with a southeast wind of 26 miles, while fresh northeast winds were reported from the northeastern Gulf. The area moved slowly northeastward and at midnight of the 15th was central in the northeastern Gulf. At that time brisk southeast to northeast winds prevailed in the Eastern Gulf states, the Mobile barometer was 0.38 below the normal, while Saint Mark's reported a heavy rain of 2.36 inches in eight hours with a maximum velocity of E. 28 miles. The morning report of the 16th showed the center over southern Alabama, Mobile barometer 0.51 below the normal. Brisk easterly winds were reported from Florida, with a maximum velocity of E. 32 at Saint Mark's, and a heavy rainfall of 2.10 inches in eight hours from Montgomery. At noon cautionary signals were ordered for Jacksonville, Savannah, and Charleston. By the afternoon of the 16th the center had reached the central Mississippi valley, Memphis barometer 0.38 below the normal. The signals on the Gulf coast and from Jacksonville to Savannah were then lowered, having been fully justified. At midnight of the 16th report showed it central with diminished energy in Illinois. Its subsequent track is described as that of area No. V, with which it united in Wisconsin on the morning of the 17th.

No. V.—This area appeared on the Oregon coast on the morning of the 11th, and during that afternoon was central in Oregon; Portland and Roseburg barometers 0.72 below the normal. At that time rainy weather, with light southerly winds prevailed in the Northern Pacific coast region. Moving slowly eastward it was central at midnight in the valley of the Columbia river; thence turning southward during the 12th, 13th, and 14th it moved slowly into the Southern Plateau district, its progress being marked by cloudy weather and light precipitation, light snow falling in Nevada. During the night of the 14th, changing its course to the northeast, it was central the morning of the 15th in Colorado—Denver barometer 0.31 below the normal. By the morning of the 16th its center was in Western Dakota—Bismarck barometer 0.43 below the normal. At that time cloudy or rainy weather prevailed in the Upper Mississippi valley and the Northwest. The afternoon reports showed its center in Dakota. At that time northerly gales, with rain, prevailed in the extreme Northwest, and cloudy weather with variable winds in the Upper Lake region. Cautionary signals were then displayed for Lake Superior and at Escanaba. On the morning of the 17th this area united with low area No. IV and reports at that time showed it to be central, with decreased pressure, in Wisconsin. Rainy or threatening weather with fresh to brisk southerly winds then prevailed in the Lake region, with a maximum velocity of S. 26 reported from Sandusky. Cautionary signals were then ordered for the rest of Lake Michigan and for Lake Huron. The afternoon reports of the 17th showed that the central area had passed northward beyond the Lake region. Brisk southwest to northwest winds yet prevailed in that section, with a maximum velocity of SW. 36 miles at Milwaukee. The course of this area during the 18th was too far north of the Lake region to permit accurate charting. During that time southwest to northwest winds, cloudy weather, and rain prevailed in the Lake region. The signals displayed in that section were lowered on the afternoon of the 18th, having been justified by velocities ranging from NW. 27 at Alpena to NW. 38 at Duluth. On the morning of the 18th signals were ordered on the Atlantic coast from Lewes northward to Sandy Hook. At midnight rainy and threatening weather, with brisk southerly winds, prevailed in the Middle Atlantic and New England states with a maximum velocity of S. 28 at Cape May. Changing its course during the night to the southeast, on the morning of the 19th the area was central in Maine, Eastport barometer 0.30 abnormally low. Rainy and threatening weather then prevailed in New England and the Middle Atlantic states, with a maximum velocity of NW. 42 miles at Sandy Hook. Cautionary signals were then ordered from New York eastward along the coast to include Eastport, and in connection with high area No. IV from Norfolk southward to Smithville. By midnight the center had passed through Nova Scotia and was over the Atlantic Ocean. During the day brisk northwest winds, with generally clear weather, prevailed along the Atlantic coast from Eastport to North Carolina, and a maximum velocity was reported of N. 40 miles at Cape May. At that time the cautionary signals from Portland southward to include New York were lowered, having been justified by velocities ranging from NW. 25 at New Haven to NW. 38 at Thatcher's Island. On the morning of the 20th signals from Sandy Hook southward, to include Smithville, were lowered, having been justified by velocities ranging from N. 32 at Macon to NE. 40 at Kittyhawk, and N. 40 at Cape May.

No. VI.—The area appeared in the Northwest on the 21st, moving southeastwardly from Manitoba, and at the afternoon report was central in Dakota, Pombina barometer 0.31 below the normal. Reaching southern Minnesota at midnight—its course thus far marked by no precipitation—it changed its direction to the northeast, and on the morning of the 22d was central in northern Michigan. Moving eastward during the afternoon of the 22d, it was central over Lake Huron. At that time partly cloudy weather with brisk southerly winds prevailed over the Lower Lake region, while in the Upper Lake region rainy and threatening weather with brisk northwest winds were reported—maximum velocity NW. 35 at Milwaukee. Cautionary signals were then displayed at Lakes Michigan, Huron, and Erie. At midnight the center had reached Ontario, Parry Sound barometer 0.21 below the normal. At that time rainy or threatening weather, with brisk westerly winds, prevailed in the Lake region and Middle Atlantic states, maximum velocities in the first section ranging from W. 25 at Port Huron to W. 30 at Alpena. Signals were then displayed for Lake Ontario, and were lowered at Escanaba, Chicago, and Milwaukee, justified except at Escanaba by NW. 36 miles at Milwaukee. Morning report of the 23d showed the center to be in the Upper Saint Lawrence valley, Burlington barometer 0.23 below the normal. Cloudy and threatening weather was then reported from New England and the Lower Lake region with brisk westerly winds, the maximum velocities in the latter district ranging from W. 25 at Toledo and Buffalo to W. 40 at Sandusky. A cautionary signal was then displayed at Eastport. The center that afternoon was in Maine. The signals at Detroit and all on Lake Michigan, except Grand Haven, were then lowered, having been justified, except at Escanaba, by velocities ranging from NW. 25 at Toledo to NW. 36 at Milwaukee. On the morning of the 24th the area having moved eastward was central over the Atlantic ocean. The signals on Lake Huron and at Grand Haven and Toledo were then lowered, and in the afternoon those yet remaining in the Lake region, having been justified, except at Oswego, by maximum velocities ranging from NW. 25 at Toledo to W. 45 at Sandusky. This area being rapidly followed by high area No. V, caused the storm to be unusually severe in the Lake region. A schooner and a steam barge were disabled on Lake Erie, and on Lake Huron one schooner was disabled, one driven ashore, and from a barge one man was lost. The signal at Eastport was lowered at midnight of the 24th not justified; the wind however, attained a velocity of S. 22 miles.

No. VII.—The morning and afternoon reports of the 25th showed rapidly increasing pressure in the Eastern Gulf states and Florida, while a slight decrease was reported from the Western Gulf states, with a NE. wind of 26 miles at Key West during the afternoon. At midnight a barometric fall was reported from the Eastern Gulf States, and high northeast winds then prevailed from Key West westward to Port Eads, attaining maximum velocities of 39 ENE. at Port Eads, and 34 NE. at Key West. During the 26th decreasing pressure and easterly winds prevailed in the Eastern Gulf, with maximum velocities of 26 NE. at Key West and 43 NE. at Port Eads. A schooner which left Key West on the 25th for Punta Rassa was compelled to return the morning of the 26th, on account of severe weather. Marine reports show violent easterly gales in the Eastern Gulf during all that day and the 27th. The brigantine *Woodland*, leaving Port Eads on the 25th, was compelled to return in distress the 28th; schooner *Sallie*, which left Pensacola on the 26th, was completely wrecked and lost all her crew but two men. Three other vessels were disabled and in distress. The S. S. *Capri* reported a "hurricane" 200 miles ESE. of Port Eads on the 26th and 27th. On the afternoon of the 27th the area was central west of the middle Florida coast, Punta Rassa barometer 0.12 below the normal. No signals was displayed in the Gulf during the passage of this area. Moving very rapidly northeastward, by midnight the center was probably off the Georgia coast. During the day very heavy rains fell in Georgia, Florida, and South Carolina, with the following totals reported: Key West 1.36 inches, Saint Mark's 4.28, Jacksonville 2.21, Savannah 1.02 and Charleston, S. C., 1.94. On the morning of the 28th the area was probably central off the North Carolina coast; Cape Lookout reported the barometer 0.28 below the normal and Cape Hatteras 3.00 inches rainfall in eight hours. On the North Carolina coast fresh northerly winds were reported, their force being probably weakened by the influence of advancing low area No. VIII. Severe easterly gales were reported, however, on the eastern side of the area, northwest of Bermuda. During the day the area moved northward with great rapidity, and with diminishing pressure. Central in Rhode Island the afternoon of the 28th, by midnight it had united with low area No. VIII in Maine. During its passage northward on that day the winds on the Jersey coast veered to the westward, and the unusual maximum velocities of W. 48 at Sandy Hook and NW. 64 at Cape May were reported. Signals had been displayed on the Atlantic coast on the 27th for low area No. VIII, in connection with which they are considered. The subsequent path of this area is described as that of No. VIII.

No. VIII.—This area appeared in Manitoba during the night of the 26th, and moving southeastward was central on the morning of the 27th in Minnesota. Brisk westerly winds with partly cloudy weather and no precipitation then prevailed on Lake Superior and Michigan. The afternoon reports showed the center to be over the northwestern portion of Michigan, with greatly decreased pressure, Escanaba barometer 0.34 below the normal. Brisk southerly winds with cloudy weather prevailed in the Upper Lake region, with maximum velocities of 26 miles at Milwaukee and Grand Haven, while from the Northwest northwest gales were reported, with rain in the Upper Mississippi valley. Moving southeastward by midnight, the center had reached, with still decreasing pressure, northern Michigan. At that time brisk southerly winds with threatening weather prevailed in the Lower Lake region, while in the Upper Lake region the winds had veered to northwest, and were brisk or high with maximum velocities reported of W. 36 at Milwaukee, and NW. 37 at Grand Haven. Cautionary signals were then ordered at Grand Haven and for Lakes Huron, Erie and Ontario, except for Oswego. On the Atlantic coast, in connection with this area and high area No. VII, cautionary signals were displayed from Smithville northward, to include Cape Henry. At the morning report of the 28th the storm was central with decreased pressure in Ontario, Saugeen and Toronto barometers respectively 0.54 and 0.55 below the normal. Brisk southwest and south winds, with rainy or threatening weather, prevailed in the Lower Lake region, while brisk to high northwest winds continued in the Upper Lake region. Maximum velocities of 36 miles were reported from Toledo, Sandusky, and Grand Haven. Cautionary signals were then ordered for Oswego and on the Atlantic coast from Lewes northward to New York. The afternoon reports showed the area central in northern New York, Kingston barometer 0.55 below the normal. At this time in connection with low area No. VII a deep barometric trough ranging from 0.28 to 0.67 below the normal covered New England, the Middle Atlantic states, the Lower Lake region, and Lake Huron. Cloudy weather and rain prevailed in New England and the Lower Lake region, with fresh to brisk variable winds in New England, and westerly winds, ranging from fresh to a gale, were reported from the Middle Atlantic states and Lower Lake region. Maximum velocities, ranging from 26 to 64 miles on the Jersey coast, were reported in connection with low area No. VII, and in the Lower Lake region ranging from 25 to 46 miles, in connection with Area No. VIII. At this time area No. VIII was central in Rhode Island. Cautionary signals were then displayed at Portland and Eastport, and the cautionary signals on the Atlantic coast from Smithville northward to New York were changed to off-shore. Off-shore signals were also ordered from New Haven northward to include Thatcher's Island. At midnight areas Nos. VII and VIII united, with their center in southeastern Maine, Portland barometer 0.90 below the normal. At this time variable winds prevailed in New England, with heavy rain and northeast gale—48 miles—at Eastport. Brisk to high westerly winds, with generally clear weather, prevailed in the Middle Atlantic states and Lower Lake region, with maximum velocities on the Atlantic coast of W. 46 at Cape May and on the Lakes of SW. 35 at Sandusky. Moving northeastward, the center, on the morning of the 29th, was in New Brunswick, Eastport barometer being remarkably low, 28.82, or 1.16 below the normal; three hours earlier it had touched 28.775. At this time the reports for the preceding eight hours showed fall of the barometer in New Brunswick and Nova Scotia, ranging from 0.37 at Eastport to 0.56 inch at Chatham below the normal. Easterly gales then prevailed on the Atlantic coast as far south as Delaware, while brisk winds still continued in the Lake region in connection with advancing area No. IX. Signals were then lowered on the Atlantic coast from Cape Henry southward to Wilmington. In the afternoon the center was in the Gulf of Saint Lawrence, Halifax barometer 28.82, or 1.06 below the normal. A barometric rise along the New England coast in eight hours, ranging from 0.15 at New London to 0.35 at Portland above the normal, caused a continuance of the brisk westerly winds. Maximum velocities ranging from SW. 25 at New London to W. 39 at Boston were reported, while in the Lower Saint Lawrence valley a northwest gale prevailed at Father Point. The signals on the Atlantic coast—fully justified—from Lewes northward to New York were then lowered. At midnight the center was near Cape Breton, Sydney barometer 28.73, or 1.16 below the normal. Fresh to brisk westerly winds and clear weather then prevailed in New England and the Middle Atlantic states. During the 28th the passage of this area was attended by a series of remarkably severe gales in Nova Scotia, and from that section eastward over the Atlantic and along the banks of Newfoundland. An immense amount of damage was done to property in Novia Scotia, and the storm was considered the worst for years. At Port Hastings, Cape Jack, Caribou Cove, Port Richmond, Antigonish, and Guysboro', N. S., many houses were destroyed. Probably a hundred vessels suffered more or less injury during the 28th and 29th, and with scarcely an exception they report the gales encountered as most violent. On the morning of the 30th the central area had passed eastward beyond the Canadian maritime stations.

No. IX.—This area appeared in Manitoba on the 28th, and moving southeastward at midnight was central in Minnesota, Pembina barometer 0.57 below the normal. The barometric pressure of the whole country was below the normal except in the Plateau district and the Northern Pacific coast region, the Lake region being covered by an abnormal pressure ranging from 0.19 to 0.60 below the normal. It caused this area to move eastward with great rapidity. On the morning of the 29th it was central with diminished pressure north of Lake Michigan, Marquette barometer 0.65 below the normal. Brisk to high westerly winds prevailed in the Upper Lake region, and brisk southerly in the Lower Lake region, with a velocity of 29 miles NW., reported from Milwaukee. Cautionary signals were then ordered for all stations on the Upper Lakes. The afternoon report showed the central area to be east of Lake Huron. Westerly winds ranging from high to a gale were then reported in the Upper Lake region and Lake Erie, with maximum velocities ranging from 28 at Duluth, Marquette, and Sandusky, to 40 at Milwaukee and Saugeen. Cautionary signals were then ordered for Detroit and for all stations on the Lower Lakes. During the day one steamer was wrecked and three schooners driven ashore on Lake Michigan. The storm was reported as being particularly violent over Lakes Michigan and Erie, being the heaviest northeast gale of the season at Cleveland. By midnight of the 29th the center had reached Northern New York, Burlington barometer 0.62 below the normal; the isobar of 30.50 at that time extended through New England, the Saint Lawrence valley, and part of Ontario and New York, while the pressure of 0.74 below the normal yet prevailed over Nova Scotia in connection with area No. VIII. The morning report of the 30th showed that the area had moved rapidly northeastward and that it was central in the Lower Saint Lawrence valley, Father Point barometer 0.65 below the normal. Brisk to high westerly winds then prevailed in the Lower Lake region, where maximum velocities changing from 26 to 37 miles were reported. Off-shore signals were then displayed on the New Jersey coast, and the cautionary signals at Eastport and Portland were then changed to off-shore, while the off-shore signals from New Haven to Boston displayed in connection with low area No. VIII remained. All signals on the Upper Lakes were then lowered, having been justified by winds ranging from NW. 38 at Marquette, Escanaba, and Duluth, to W. 40 at Milwaukee. During the afternoon of the 30th the storm was central over the Gulf of Saint Lawrence, and cautionary signals in the Lower Lake region were then lowered, justified by velocities ranging from W. 30 at Rochester to W. 37 at Cleveland. At midnight all off-shore signals from Eastport southward to Cape May were then lowered, having been fully justified. These signals were lowered somewhat soon, as brisk to high northerly winds continued on the Atlantic coast until midnight of the 31st, with maximum velocities ranging from 28 at Cape Lookout and Portland to 33 at Boston and 42 at Cape May.

INTERNATIONAL METEOROLOGY.

Three international charts, Nos. IV, V, and VI, accompany the present review. No. IV indicates the probable course of low-pressure areas over the North Atlantic Ocean and neighboring waters and continents during the month of September, 1879, and is based upon data received at this office up to October 31, 1879. Nos. V and VI are charts for the month of March, 1878, and are based upon international simultaneous observations, as described in the REVIEW for July, 1879, supplemented by such other observations as have been considered specially applicable and trustworthy.

On chart No. IV the tracks of eight areas of low pressure are traced, which, during a portion of their existence, were located over the North Atlantic Ocean. Areas I, III, IV, and VI are prolonged tracks, portions of which have already appeared on charts I and IV of the September REVIEW. No. I was probably central on the morning of September 1 about 60° N., 40° W. On this day southerly winds prevailed over the Atlantic, between 45° and 55° N., veering to SW. and W. westward of 30° W.; strong SW. gales, squally and rainy weather, and confused or high westerly seas were reported between 30° to 45° W., and 46° to 53° N. On the 2d a sudden fall of the barometer occurred over the northern portions of the British Isles and the depression moved eastwardly to the coast of Norway. A "heavy" gale prevailed along the north coast of Ireland, and a "violent" gale was experienced in the northeast of Scotland, doing about $2,000 damage to boats engaged in the herring fisheries; "captains of river steamers arriving at Glasgow reported the weather down the frith of Clyde as fearful." The winds over the Atlantic between 45° and 54° N. changed to SW. eastward of 30° W., and to northerly westward of that meridian. No. II appeared about mid-ocean in 45° N. on the 4th, on which day easterly winds generally prevailed from 10° to 33° W. in about 50° N. with thick weather and rain near center of depression; on the 5th it had moved northward, followed by rapidly-rising and high barometer from the 30th meridian westward, as the "anti-cyclone" or area of high barometer, which had covered the British Isles since the passage of preceding low area, moved slowly away in an easterly direction; on the 6th the barometer fell over the British Isles, with southerly winds and rising temperature generally, and heavy rains at some of the western ports; on the 7th and 8th it passed in an irregular course centrally over Ireland and Scotland, accompanied by southerly to westerly gales and heavy rains, followed over the eastern half of the Atlantic, between 45° and 55° N., by northerly squalls and gales, which on the 9th spread eastward over the British Isles. No. III moved eastward north of Newfoundland on the 9th; on the morning of the 10th the weather was still unsettled at Saint John's, but cleared during the day with slowly rising pressure. On the 11th the pressure increased rapidly off the coast of Newfoundland, with easterly winds at Saint John's, and the area of low barometer was probably transferred to the eastern half of the ocean north of 50° N. On the 11th the barometer fell rapidly, and on the morning of the 12th a very extensive depression covered the British Isles, but with its center at some distance to the northwest of Scotland; dull, rainy, and squally weather prevailed over the British Isles, and on the coast of Norway the wind rose to a southerly gale. No. IV passed northeastward over Labrador on the 18th. No. V appeared as a large depression off the northwest coast of Ireland and Scotland on the 20th, moving toward the northeast; westerly gales were experienced westward to 15° W. No. VII probably formed in the southwest quadrant of area No. V on the 21st; on the 22d it developed into quite a severe storm, and was encountered off the north of Ireland by steamer *Corinthian*, which reported a severe gale from NE. and high seas; and ship *Spartan*, when three miles northwest of Inishtrahull Light, which vessel reported "cyclone from SW. to SSE., and later from WNW"; lost entire suit of sails. S. S. *Cybele*, at Quebec, October 3, from Glasgow, reported loss of captain, "who was supposed to have been washed overboard during a violent gale on the morning of the 23d." On this day (23d) severe northwest gales and very high confused seas prevailed from 15° to 25° W. and from 46° N. northwards. At 7 a. m. the barometer at Stornoway read 28.37, wind SSW. light. Very heavy gales were experienced during the night of 23d–24th along the east coast of Northumberland. No. VI moved eastward over Newfoundland on the 25th, followed by cold NW. winds, clear weather, and rapidly increasing pressure on the 26th, on which day rainy and squally weather prevailed over the ocean in lat. 50° N., from 45° to 20° W. On the 27th and 28th it passed northeastward north of the British Isles, producing strong southeast to southwest gales on the British and Norwegian coasts; in England heavy rains caused much damage to crops. From the 25th to the end of the month an area of high barometer existed over Newfoundland which probably extended over the western portion of the ocean, but on the 30th an area of quite low pressure appeared over the eastern half, central in the morning probably near 20° W. 55° N., and which, after having been preceded by a southerly gale on the east coast of Scotland during the night of the 30th, passed slowly eastward from October 1 to 3, with its center to the north of Scotland, producing westerly winds and heavy rains over the British Isles. *Pacific Ocean.*—During the months of May and June, 1879, areas of quite low pressure were observed along the China coast on the following dates: May 17, 23, 24, and 29; June 4 and 5, 11 to 13, 17 to 19, and on the 30th. The probable positions of the center of the area observed from the 17th to the 19th of June are indicated on chart IV, but in regard to the other areas the data as yet to hand is insufficient to enable us to locate the centers. *Indian Ocean.*—On August 119, 879, ship *Dunalister*, in 39° 30′ S., 50° E., experienced a hurricane which lasted two days, and threw vessel on her beam-ends, wind WSW. veering to SW., and ending S.; lowest reading of barometer, 29.50. *South Pacific Ocean.*—Ship *Edderside*, at San Francisco, October 1, 1879, from Sydney, N. S. W., reports: "Off the coast of Australia encountered a violent hurricane, commencing at WSW. and ending at ENE., accompanied with very heavy sea, decks constantly filled with water; gale lasted eight hours." At Brisbane, N. S. W., a terrific hurricane, uprooting large trees, &c., occurred on the night of June 23, 1879.

TEMPERATURE OF THE AIR.

The isothermal lines upon chart No. II show the general distribution of the temperature for the month of October, 1879, accompanying which is a table of comparative temperatures. In strong contrast with the month of September, the mean temperature of the present month over the eastern section of the country is decidedly above the average of the past eight years, ranging from 3° to 4° in the Gulf states, 5° to 6°.5 in the Atlantic states, and from 8° to 9°.5 in the Ohio valley, Lake region, and Upper Mississippi valley. Westward of the latter the excess rapidly diminishes, being 7° in the Missouri valley, and 3°.3 over the middle Eastern Rocky Mountain slope. West of the Rocky Mountains it is below the normal, the deficiency ranging from 1° to 4°. On the summit of Pike's Peak, Colo., at an elevation of 14,150 feet, the mean temperature was 26°.3, or 4°.9 above the mean of the five preceding Octobers; and on the summit of Mount Washington, at an elevation of 6,285 feet, 29°.8, or 5°.6 above the mean of the eight preceding Octobers. The following table shows the established mean temperature of the month of October for 40 places, included within the area of high temperature, as accurately as the same can be computed from material at present in the possession of this office, with the number of years covered by the observations from which they are deduced. On comparing these means with those for the present month, it is found that only four show an excess of less than 4°, namely, Key West, Mobile, Norfolk, and West Point. Those having an excess of 10° or more occur in Ohio, Illinois, Michigan, Iowa, and Minnesota. In the sixth column is given the highest maximum October temperature at each place yet published and of which this office possesses a record. On comparing these with the maxima of the present month it is seen that higher temperatures have been recorded at most stations in New England and New York during the present October than ever before, while in the other districts the previous maxima have not been exceeded, excepting at Fort Brady and Dubuque.

Place of observation.	Number of years of observation.	Established mean.	Mean for 1879.	Difference.	Highest maximum temperature published.	Maximum in 1879.	Difference.
		°	°	°	°	°	°
Fort Preble, Me	35	49.1	54.8	+ 5.7	74	82	+ 8
Gardiner, Me	40	46.6	52.5	+ 5.9	77	80	+ 3
Portland, Me	46	46.3	55.6	+ 9.3	77	83	+ 6
Burlington, Vt	39	47.2	54.7	+ 7.5	....	78	....
Lunenburg, Vt	28	44.5	50.3	+ 6.2	83	84	+ 1
Boston and Cambridge, Mass	96½	50.8	56.6	+ 5.8	....	88	....
Fort Independence, Mass	36	52.8	57.6	+ 4.8	83	80	— 3
Lawrence, Mass	23	48.0	55.0	+ 7.0	75	80	+ 5
Mendon, Mass	46	48.5	56.7	+ 8.2	84	78	— 6
New Bedford, Mass	67	52.8	56.8	+ 4.0	83	82	— 1
Newport, R. I	49	53.3	58.4	+ 5.1	79	81	+ 2
New Haven, Conn	86	51.1	59.0	+ 7.9	83	83	0
Plattsburg Barracks, N. Y	24	46.0	53.6	+ 7.5	78	74	— 4
Albany, N. Y	51	49.0	56.1	+ 7.1	80	81	+ 1
West Point, N. Y	54	54.3	58.1	+ 3.8	87	89	+ 2
Fort Columbus, N. Y	58	54.6	61.5	+ 6.9	86	84	— 2
Rochester, N. Y	48	48.8	57.9	+ 9.1	83	86	+ 3
Buffalo, N. Y	36	49.1	58.3	+ 9.2	80	83	+ 3
Philadelphia, Pa	68	54.8	61.7	+ 6.9	88	87	— 1
Pittsburgh, Pa	20	63.1	60.7	+ 7.6	....	91	....
Baltimore, Md	44	65.6	63.1	+ 6.5	89	89	0
Washington, D. C	50	55.6	62.5	+ 6.9	90	92	+ 2
Fort Monroe, Va	54	61.9	67.4	+ 5.5	89	85	— 4
Norfolk, Va	33	61.7	64.9	+ 3.2	....	87	....
Charleston, S. C	33	65.4	70.6	+ 5.2	89	87	— 2
Savannah, Ga	34	66.2	70.5	+ 4.3	88	86	— 2
Key West	44	78.7	79.8	+ 1.1	93	87	— 6
Mobile, Ala	18	65.9	69.7	+ 3.8	94	90	— 4
New Orleans, La	41	69.1	77.6	+ 8.5	90	86	— 4
Cincinnati, Ohio	55	53.8	64.8	+11.0	90	86	— 4
Chicago, Ill	25	46.3	60.5	+11.2	90	84	— 6
Detroit, Mich	38	49.6	58.9	+ 9.3	86	85	— 1
Fort Brady, Mich	32	43.9	54.1	+10.2	82	84	+ 2
Milwaukee, Wis	35	47.8	55.6	+ 7.7	81	81	0
Saint Louis, Mo	49	55.4	62.5	+ 7.1	91.5	90	— 1.5
Iowa City, Iowa	40	48.0	59.1	+11.1	86	86	0
Dubuque, Iowa	25	48.9	59.0	+10.1	85	86	+ 1
Fort Snelling, Minn	42	47.3	57.5	+10.2	90	90	0
Fort Gibson, Ind. T	35	60.1	65.0	+ 4.9	95	89	— 6
Leavenworth, Kans	48	54.9	62.1	+ 7.2	93	89	— 4

An examination of the minimum temperature shows that temperatures ranging from —1° to 20° occurred during the month in the Northwest and in parts of Nebraska. The line of 40° ran westward through the northern portions of South Carolina and the Gulf states to Northeastern Texas, when it bent southwestward to the Rio Grande valley. The only stations in the country above 50° are those on the Gulf coast and in Florida. The maximum temperatures throughout the country were most remarkably uniform, ranging, with few exceptions, from 80° to 90°. The extreme temperatures, except at high stations, were 72° at Roseburg, 75° at Umatilla, 77° at Wood's Holl, 95° at Fort Buford, Dak., 96° at Visalia, Los Angeles, and Knoxville, and 102° at Yuma, Ariz.

Minimum temperatures.—*Maine:* 22° at *Gardiner and 26° at Eastport. *New Hampshire:* 10° at *Dunbarton. *Vermont:* 22° at *Lunenburg and 26° at Burlington. *Massachusetts:* 16° at *Westborough and 25° at Boston. *Rhode Island:* 29° at *Fort Adams and 31° at Newport. *Connecticut:* 18° at *Mystic and 24° at New Haven. *New York:* 17° at *Niles and 19° at Rochester. *Pennsylvania:* 10° at *Wellsboro' and 29° at Pittsburgh. *Delaware:* 36° at *Dover. *Maryland:* 22° at *Woodstock and 30° at Baltimore. *District of Columbia:* 28° at Washington. *Virginia:* 21° at *Snowville and 28° at Lynchburg and Fort Whipple. *West Virginia:* 22° at *Helvetia and 28° at Morgantown. *North Carolina:* 22° at *Highlands and 30° at Charlotte. *South Carolina:* 36° at *Aiken and 44° at Charleston. *Georgia:* 32° at *Gainesville and 40° at Augusta. *Florida:* 45° at *Fort Barrancas and 52° at Jacksonville. *Alabama:* 43° at Montgomery. *Mississippi:* 30° at Vicksburg. *Louisiana:* 39° at Shreveport. *Texas:* 31° at McKavett. *Ohio:* 17° at *Westerville and 35° at Columbus. *Kentucky:* 36° at Louisville. *Tennessee:* 27° at Nashville. *Arkansas:* 40° at Little Rock. *Michigan:* 18° at *Hudson and 22° at Marquette. *Indiana:* 19° at *Arlington and 30° at Indianapolis. *Illinois:* 16° at *Elmira and *Geneva and 28° at Chicago. *Missouri:*

21° at *Pierce City and 32° at Saint Louis. *Kansas:* 16° at *Fort Wallace and 26° at Leavenworth. *Wisconsin:* 15° at *Neillsville and 22° at La Crosse. *Iowa:* 11° at *Ames and 24° at Davenport and Dubuque. *Nebraska:* 12° at *Fort McPherson and 20° at North Platte. *Indian Territory:* 29° at Fort Gibson. *Minnesota:* 13° at Breckenridge. *Dakota:* 6° at *Olivet and 10° at Bismarck. *Colorado:* 18° at *Fort Lyon and 20° at Denver. *New Mexico:* 26° at Santa Fé. *Wyoming:* 18° at Cheyenne. *Utah:* 33° at Salt Lake City. *Nevada:* 21° at *Carson City and 23° at Winnemucca. *Arizona:* 26° at Fort Apache. *Idaho:* 8° at *Fort Hall and 25° at Boise City. *California:* 24° at Campo. *Oregon:* 17° at Umatilla.

Maximum temperatures.—Maine: 85° at *West Waterville and *Orono and 83° at Portland. *New Hampshire:* 84° at *Dunbarton, *Contoocookville and *Grafton. *Vermont:* 78° at Burlington and 84° at *Lunenburg. *Massachusetts:* 90° at *Somerset and 88° at Boston. *Rhode Island:* 83° at *Fort Adams and 81° at Newport. *Connecticut:* 92° at *Mystic and 83° at New Haven and New London. *New York:* 92° at *Niles and 88° at New York City. *Pennsylvania:* 91° at Pittsburgh. *Delaware:* 83° at *Dover. *Maryland:* 89° at *Emmittsburg and Baltimore. *District of Columbia:* 92° at Washington. *Virginia:* 91° at *Mount Solon and *Accotink, and 90° at Fort Whipple. *West Virginia:* 85° at Morgantown and 86° at *Helvetia. *North Carolina:* 92° at *Weldon and 87° at Charlotte. *South Carolina:* 87° at *Aiken and Charleston. *Georgia:* 90° at *Gainesville and 89° at Augusta. *Florida:* 89° at Punta Rassa and 98° at *Houston. *Alabama:* 90° at Mobile. *Mississippi:* 90° at Vicksburg. *Louisiana:* 89° at Shreveport. *Texas:* 100° at Pilot Point. *Ohio:* 94° at *Jacksonburg and *Norwalk, and 87° at Cleveland and Sandusky. *Kentucky:* 88° at Louisville. *Tennessee:* 96° at Knoxville, *Arkansas:* 89° at Little Rock. *Michigan:* 89° at *Lansing and 87° at Marquette. *Indiana:* 90° at *New Corydon and *Logansport, and 86° at Indianapolis. *Illinois:* 90° at Peoria, *Hinsdale and *Decatur, and 87° at Cairo. *Missouri:* 90° at Saint Louis and 97° at *Booneville. *Kansas:* 84° at Leavenworth and 91° at *Fort Wallace. *Wisconsin:* 87° at *Beloit and 84° at Madison and La Crosse. *Iowa:* 87° at Keokuk and 90° at *Guttenburg. *Nebraska:* 93° at *Fort McPherson and 89° at North Platte. *Indian Territory:* 90° at Fort Sill. *Minnesota:* 89° at Breckenridge. *Dakota:* 95° at *Morristown and Fort Buford. *Colorado:* 91° at *Fort Lyon and 84° at Denver. *New Mexico:* 92° at La Mesilla. *Wyoming:* 80° at Cheyenne. *Utah:* 82° at Salt Lake City. *Nevada:* 84° at Winnemucca and 89° at *Fort Halleck. *Arizona:* 102° at Yuma. *Idaho:* 85° at Boise City and 86° at *Fort Hall. *California:* 96° at Los Angeles. *Oregon:* 75° at Umatilla.

Ranges of temperature at Signal Service stations.—The *monthly ranges* will appear from an examination of the maxima and minima given. The greatest *daily* ranges vary in New England from 21° at Wood's Holl to 26° at Easport and 35° at Boston. Middle Atlantic states, from 21° at Cape May to 30° at Albany and 33° at Washington. South Atlantic states, from 15° at Portsmouth, N. C., to 33° at Augusta. Gulf states, from 13° at Key West to 16° at New Orleans and 35° at Shreveport. Ohio valley and Tennessee, from 25° at Indianapolis to 28° at Cairo and 36° at Knoxville. Lower Lakes, from 22° at Erie to 25° at Detroit and 33° at Rochester. Upper Lakes, from 22° at Chicago to 35° at Marquette. Upper Mississippi valley, from 26° at Davenport to 32° at Saint Paul. Red River of the North valley, from 45° at Pembina to 48° at Breckenridge. Lower Missouri valley, from 32° at Leavenworth to 52° at Fort Stevenson. Eastern Rocky Mountain slope, from 32° at Denison, 43° at Fort Gibson, 48° at North Platte to 54° at Uvalde. Rocky Mountains, from 31° on Pike's Peak, 36° at Santa Fé, 34° at Virginia City to 48° at Denver. Northern and Middle Plateau districts, 31° at Pioche, 35° at Boise City to 48° at Winnemucca. California, 20° at San Francisco, 37° at Red Bluff to 43° at Los Angeles.

Frosts.—Frosts have been too numerous and frequent to permit their being enumerated in detail. In the Plateau districts frosts occurred from the 8th. At Visalia, Cal., 9th to 11th. In the extreme Northwest, from the 10th. In the Northwest, 11th and after. New England and Lake region, from the 14th. Missouri and Upper Mississippi valleys, from the 19th. Middle Atlantic states and Ohio valley, from the 20th. Tennessee, from the 24th. Virginia, 24th to 26th. Georgia, 25th. Northern Alabama, 24th and 25th. Northern half of Mississippi and Louisiana, 25th. Texas, interior, 25th and after. Pensacola, Fla., 29th, "very light."

Ice has been generally reported north of Arkansas, Tennessee and North Carolina from the 23d. It was reported in the interior of Texas from the 24th to 27th, and Indian Territory, 24th and 25th, and at Charlotte, N. C., on 25th and 26th.

Ground frozen.—Catawissa, Pa., 25th; Hinsdale, Ill., 31st; Oregon, Mo., 24th; Dyberry, Pa., 26th, two inches; Embarrass, Wis., 31st.

PRECIPITATION.

The general distribution of rainfall for the month is illustrated as accurately as possible on chart No. III, from about 500 reports; it is accompanied by a table giving the average precipitation for the month of October by districts. The rainfall has

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Those marked with (*) are voluntary reports.

been below the normal in all districts, excepting the South Atlantic and East Gulf states, the Lower Missouri valley, northern portions of Minnesota and Michigan and along the Pacific coast. In the Rocky Mountain region and Plateau districts, the rainfall has been moderate and probably about the normal amount for the month. Areas of quite small rainfall are noticed in Western Nevada, on the lee side of the Sierra Nevadas; and over portions of Colorado and Kansas, similarly situated with regard to most elevated portion of the Rocky Mountains, no rain is reported. An examination of the chart shows extensive areas of less than one inch rainfall covering California, and the whole western half of the Plateau districts, the Eastern Rocky Mountain slope from Dakota to Texas, the Upper Mississippi valley from Dubuque to Saint Louis, the Southwest from Southern Missouri to the Gulf coast, and two large areas including portions of the Ohio valley, Lower Lake region, Middle states, and New England. Severe droughts are reported in all these sections, and throughout the country generally, rivers and springs are reported very low. These will be noted in detail under their respective headings.

Annual rainfall.—The following report of rainfall, measured by James G. Swan, voluntary observer at Neah Bay, Clallam County, Wash. T., for the year ending September 30, 1879, is published as being probably the heaviest rainfall during a single year ever reported in the United States: October, 1878, 12.76 inches; November, 19.71; December, 8.48; January, 1879, 13.93; February, 24.33; March, 23.83; April, 7.68; May, 7.14; June, 1.48; July, 4.63; August, 5.84; September, 4.90. Total, 134.71 inches. The heaviest rainfall of published records in possession of this office are those of Neah Bay, Wash. T., 1867, 126.50 inches; 1865, 121.30 inches, and Baton Rouge, La., 1846, 116.40 inches.

Special heavy rains.—1st, Rio Grande, Tex., 1.24 inches in 35 minutes. 2d, Vicksburg, 1.25 inches in 2 hours and 35 minutes; Melissa, Tex., 2d and 3d, 4.50 inches in 27 hours; New Ulm, Tex., 2.38 inches in 1 hour and 5 minutes. 3d, Indianola, Tex., 4.71 inches in 5 hours and 15 minutes; Mobile, Ala., 1.03 inches in 2 hours. 4th, Thomasville, Ga., 2.40 inches in 4 hours and 30 minutes; Austin, Tex., 1.10 inches in 3 hours. 9th, Highlands, N. C., 1.92 inches. 10th, Savannah, Ga., 1.18 inches in 1 hour and 40 minutes; Fort Halleck, Nev., 1.06 inches; Fort Davis, Tex., 2.88 inches in 16 hours; Lawrence, Kans., 1.5 inches. 11th, Independence, Mo., 2.72 inches; near Arlington, Ind., 1.00 inch in 1 hour. 12th, Okalooska, La., 1.05 inches in 4 hours. 13th, Key West, 4.22 inches. 15th, Fort Meade, Dak., 1.24 inches. 16th, Deadwood, Dak., 2.92 inches in 17 hours; Montgomery, Ala., 2.10 inches in 8 hours and 30 minutes; Ames, Iowa, 2.30 inches; Nora Springs, La., 1.50 inches in 1 hour; Cresco, La., 1.65 inches in 12 hours; Cairo, Ill., 2.53 inches in 11 hours 30 minutes. 17th, Montgomery, Ala., 3.13 inches in 7 hours and 30 minutes; Lenoir, N. C., 17th to 19th, 6.50 inches; Highland, N. C., 17th to 20th, inclusive, 11.59 inches, of which 7.50 inches fell on the 17th; Asheville, N. C., 17th to 18th, 6.40 inches in 4 hours. 18th, Gainesville, Ga., 16th to 18th, 5 inches; Aiken, S. C., 2.25 inches; Forsyth, Ga., 16th to 18th, 2.85 inches; Murphy, N. C., 4.30 inches in 28 hours; Webster, N. C., 16th to 18th, 6.70 inches; Franklin, N. C., 16th to 18th, 7.00 inches; Fort Barrancas, Fla., 4.53 inches; Atlanta, Ga., 1.48 inches in 16 hours. 20th, Quitman, Ga., 1.50 inches. 22d, Thomasville, Ga., 4.40 inches in 16 hours. 26th, Brownsville, Tex., 2.20 inches in 6 hours 30 minutes. 27th, Key West, on 26th and 27th, 3.37 inches; Fort Barrancas, Fla., 3.04 inches. 28th, Cape Hatteras, 3.00 inches in 8 hours 30 minutes.

Largest monthly rainfalls.—Highlands, N. C., 15.83 inches; Key West, Fla., 14.20 inches; Thomasville, Ga., 13.78 inches; Saint Mark's, Fla., 12.94 inches; Fort Barrancas, Fla., 12.11 inches; Franklin, N. C., 11.40 inches; Montgomery, Ala., 10.20 inches; Daytona, Fla., 9.96 inches; Jacksonville, Fla., 9.45 inches; Quitman, Ga., 8.50 inches; Lenoir, N. C., 8.40 inches; Webster and Asheville, N. C., 8.10 inches; Kittyhawk, N. C., 7.90 inches; Forsyth, Ga., 7.86 inches; Gainesville, Ga., 7.60 inches; Charleston, S. C., 6.74 inches; Cape Hatteras, N. C., 5.86 inches; Paducah, Ky., 5.59 inches; Atlanta, Ga., 5.44 inches; Murphy, N. C., 5.30 inches; Wytheville, Va., 5.25 inches; Mobile, Ala., 5.15 inches; Snowville, Va., 5.10 inches; Mount Washington, N. H., and Melissa, Tex., 5.03 inches.

Smallest monthly rainfalls.—Fort Lyon, Cal., and Fort Wallace, Kans., none; Cumberland, Md., Fayette, Miss., and Hector, N, Y., trace; Fort McDermitt, Nev., 0.05 inch; Fort McHenry, Md., and Mendon, Mass., 0.09 inch; Wickenburg, Ariz., 0.10 inch; Pilot Point, Tex., 0.11 inch; Spiceland, Ind., 0.14 inch; Fort Sill, Ind. T., 0.15 inch; Carson City, Nev., 0.18 inch; Augusta, Ill., and Denver, Colo., 0.19 inch; Concho, Tex., 0.20 inch; North Platte, Nebr., and Brackettville, Tex., 0.21 inch; Fort Verde, Ariz., 0.23 inch; Norfolk, Va., 0.25 inch; Columbus, Ohio, 0.26 inch; Phœnix, Ariz., Laredo, Tex., and South Orange, N. J., 0.27 inch; Vevay, Ind,, and Keokuk, Iowa, 0.28 inch; San Diego, Cal., 0.29 inch; Ruggles, Ohio, and Alcatraz Island, Cal., 0.30 inch; Linden, N. J., and Ithaca, N. Y., 0.31 inch; Paterson,N. J., 0.32 inch; Umatilla, Oreg., Yuma, Ariz., and Yankton, Dak., 0.33 inch; Ashland, Wis., 0.35 inch;

Prescott, Ariz., Pt. San José, Cal., and Lima, N. Y., 0.37 inch; Henrietta, Tex., and Fort Columbus, N. Y., 0.38 inch; Margaretta and Troy, Ohio, 0.40 inch; Philadelphia, Pa., 0.41 inch; Starkey, N. Y., 0.42 inch; Norwalk, Ohio, Wellsborough, and Hulmeville, Pa., 0.44 inch; Penn Yan, N. Y., 0.46 inch; Sandy Hook, N. J., 0.47 inch; Fallsington, Pa., 0.48 inch

Rainy days.—The number of days on which rain or snow has fallen varies as follows: New England, from 5 to 13; Middle Atlantic states, 4 to 9; South Atlantic states, 4 to 20; Eastern Gulf states, 11 to 20; Western Gulf states, 5 to 10; Ohio valley and Tennessee, 6 to 10; Lower Lake region, 6 to 13; Upper Lake region, 9 to 15; Upper Mississippi valley, 4 to 10; Missouri valley, 7 to 9; Red River of the North valley, 6 to 11; Eastern Rocky Mountain slope, 1 to 5; Rocky Mountains, 1 to 4; California, 1 to 3.

Cloudy days.—The number varies in New England from 4 to 17; Middle Atlantic states, 4 to 7; South Atlantic states, 5 to 18; Eastern Gulf states, 11 to 16; Western Gulf states, 2 to 5; Lower Lake region, 5 to 11; Upper Lake region, 7 to 14; Ohio valley and Tennessee, 3 to 9; Upper Mississippi valley, 3 to 6; Missouri valley, 2 to 5; Red River of the North valley, 3 to 11; Eastern Rocky Mountain slope, 1 to 11; Rocky Mountains, 0 to 5; California, 3 to 5.

Hail.—Hail has been generally reported during the month from Indiana to Michigan, eastward to New England, in the Northwest, the Middle Plateau, and on Pike's Peak. On the 10th hail fell at Augusta, Ga. The only wide-spread fall appears to have been on the 28th, when hail fell generally along Lake Erie and in the Middle Atlantic States. No storm of unusual severity has been reported,

Snow.—From the Lake region and Ohio valley eastward to New England and as far south as Maryland, light snow was reported on the 24th. In the Plateau districts it appeared as early as the 8th, and on the eastern slope of the Rocky Mountains from the 15th.

Depth of snow on ground at end of month.—Fort Collins, Colo., 1.5 inches; Pike's Peak, 6 to 10 inches; Mount Washington, 0.5 inch.

Droughts.—West Charlotte, Vt., 25th, drought very severe; Lake Champlain lower than ever remembered in fifty years and falling every day. Waltham, Mass., drought during last half of month. Hector, N. Y., severe drought throughout the month. 17th, Brooklyn, N. Y., "no rain has fallen here for a month, and wells on Staten Island and Jersey City are drying up"; New York City, "comparison with records for past twenty years shows that the rainfall from September 1 to October 17 has not been as low as this year"; Philadelphia, "in towns well up the Schuylkill a water famine is prevailing. The Schuylkill is lower than for an indefinite period. Hundreds of canal boats are laid up for want of water to move them; "the drought in southern Livingston and northern Steuben Counties, New York, has already caused great damage to pastures, winter wheat, and late corn." Nile, N. Y., 31st, great scarcity of water, many wells dry. Newburg, N. Y., 19th, authorities ordered the greatest economy in using water for fear of famine. 17th, farmers throughout Camden and Burlington Counties, New Jersey, report fall crops suffering for want of rain and that water for domestic uses is difficult to obtain. Such an extended spell of dry weather has not been known for years in West and South Jersey." Linden, N. J., during 45 days rainfall only 0.32; great scarcity of water. Wellsborough, Pa., drought unprecedented; the Tioga and Cowanesque rivers nearly dry; streams, springs, and wells dry; water for domestic use hauled long distances. Schuylkill County, Pennsylvania, severe drought continuing still on the 11th; many collieries stopped for a lack of water, crops already injured; at Mahaney Plane, "the wells in the town have been exhausted for some time, and the people are obliged to bring water half a mile." Harbor Creek, Pa., "people suffering from the effects of a prolonged drought; streams, springs, and wells that never failed before are now nearly exhausted." Reading, Pa., "very severe drought; no rain has fallen for many weeks; streams, wells, and springs are all drying up; water supply for city entirely inadequate to domestic uses." Pittsburgh, Pa., "very severe drought is still prevailing in the surrounding country, wells dry, pastures scorched and burned up, and stock suffering severely for want of food and water." Catawissa, Pa., "severe drought during the entire month, streams unusually low, and nearly all wells exhausted. North branch of the Susquehanna River at this place two inches lower than established low-water mark." Dyberry, Pa., 31st, "water for domestic purposes carried long distances, many wells and springs drying up." Fallston, Md., in "45 days preceding October 20 only 0.30 inch rainfall; many springs and wells exhausted." Petersburg, Va., 26th, "mills which have been on quarter capacity for lack of water commenced running full capacity from late rains." Walnut Grove, Va., driest October for many years. West Liberty, Ohio, 31st, the whole country about suffering for want of rain. Ringgold, Ohio, 17th to 30th, severe drought. North Lewisburg, Ohio, 31st, "exceedingly dry, only 0.63 inch of rain has fallen in the last 42 days." Westerville, Ohio, 31st, wells failing. Little Mountain, Ohio, "the driest October ever observed." Augusta, Ill., 21st, wells getting dry and water scarce. Springfield, Ill., 24th, all railroads leading into the city were obliged to run daily water trains on account of the drought. Wabash, Ind., "greater deficiency in the rainfall of the present month than for the month of October during the past 14 years; creeks and springs never before known to fail are dry; the greatest scarcity of water prevails in all sections of the country remote from the river, which at this place is lower than ever known before." Embarrass, Wis., 31st, brooks and rivers very low and many wells dry. Fort Madison, Iowa, drought worse than last month. Professor Nipher, of Missouri Weather Service, reports it "the driest October in 40 years; the area of smallest rainfall extending from Saint Louis to the northwest, its western boundary being the summit of the 'divide' between the drainage systems of the Missouri and Mississippi Rivers." Chattanooga, Tenn., 3d, "drought is commencing to be felt." Fayette, Miss., 31st, vegetation scorched and water very scarce. Clarksville, Tex., "month has been very dry, and the earth is so parched that but little winter grain has been sown." Melissa, Tex., 2d, drought of August and September ended. Sulphur Springs, Tex., 29th, the "long drought still continues." Coalville, Utah, 7th, "very dry; first rain since April." Winnemucca, Nev., 22d, "Humboldt river is reported very low, and fears are entertained of a scarcity of water." Cloverdale, Cal., 31st, many places in Russian river dry.

RELATIVE HUMIDITY.

The percentages of mean relative humidity for the month range as follows: New England, 64 to 81; Middle Atlantic states, 66 to 80; South Atlantic states, 68 to 82; Eastern Gulf states, 72 to 82; Western Gulf states, 64 to 72; Ohio valley and Tennessee, 59 to 74; Lower Lakes, 65 to 74; Upper Lakes, 65 to 77; Upper Mississippi valley, 60 to 65; Lower Missouri valley, 59 to 65; Red River of the North valley, 61 75; Northern Rocky Mountain slope, 52 to 59; Texas, 49 to 82; Southern Plateau districts, 32 to 54; California, 48 to 69; Oregon, 74 to 80. *High stations* report the following averages, not corrected for altitude: Mount Washington, 88.3; Cheyenne, 33; Denver, 35.6; Santa Fé, 41.5; Pike's Peak, 42.7; Virginia City, 48.4.

WINDS.

Total movements of the air.—The following were the largest monthly movements in miles recorded at the Signal Service stations: Pike's Peak, 16,091 miles; North Platte, 13,249; Breckenridge, 12,007; Cape Lookout, 10,626; Key West, 10,552; Portsmouth, N. C., 10,510; Cape May, 10,087; Thatcher's Island, 10,010; Sandy Hook, 9,855; Yankton, 9,657; Kittyhawk, 9,411; Punta Rassa, 9,219; Sandusky, 8,809; Indianola, 8,745; Bismarck, 8,720; Cape Hatteras, 8,543. The *smallest* movements were: Silver City, N. Mex., 1,148 miles; La Mesilla, N. M., 1,512; Visalia, Cal., 1,656; Lynchburg, 1,821; Roseburg, Oreg., 1,997; Laredo, Tex., 2,031; Fredericksburg, Tex., 2,209; Uvalde, Tex., 2,379; Shreveport, 2,511; Indianapolis, 2,495; Deadwood, 2,532; Socorro, N. M., 2,548; San Antonio, Tex., 2,637; Graham, Tex., 2,679; Brownsville, Tex., 2,773.

Local storms.—Matronsville, Tuscola County, Michigan, 3d p. m., a "cyclone" accompanied by heavy rains passed over the county fair grounds, doing great damage; cloth tents were torn to shreds, fences blown down, and much other destruction committed. "Waynesborough, Ga., 10th, very destructive storm, demolishing a church and uprooting many trees."

Sand-storms.—Fort Yuma, Cal., 7th, 13th, 14th, 25th, 27th; Visalia, Cal., 7th; Los Angeles, Cal., 8th; Burkes, Ariz., 18th, 26th and 27th.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily weather indications for October, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of omissions to be 0.87 per cent., and of verifications to be 86.3 per cent. The percentages for the four elements have been; Weather, 91.4; direction of the wind, 87.0; temperature, 86.9; barometer, 82.5. The percentages of verifications by geographical districts, have been: New England, 85.8; Middle states, 89.5; South Atlantic states, 87.3; Eastern Gulf states, 87.9; Western Gulf states, 85.2; Lower Lake region, 88.2; Upper Lake region, 89.5; Tennessee and the Ohio valley, 88.2; Upper Mississippi valley, 84.0; Lower Missouri valley, 85.0; Northern Pacific coast region, 65.7; Central Pacific coast region, 95.2; Southern Pacific coast region, 100.0. Of the 3,780 predictions that have been made, 137, or 3.62 per cent., are considered to have entirely failed; 87, or 2.30 per cent. were one-fourth verified; 408, or 10.79 per cent., were one-half verified; 330, or 8.73 per cent., were three-fourths verified; 2,818, or 74.55 per cent., were fully verified, so far as can be judged from the tri-daily weather maps.

Cautionary signals.—166 cautionary signals were displayed during the month, of which 114, or 68.7 per cent., were justified by winds of 25 miles per hour, or over, at or within a radius of 100 miles of the station. 51 cautionary off-shore signals were displayed, which were all justified as to direction, and of which 44, or 86.3 per cent., were fully justified. Of the cautionary off-shore signals, 15 were changed from cautionary. 217 signals of both kinds were displayed, of which 158, or 72.8 per cent., were fully justified. The above does not include signals ordered at 52 display-stations, where the velocity is only estimated. 52 cases were reported of winds of 25 miles or over where signals were not ordered.

NAVIGATION.

In the table in the right hand side of Chart No. III are given the highest and lowest readings of the Signal Service river-gauges for the month, with the dates of the same. The rivers have continued very low throughout the entire month. The low stage of water in the Red and Ohio rivers deserves special notice. The Red river at Shreveport continued below the previous low-water mark, and on the 31st had fallen to 41 inches below it, navigation continuing entirely suspended. The Arkansas at Little Rock fell on the 11th to a lower level than ever before known, and the observer reports great scarcity of water throughout that section. The Ohio at Pittsburgh was 13 inches below previous low-water mark on the 19th and 20th; at Wellsburg, W. Va., near the end of the month, the river was 2 inches lower than known before, and at Louisville, at the end of the month, it was reported lower than before known, "there being scarcely 2 feet depth of water in many places, while what is known as the falls presented a bleak and barren appearance, huge rocks and stone-bed being visible for miles." At Trenton, N. J., on the 18th the Delaware river was lower than it has been for many years. The lakes are also very low, the water in Grand Traverse Bay, Lake Michigan, on the 31st, being lower than for many years past, and in Sandusky Bay, Lake Erie, on the same date, lower than for twenty years past. Lake Champlain was reported on the 31st to be lower than for the last fifty years, and falling. The only high waters during the month worthy of notice occurred on the 19th and 20th in the rivers rising in the Cumberland and Blue Ridge Mountain region. The Savannah, at Augusta, rose to 23 feet, and the Tennessee, at Chattanooga, to 13 feet on the above dates.

High tides.—Saint Mark's, Fla., 7th, 5 feet above the mean; Cape Lookout, N. C., 13th, 14th, 16th, 17th, and 18th; Cape Hatteras, N. C., 13th, and 14th; Fort Macon, N. C., 16th to 18th unusually high tides; Barnegat, N. J., 15th, unusually high; Jacksonville, Tenn., 16th, highest tide ever known on the bar at the mouth of Saint John's river; Punta Rassa, 15th; Indianola, Tex., 2d, 3d, 8th, 9th, 10th, 11th, 12th, 16th, 17th, 18th, 20th, 24th, 26th, and 28th; Portsmouth, N. C., 12th, 14th, and 16; Eastport, Me., 16th, 17th, 20th, and 21st.

TEMPERATURE OF WATER.

The temperature of water, as observed in rivers and harbors, with average depth at which the observations were taken, are given on Chart No. II. At the following stations no observations were made on the dates indicated: At Augusta, from the 24th to the 31st, and at Norfolk from the 13th to the 24th, by reason of breakage of thermometer; and at Cleveland on the 19th, 23d, 24th, and from the 28th to 31st, the lake being too rough for observations to be made. Reports are not yet to hand from Escanaba, and the station at Saint Mark's, Fla., has been discontinued.

ATMOSPHERIC ELECTRICITY.

Thunder Storms.—These storms have been reported in considerable numbers during the month. They were most numerous and wide-spread, as follows: On the 28th they generally occurred in New England and the Middle Atlantic states. On the 10th and 11th they prevailed in the South Atlantic and Gulf states; from 10th to 12th in the Upper Mississippi valley; on the 12th in the Ohio valley. In California, at Fort Yuma, on the 5th; at Calistoga on the 12th, and at Princeton on the 7th and 12th. On the 15th, at Cheyenne, a heavy snow storm, accompanied by thunder and lightning, wind NW. 44 miles.

Auroras.—But one auroral display has been extensively observed during the month. It occurred on the 7th, from 7 to 10 p. m., and extended from Maine to Nebraska, being observed in the latter State at Clear Creek. Its detailed description is as follows: Cresco, Iowa, 7 to 7.10 p. m., low arch in the northeast, with patches of light beneath; Monticello, Iowa, at 9 p. m.; Cornish, Me., all the evening; Gardiner, Me., at 9.30 p. m., quite faint; Orono, Me., faint; Somerset, Mass., early evening, dark cloud below arch; Cambridge, Mass., 8 to 8.45 p. m.; Waltham, Mass., 7.20 to 8 p. m., faint nebulous haze; Newburyport, 7 to 10 p. m., faint above a dark segment; Clear Creek, Nebr., faint; Contoocookville, N. H., 7.30 p. m., diffuse light; Grafton, N. H., 8.30 to 9.30 p. m., not very bright; Argyle, N. Y., slight diffuse light in the early part of the evening; Woodstock, Vt., 8 p. m., slight nebulous light; Newport, Vt., faint; Saint Paul, 7.40 p. m., faint light and arch; Eastport, Me., 7.30 p. m., arch extended from NE. to NW. and consisting of two brilliant unbroken bands reaching 30° towards the zenith; streamers were observed to play between the bands several times extending from one to the other, General cloudiness prevailed throughout the Lake region during that evening, which prevented observations of the display. The following isolated cases of aurora are reported. 6th, Starkey, N. Y. 9th, Arlington, Ind., 9 p. m.; New Corydon, Ind. 10th, Oregon, Mo., at 9 p. m.; Port Huron. 11th, Oregon, Mo., at 9 p. m. 17th, Vevay, Ind. 18th, Arlington, Ind., 10 p. m. 19th, Detroit, 8 p. m., quite feeble; Wellsborough, Pa. 22d, Fort Wayne, Ind. 24th, Wellsborough, Pa. 25th, Woodstock, Vt. 26th, Woodstock, Vt. 27th, Starkey, N. Y. 28th, New Corydon, Ind., corona appeared at 8 p. m., disappearing shortly after; Arlington, Ind. 31st, Starkey, N. Y.

Telegraphic communication interfered with by atmospheric electricity.—Santa Fé, 12th, 13th; Jacksborough, Tex., 2d, 3d, 5th, 10th; Fort Davis, Tex., 5th; Castroville, Tex., 3d, 8th, 12th, 16th; Eagle Pass, Tex., 1st, 10th; Edinburg, Tex., 1st; Pembina, 1st, 11th.

OPTICAL PHENOMENA.

Solar halos were seen in greatest numbers from the 25th to 27th, twelve on the latter date, extending from Maine westward, to Minnesota, and as far south as Virginia; but few were reported from the Gulf States.

Lunar halos were frequently observed east of the Rocky Mountains from the 22d to the 31st; there being no State from which one or more has not been reported.

MISCELLANEOUS PHENOMENA.

Prairie and forest fires.—Fort Gibson, 14th, 17th, 19th to 23d, 28th to 31st; Fort Sill, 7th, 8th, 13th to 20th, 26th to 29th; Springfield, Mass., 14th, 15th; Creswell, Kans., 17th to 19th, 24th to 29th; Enfield, N. H., 15th to 17th; Fort Dodge, Iowa, 2d, 3d, 6th, 8th, 10th, 13th, 14th, 15th; Litchfield, Mich., 1st to 18th; Mount Solon, Va., 29th to 31st; Walnut Grove, Va., 16th; Camp Sheridan, Nebr., 3d, 4th, 5th; Fort Randall, Dak., 5th, 8th, 9th; Fort Hale, Dak., 5th; Mount Vernon, Iowa, 2d, 3d; Red Bluff, Cal., 25th to 31st, in mountains; Los Angeles, Cal., 25th; Virginia City, 5th, very extensive in Ruby valley; Yankton, 1st, 8th, 9th, 10th, 20th; Fort Stevenson, Dak., 5th; Deadwood, 5th, 6th, 7th, 13th; North Platte, 9th, 18th, 20th; Henrietta, Tex., 29th, 30th; Coleman, Tex., 19th, 20th; Pembina, 1st to 5th, 6th, 16th to 24th; Burlington, Vt., 3d, 4th, 13th to 25th; in Vermont, between Camel's Hump and Mansfield Mountains, on 16th, forest fires destroyed large tracts of valuable timber; also, near Plymouth, Windsor county, large areas burned over and much lumber destroyed. Port Jervis, N. Y., 16th, in mountains. Waterbury, Vt., 14th, immense damage inflicted. Brentwood, Long Island, 16th to 18th. Weymouth, Norfolk County, Massachusetts, 28th, over 100 acres of woodland burned. Wellsborough, Pa., during portions of the month severe forest fires have raged through the county, doing much damage; Brockville, Ont., 15th, severe bush fires raging near Westport; over 400 acres burned; other fires were reported in various parts of that and adjacent counties. Lebanon, N. H., 15th, on Grantham Mountain, doing great damage to valuable timber; hundreds of acres burned over. Northampton, Mass., 15th, "a severe fire has been raging in the woods north of that place during the past two days. The whole western part of the State is enveloped in dense smoke from forest fires." Concord, N. H., 15th, a large territory of woodland burned over; over 2,000 cords of wood destroyed for one firm. Pembina, 1st to 7th, very extensive prairie fires, doing much damage. Norfolk, N. Y., 3d, forest fires raged fearfully, "destroying farm-houses, barns, and farm property. Some of the roads are impassable." Whitestone, Long Island, 16th, "during past twenty-four hours dense clouds of smoke from the forest fires rendered it necessary to keep the fog bells tolling from Fort Schuyler to Executive Lights." Sparta, N. Y., 17th, large forest fires raging, destroying valuable timber, fences, and orchards. Montreal, Can., 17th, "dense smoke on the river still continues and navigation is entirely suspended." Sweetwater valley, San Diego county, California, 28th, one of the greatest conflagrations "ever known to the oldest inhabitant—from 40 to 50 square miles of territory burned over."

Meteors have been seen in considerable numbers throughout the country east of the Mississippi valley, the largest number of stations reporting them as visible on the 12th and 13th. None of particular importance were observed, except at Indianola on the 12th, 10.20 p. m. A very brilliant meteor started in the vicinity of Aquarius, about 25° above the horizon and moved southward. Apparent size one-fourth of the full moon, color white. When about 10° above the horizon it exploded into seven fragments, lighting up the whole southern sky, as though the full moon had been present.

Earthquakes.—June 3, 9.32 a. m., on Atka Island, Alaska, eight sharp shocks in rapid succession, lasting about two seconds each, movement from SSE. to NNW. October 2 a sharp shock of earthquake was felt at 6.30 a. m. at Oakland and other places around San Francisco Bay. Winnsborough, S. C., 26th, a. m., slight shock. New Haven, Conn., 24th, 6.12 to 6.13 p. m., two slight shocks at intervals of 2 or 3 seconds. The shocks were felt at Bridgeport, 15 miles distant, at about the same time.

Sunsets.—The characteristics of the sky at sunset, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from 134 stations show 4,087 observations to have been made, of which 29 were reported doubtful; of the remainder 3,532, or 87.0 per cent., were followed by the expected weather.

Grasshoppers.—Dayton, Wash. T., 1st, doing some injury to fruit and laying many eggs; October 4, large numbers reported as appearing in Stephen's county, Texas; Pilot Point, Tex., 17th, in large numbers, passing over station from the northwest, few alighting; 19th, disappeared; 20th, reappeared, but did no damage; 21st, large wheat fields were reported destroyed 15 miles southeast of station, disappearing afterwards to the southward without depositing eggs; Jacksborough, Tex., 17th and 18th, flying south; Coleman, Tex., 17th, passing southward, very few alighting; Fredericksburg, Tex., 19th., passed southwards near station, none alighting. Fort Sill, Ind. T., 28th, disappearing, very few to be seen; Melissa, Tex., 18th, myriads passing over station; 17th, Dallas, Tex., moving south in clouds, very few alighted, reported thick in counties to the west and northwest, "no damage done as yet"; Waco, Tex., "passing over city all day, and 12 miles west have appeared in myriads"; 19th, reported to be damaging wheat near Staunton, Ill.; early part of October in Parker County, Texas, doing some damage; Shackelford County, southern portion, "in innumerable numbers"; Erath county, Texas, many passed "over," few alighted, but did little damage; Denison, Tex., 21st, large swarms passed over station to the southwest, continuing until 3 p. m. of the 22d; San Antonio, Tex., 24th, many passed over station to the southeast, but no destruction was heard of; Bosque county, Texas, 25th, very plentiful, "the new wheat crop has been entirely eaten up by them."

Geese flying south at Hulmeville, Pa., 11; Visalia, Cal., 9th, 25th; Red Bluff, Cal., 3d; Roseburg, Oreg., 6th, 11th; Yankton, 7th, 26th; North Platte, 21st, 30th; Bismarck, 2d, 14th, 21st; Pilot Point, Tex., 22d; Uvalde, Tex., 14th; Jacksborough, Tex., 22d; Henrietta, Tex., 28th, 30th; Graham, Tex., 24th; Little Rock, Ark., 17th; Pembina, 21st, 22d; Saint Louis, 24th; Duluth, 19th, 27th.

Polar bands.—Gardiner, Me., 26th; Freehold, N. J., 29th; Wytheville, Va., 24th; Tabor, Iowa, 1st, 2d; Pembina, 13th, 18th, 25th; Leavenworth, 21st, 30th.

Mirage.—Olivet, Dak., 21st, 26th, 31st.

Zodiacal light.—Pike's Peak, 24th, 5.54 p. m., a rosy yellowish light of conical shape.

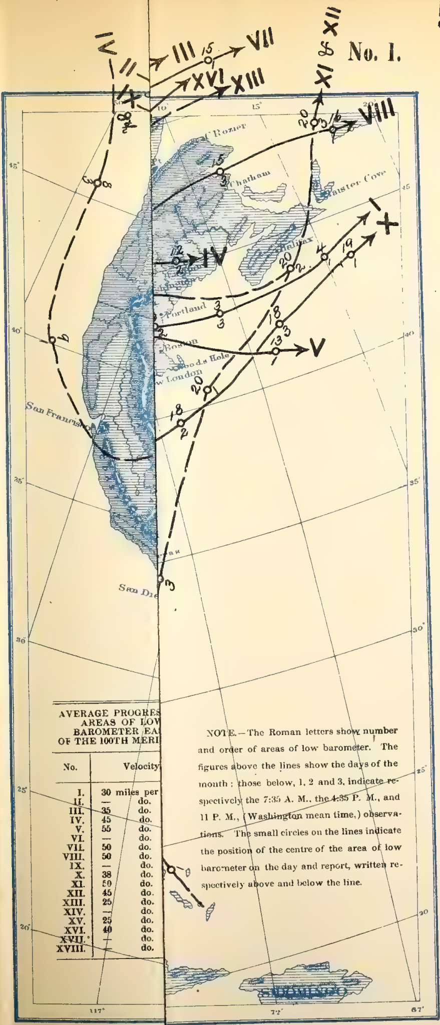
Sun spots.—The following record of observations made by D. P. Todd, assistant, has been forwarded to Prof. S. Newcomb, U. S. Navy, superintendent Nautical Almanac, Washington, D. C.:

Date.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	
Oct., 1879.									
1st, 3 p. m.	0	0	0	0	0	0	1	1	Spot much smaller.
2d, 4 p. m.	1	9	0	0	0	0	1	9	
3d, 4 p. m.	0	0	0	0	0	0	1	1	Faculæ.
5th, 5 p. m.	0	0	0	0	0	0	0	0	Faculæ.
7th, 4 p. m.	1	4	0	0	1	4	1	4	Faculæ.
9th, 5 p. m.	0	12	0	0	0	6	1	16	
10th, 4 p. m.	0	0	0	0	0	0	1	13	
12th, 5 p. m.	1	4	0	0	0	0	2	17	
13th, 8 a. m.	1	4	0	4	1	4	3	17	Faculæ.
13th, 4 p. m.	0	0	0	0	0	0	3	10	Faculæ.
14th, 4 p. m.	0	0	0	0	0	0	3	7	Faculæ.
15th, 4 p. m.	0	0	1	2	0	0	1	3	
19th, 9 a. m.	1	17	0	0	0	0	1	17	
19th, 5 p. m.	0	0	0	0	0	0	1	17	
20th, 1 p. m.	0	0	0	6	0	0	1	11	
23d, 8 a. m.	0	0	1	11	0	0	0	0	Spots probably disappeared by solar rotation.
30th, 8 a. m.	0	0	0	0	0	0	0	0	Faculæ.
31st, 8 a. m.	0	0	0	0	0	0	0	0	

Observations were also made on the 6th and 16th at 4 p. m., on the 24th, 25th, 26th, and 28th at 8, 9, 10, and 7 a. m., respectively, and on the 31st at 5 p. m., but no spots were seen. Mr. David Trowbridge, at Waterburg, N. Y., observed the sun on the 2d, 3d, 4th, 5th, 6th, 7th, 9th, 11th, 12th, 14th, 16th, 23d, 24th, 25th, 26th, 29th, and 30th, but saw no spots on those days. On the 19th, at 3.30 p. m., saw two groups near the west margin of the disk; one contained 2 spots and the other 3. These groups and spots were also seen on the 20th and 21st. They disappeared by rotation, presumably by the 22d. Mr. H. D. Gowey, at North Lewisburg, Ohio, observed three large spots on the 18th, at 7.50 a. m., in the southeast quadrant.

Prof. F. Hess, at Fort Dodge, Iowa, reports the following spots: 8th, 10 a. m., 3 spots in SE. quadrant; 10th, 8.30 a. m., 9 in SE. quadrant; 12th, 11 a. m., 1 in SE. quadrant; 13th, 7 a. m., 5 spots, 1 in SE. quadrant and 4 in NW. quadrant; 14th, 3 spots; 15th, 7 a. m., 2 in SE. quadrant; 18th, 9 a. m., 3 in N. W. quadrant; 19th, 4 in SW. quadrant; 20th, 5 in SW. quadrant; 22d, 3 in SW. quadrant. No observations were made on the 9th and 11th; on the 16th and 17th the sun was hidden; on the other days of the month observations were made, but no spots seen. Professor Hess says: "The sun-spot observations were of unusual interest. At least one of the spots mentioned,

No. 1.



AVERAGE PROGRES
AREAS OF LOV
BAROMETER EA
OF THE 100TH MERI

No.	Velocity
I.	30 miles per
II.	— do.
III.	35 do.
IV.	45 do.
V.	55 do.
VI.	— do.
VII.	50 do.
VIII.	50 do.
IX.	— do.
X.	38 do.
XI.	50 do.
XII.	45 do.
XIII.	25 do.
XIV.	— do.
XV.	25 do.
XVI.	40 do.
XVII.	— do.
XVIII.	— do.

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	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	
Oct., 1879.									
1st, 3 p. m.	0	0	0	0	0	0	1	1	Spot much smaller.
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3d, 4 p. m.	0	0	0	0	0	0	1	1	Faculæ.
5th, 5 p. m.	0	0	0	0	0	0	0	0	Faculæ.
7th, 4 p. m.	1	4	0	0	1	4	1	4	Faculæ.
9th, 5 p. m.	0	12	0	0	0	6	1	16	
10th, 4 p. m.	0	0	0	0	0	0	1	13	
12th, 5 p. m.	1	4	0	0	0	0	2	17	
13th, 8 a. m.	1	4	0	4	1	4	3	17	Faculæ.
13th, 4 p. m.	0	0	0	0	0	0	3	10	Faculæ.
14th, 4 p. m.	0	0	0	0	0	0	3	7	Faculæ.
15th, 4 p. m.	0	0	1	2	0	0	1	3	
19th, 9 a. m.	1	17	0	0	0	0	1	17	
19th, 5 p. m.	0	0	0	0	0	0	1	17	
20th, 1 p. m.	0	0	0	6	0	0	1	11	
23d, 8 a. m.	0	0	1	11	0	0	0	0	Spots probably disappeared by solar rotation.
30th, 8 a. m.	0	0	0	0	0	0	0	0	Faculæ.
31st, 8 a. m.	0	0	0	0	0	0	0	0	

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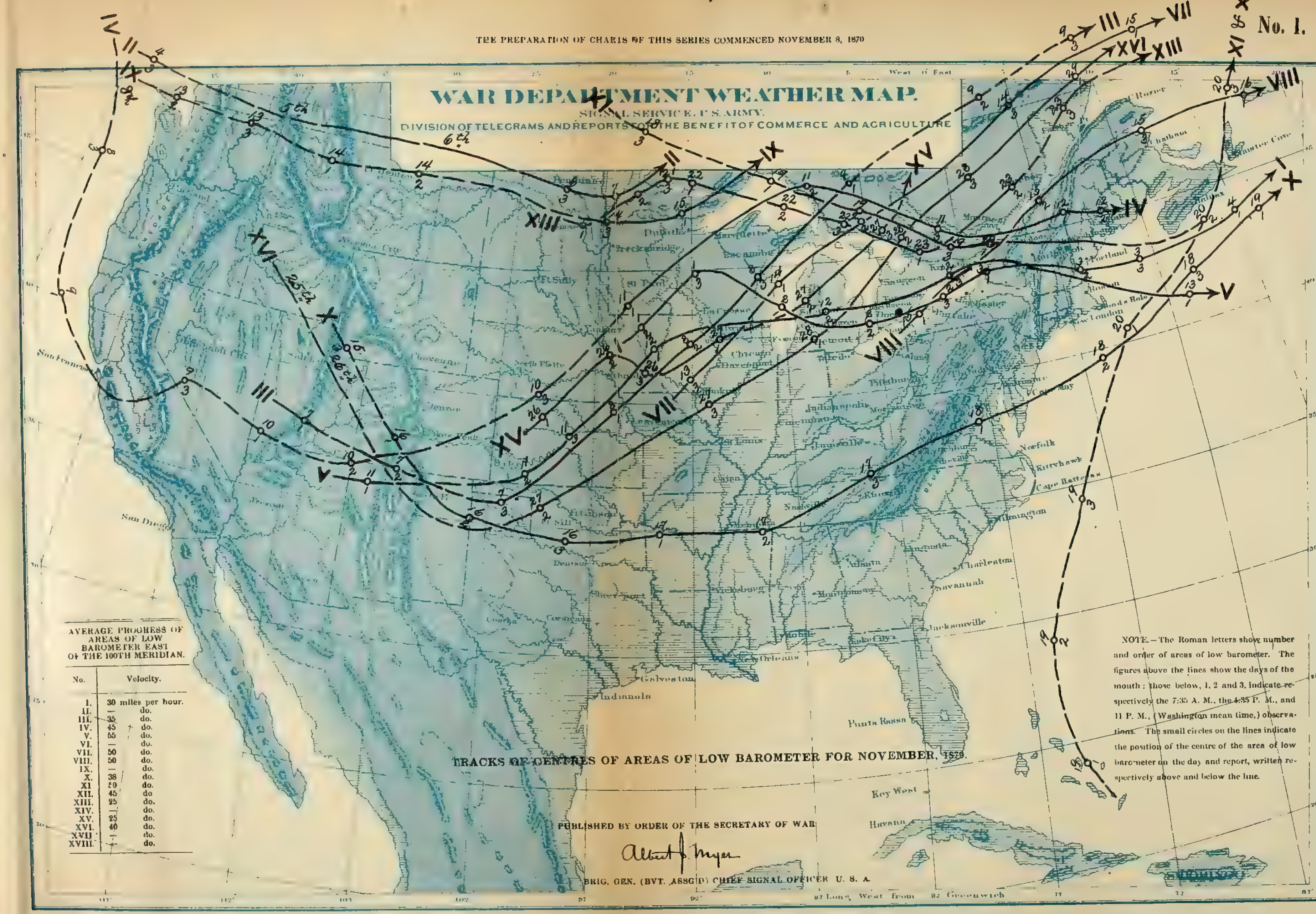
No. 1.

THE PREPARATION OF CHARTS OF THIS SERIES COMMENCED NOVEMBER 8, 1870

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE



TRACKS OF CENTRES OF AREAS OF LOW BAROMETER FOR NOVEMBER, 1879.

AVERAGE PROGRESS OF AREAS OF LOW BAROMETER EAST OF THE 100TH MERIDIAN.

No.	Velocity.	
I.	30	miles per hour.
II.	—	do.
III.	35	do.
IV.	45	do.
V.	55	do.
VI.	—	do.
VII.	50	do.
VIII.	50	do.
IX.	—	do.
X.	38	do.
XI	50	do.
XII.	45	do
XIII.	25	do.
XIV.	—	do.
XV.	25	do.
XVI.	40	do.
XVII.	—	do.
XVIII.	—	do.

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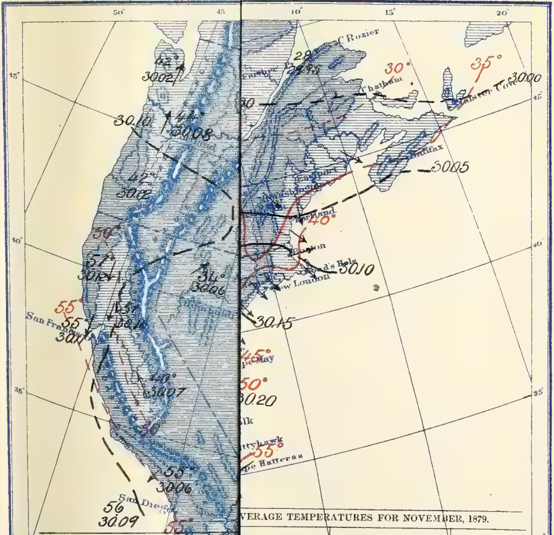
PUBLISHED BY ORDER OF THE SECRETARY OF WAR

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER U. S. A.

No. II. 51



TEMPERATURE OF WATER FOR NOVEMBER, 1879.

STATIONS.	Temperature at bottom.		Average depth of water, feet.
	Max.	Min.	
Alpena	44°	32°.5	42
Augusta	63	49	[illegible]
Baltimore	59	43	11
Buffalo	53	36	16
Burlington, Vt.	50	42	15.7
*Cedar Keys	66	58	11.5
Charleston	64	56	13.5
Chicago	49	34	[illegible]
*Cleveland	54	35	14
Detroit	51	34	23
Duluth	41.5	34	10 5
Eastport	47	43	19.9
*Escanaba	44.5	34.5	15
Galveston	77	57	13.5
Grand Haven	54	35	19
Jacksonville	74	62	18
Key West	80	65	18
Marquette	43.5	34	10.3
Milwaukee	46	34	15
Mobile	70	57	15.5
New London	56	41	12
New York	54	43	15
Norfolk	56	45	22
Portland, Maine	46	40	26
Punta Rassa	78	64	12
Sandusky	54	31	9.5
San Francisco	59	57.5	23
Savannah	65	49	11.5
Toledo	53	32	9
Wilmington	68	59	11.5
Wood's Holl	52	42	8

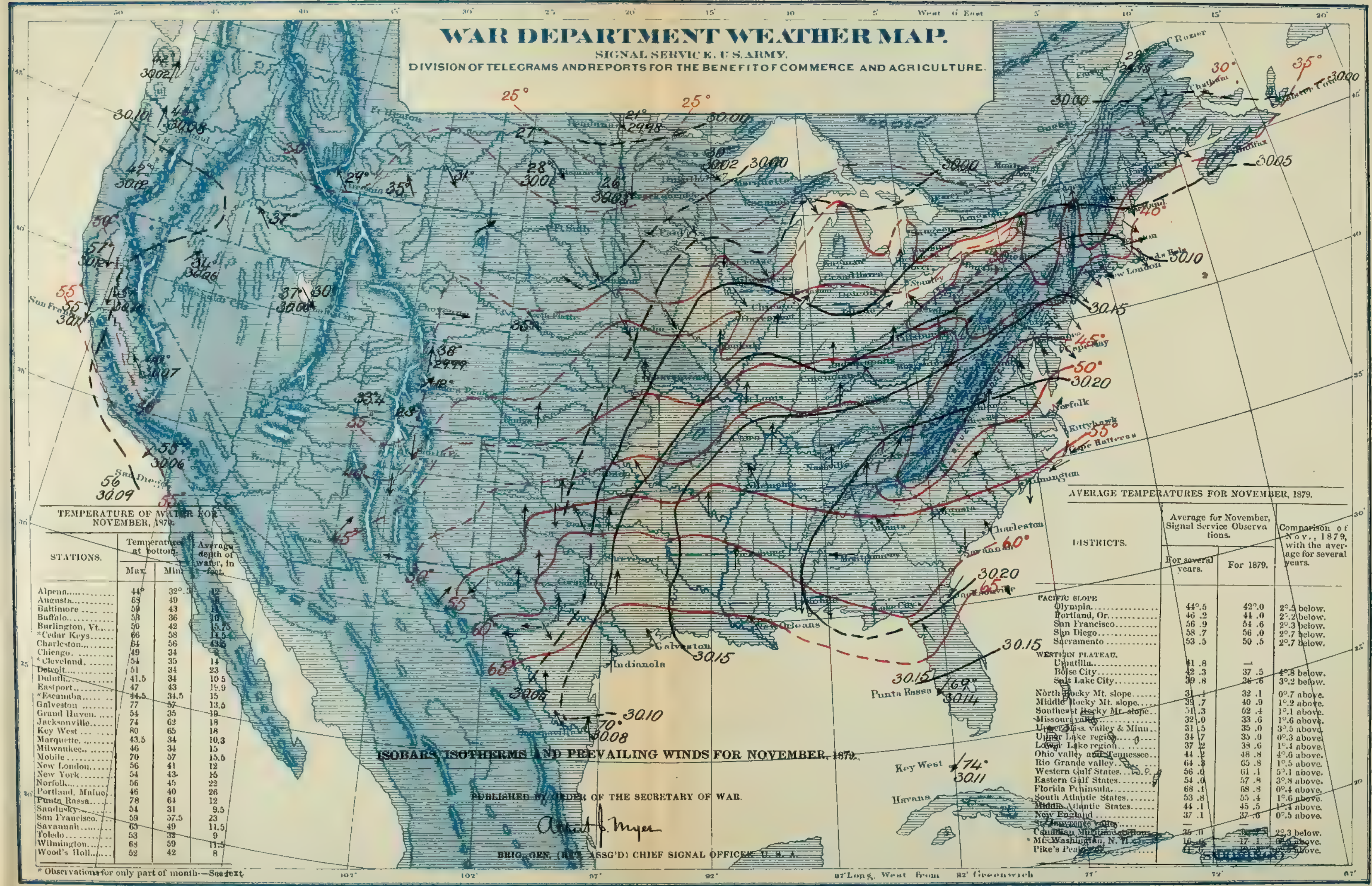
* Observations for only part of month—See

VERAGE TEMPERATURES FOR NOVEMBER, 1879.

ISTRICTS.	Average for November, Signal Service Observations.		Comparison of Nov., 1879, with the average for several years.
	For several years.	For 1879.	
LOPE			
pia	44°.5	42°.0	2°.5 below.
and, Or.	46 .2	44 .0	2°.2 below.
rancisco	56 .9	54 .6	2°.3 below.
iego	58 .7	56 .0	2°.7 below.
mento	53 .5	50 .5	2°.7 below.
PLATEAU.			
illa	41 .8	—	
City	42 .3	37 .5	4°.8 below.
Lake City	39 .8	36 .6	3°.2 below.
ky Mt. slope	31 .4	32 .1	0°.7 above.
ocky Mt. slope	39 .7	40 .9	1°.2 above.
Rocky Mt. slope	51 .3	52 .4	1°.1 above.
alley	32 .0	33 .6	1°.6 above.
ss. valley & Minn.	31 .5	35 .0	3°.5 above.
ke region	34 .7	35 .0	0°.3 above.
ke region	37 .2	38 .6	1°.4 above.
y and Tennessee	44 .2	48 .8	4°.6 above.
le valley	64 .3	65 .8	1°.5 above.
ulf States	56 .0	61 .1	5°.1 above.
lf States	54 .0	57 .8	3°.8 above.
ninsula	68 .4	68 .8	0°.4 above.
ntic States	53 .8	55 .4	1°.6 above.
antic States	44 .1	45 .5	1°.4 above.
and	37 .1	37 .6	0°.5 above.
nce valley	—	—	
Maritime stations	35 .0	[illegible]	2°.3 below.
ington, N. H.	16 .[illegible]	17 .1	[illegible] above.
[illegible]	[illegible]	[illegible]	[illegible] above.

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY.
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.



ISOBARS, ISOTHERMS AND PREVAILING WINDS FOR NOVEMBER, 1879.

TEMPERATURE OF WATER FOR NOVEMBER, 1879.

STATIONS.	Temperature at bottom.		Average depth of water, in feet.
	Max.	Min.	
Alpena	44°	32°.3	12
Augusta	63	49	[illegible]
Baltimore	59	43	[illegible]
Buffalo	58	36	10
Burlington, Vt.	50	42	15.75
*Cedar Keys	66	58	11.5
Charleston	64	56	[illegible]
Chicago	49	34	[illegible]
*Cleveland	54	35	14
Detroit	51	34	23
Duluth	41.5	34	10 5
Eastport	47	43	19.9
*Escanaba	44.5	34.5	15
Galveston	77	57	13.6
Grand Haven	54	35	19
Jacksonville	74	62	18
Key West	80	65	18
Marquette	43.5	34	10.3
Milwaukee	46	34	15
Mobile	70	57	15.6
New London	56	41	12
New York	54	43	15
Norfolk	56	45	22
Portland, Maine	46	40	26
Punta Rassa	78	64	12
Sandusky	54	31	9.5
San Francisco	59	57.5	23
Savannah	63	49	11.5
Toledo	53	32	9
Wilmington	68	59	11.5
Wood's Holl	52	42	8

* Observations for only part of month.—See text.

AVERAGE TEMPERATURES FOR NOVEMBER, 1879.

DISTRICTS.	Average for November, Signal Service Observations.		Comparison of Nov., 1879, with the average for several years.
	For several years.	For 1879.	
PACIFIC SLOPE			
Olympia	44°.5	42°.0	2°.5 below.
Portland, Or.	46 .2	44 .0	2°.2 below.
San Francisco	56 .9	54 .6	2°.3 below.
San Diego	58 .7	56 .0	2°.7 below.
Sacramento	53 .5	50 .5	2°.7 below.
WESTERN PLATEAU.			
Umatilla	41 .8	—	
Boise City	42 .3	37 .5	4°.8 below.
Salt Lake City	39 .8	36 .6	3°.2 below.
North Rocky Mt. slope	31 .4	32 .1	0°.7 above.
Middle Rocky Mt. slope	39 .7	40 .9	1°.2 above.
Southeast Rocky Mt. slope	51 .3	52 .4	1°.1 above.
Missouri valley	32 .0	33 .6	1°.6 above.
Upper Miss. valley & Minn.	31 .5	35 .0	3°.5 above.
Upper Lake region	34 .7	35 .0	0°.3 above.
Lower Lake region	37 .2	38 .6	1°.4 above.
Ohio valley and Tennessee	44 .2	48 .8	4°.6 above.
Rio Grande valley	64 .3	65 .8	1°.5 above.
Western Gulf States	56 .0	61 .1	5°.1 above.
Eastern Gulf States	54 .0	57 .8	3°.8 above.
Florida Peninsula	68 .4	68 .8	0°.4 above.
South Atlantic States	53 .8	55 .4	1°.6 above.
Middle Atlantic States	44 .1	45 .5	1°.4 above.
New England	37 .1	37 .6	0°.5 above.
St. Lawrence valley	—	—	
Canadian Maritime stations	35 .0	[illegible]	2°.3 below.
Mt. Washington, N. H.	16 .[illegible]	17 .1	[illegible] above.
Pike's Peak	[illegible]	[illegible]	[illegible] above.

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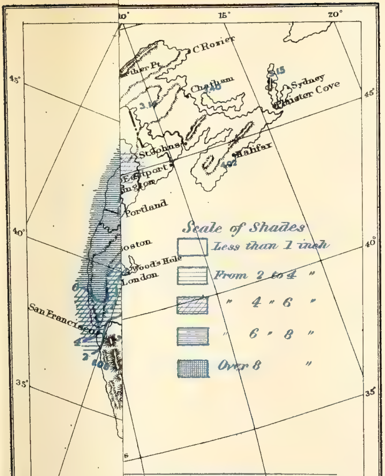
Albert J. Myer

BRIG. GEN. (BVT.) ASS'G'D CHIEF SIGNAL OFFICER, U. S. A.

No. III.



ABOVE LOW-WATER MARK, NOV., 1879

AVER

DISTRIC

	anger oint on gauge.		HIGHEST WATER.				LOWEST WATER.		
			Date.	Height.		Date.	Height.		
	ft.	in.	Nov.	ft.	in.	Nov.	ft.	in.
	29	9	17	−2	10	1	−3	6
	–	–	25, 26	0	1	1 to 13	−2	6
	20	0	1 to 6&17	2	7	25 to 27	2	2
	16	0	6, 7	5	7	.30	4	5
	21	0	14, 15	7	7	1, 2	4	2
	14	6	30	2	6	25	1	0
	18	0	18, 19	2	9	29, 30	1	1
	21	10	21, 22	5	7	7, 8	3	4
	15	0	20	3	11	8, 9	2	0
	14	6	20, 22	5	1	8 to 11	2	9
	30	0	18, 19	13	11	6	8	1
	40	0	22, 23	15	10	10 to 14	3	5
	34	0	25	10	6	12 to 15	1	11
	41	0	30	13	9	17	3	9
	3	6	9	−12	10	22	−14	7
St. Lawrence Val								
New England..	20	0	17	7	6	1	0	4
Middle Atlantic	50	0	23	12	5	10	2	9
South Atlantic S	33	0	24, 25, 30	6	6	6 to 11	2	6
Florida Peninsul								
Eastern Gulf Sta	12	0	23, 24	8	11	6, 7	1	2
Western Gulf St								
Tennessee.......								
Ohio Valley....	31		20, 30	4	11	10	1	6
Lower Lake Regi								
Upper Lake Regi	28	0	15, 16, 20	5	3	30	5	2
Upper Mississipp	29	0	17	7	6	1	0	4
Minnesota......								
Lower Missouri V								
Upper Missouri V			30	10	9	5 to 9	5	3
California Coast.								
Portland, Or....	–	–	16	[illegible]	[illegible]	2	1	5

ST. DOMINGO

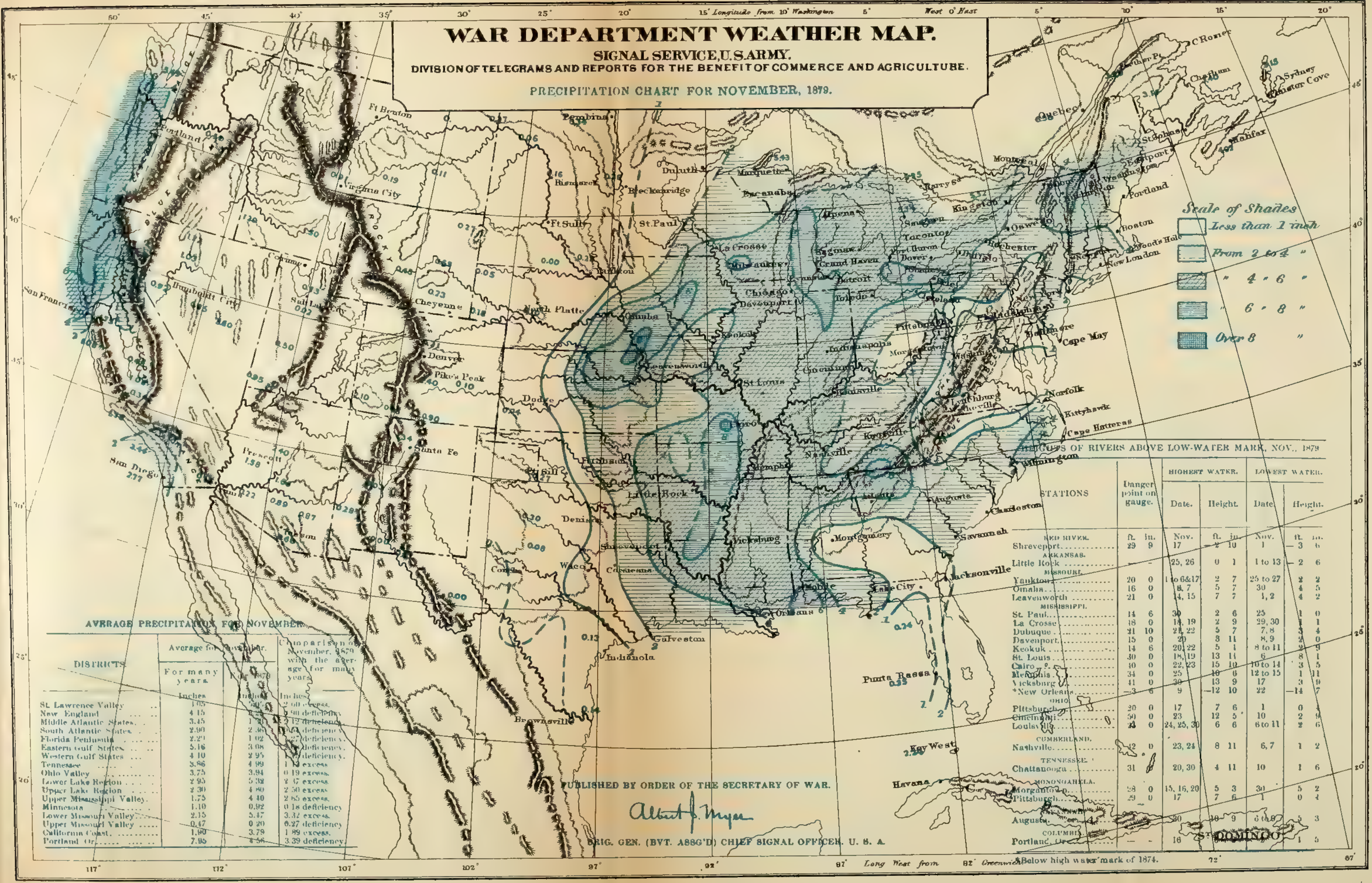
117° f 1874. 72° 67°

No. III.

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

PRECIPITATION CHART FOR NOVEMBER, 1879.



AVERAGE PRECIPITATION FOR NOVEMBER.

DISTRICTS	Average for November.		Comparison of November, 1879, with the average for many years.
	For many years.	For 1879.	
	Inches	Inches	Inches
St. Lawrence Valley	1.05	[illegible]	2.00 excess.
New England	4.15	[illegible]	2.90 deficiency.
Middle Atlantic States	3.45	[illegible]	2.12 deficiency.
South Atlantic States	2.90	2.36	[illegible] deficiency.
Florida Peninsula	2.29	1.02	[illegible].27 deficiency.
Eastern Gulf States	5.16	3.08	[illegible] deficiency.
Western Gulf States	4.10	2.95	[illegible] deficiency.
Tennessee	3.86	4.99	[illegible] excess.
Ohio Valley	3.75	3.94	0.19 excess.
Lower Lake Region	2.95	5.32	2.37 excess.
Upper Lake Region	2.30	4.80	2.50 excess.
Upper Mississippi Valley	1.75	4.40	2.65 excess.
Minnesota	1.10	0.92	0.18 deficiency.
Lower Missouri Valley	2.15	5.47	3.32 excess.
Upper Missouri Valley	0.47	0.20	0.27 deficiency.
California Coast	1.90	3.79	1.89 excess.
Portland, Or.	7.95	4.56	3.39 deficiency.

HEIGHTS OF RIVERS ABOVE LOW-WATER MARK, NOV., 1879.

STATIONS	Danger point on gauge.		HIGHEST WATER.			LOWEST WATER.		
			Date.	Height.		Date.	Height.	
	ft.	in.	Nov.	ft.	in.	Nov.	ft.	in.
RED RIVER.								
Shreveport	29	9	17	−2	10	1	−3	6
ARKANSAS.								
Little Rock	–	–	25, 26	0	1	1 to 13	−2	6
MISSOURI.								
Yankton	20	0	1 to 6 & 17	2	7	25 to 27	2	2
Omaha	16	0	6, 7	5	7	30	4	5
Leavenworth	21	0	14, 15	7	7	1, 2	4	2
MISSISSIPPI.								
St. Paul	14	6	30	2	6	25	1	0
La Crosse	18	0	18, 19	2	9	29, 30	1	1
Dubuque	21	10	21, 22	5	7	7, 8	3	4
Davenport	15	0	20	3	11	8, 9	2	0
Keokuk	14	6	20, 22	5	1	8 to 11	2	9
St. Louis	30	0	18, 19	13	11	6	8	1
Cairo	40	0	22, 23	15	10	10 to 14	3	5
Memphis	34	0	25	10	6	12 to 15	1	11
Vicksburg	41	0	30	13	9	17	3	9
*New Orleans	−3	6	9	−12	10	22	−14	7
OHIO.								
Pittsburgh	20	0	17	7	6	1	0	4
Cincinnati	50	0	23	12	5	10	2	9
Louisville	24	0	24, 25, 30	6	6	6 to 11	2	6
CUMBERLAND.								
Nashville	42	0	23, 24	8	11	6, 7	1	2
TENNESSEE.								
Chattanooga	31	[illegible]	20, 30	4	11	10	1	6
MONONGAHELA.								
Morgantown	28	0	15, 16, 20	5	3	30	5	2
Pittsburgh	29	0	17	7	6	1	0	4
SAVANNAH.								
Augusta	[illegible]	[illegible]	30	10	9	3 to 9	5	3
COLUMBIA.								
Portland, Or.	—	-	16	[illegible]	[illegible]	[illegible]	1	5

*Below high water mark of 1874.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER. U. S. A.

namely, that observed on the 12th alone, and on the 13th, together with four others, and perhaps, also, some of the group of nine spots observed on the 10th, did not disappear by solar rotation, but seemed to fade away long before they would have disappeared by rotation." Mr. William Dawson, Spiceland, Ind., noticed the following spots: 7th, one group of 4 large spots, faculæ very prominent, clouds prevented good observations; 8th, fine group of 14 spots near east edge, faculæ very beautiful; 9th, 25 spots in the group, 6 very prominent; 10th, 25 spots, one group, one spot quite large with penumbra; 11th, 20 spots, the large one having divided into 3; 12th, only 10 spots in the late group, and all small but one; another group of 8 small spots in SW. quadrant, 2 spots and faculæ at east edge; 13th, 30 spots in three groups, 10 spots in the waning group near center, 14 spots in SW. group, and 6 spots in new group at east edge; 14th, 20 spots in four groups, new group at SW. margin; 18th, 13 spots in one group in NW. quadrant, 3 large; 20th, 25 spots in two condensed groups near together, about 3′ from west edge. No spots from 22d to 31st, inclusive.

Prof. Gustavus Hinrichs, of Iowa City, Iowa, says: "A group of sun spots, comprising two very large spots, traversed the sun's disk between the 14th and the 21st.

Observations were also made throughout the month at Fort Whipple, Va., but no spots were seen.

NOTES AND EXTRACTS.

Alexander Buchan, in Nature, October 22, 1879, briefly discusses the Greenwich meteorological observations from 1854 to 1873. He says: "There can be no doubt that in these twenty years' average we have the closest approximation to the mean monthly diurnal inequality of the barometer, in other words, to one of the prime factors of the meteorology of Greenwich. Of special interest are the results for the warmer months of the year, which class Greenwich among the places in middle and higher latitudes, whose climates are more or less continental in their character—these more special features being the occurrence of the forenoon maximum as early as 9 a. m., and a marked diminution in the amount and amplitude of the morning minimum. The almost strictly local character of the diurnal phases of atmospheric pressure, as disclosed by the observations at Greenwich, is seen from the occurrence of the a. m. maximum an hour earlier at Kew, where also the a. m. minimum becomes still less pronounced than that of Greenwich. On the other hand, at Falmouth, the a. m. minimum is much the greater of the two daily minima, and the a. m. maximum is delayed from two to three hours later than at Greenwich. Hence the true value of the Greenwich results can only be appreciated after a comparison has been made between them and the results obtained from other meteorological observatories.

"The observations of temperature are discussed with particular fullness, and the length of time is sufficient to give curves showing a diurnal inequality of temperature such as will substantially represent the curves for large portions of the south of England not bordering the sea, where the thermometers are similarly placed to those at Greenwich.

"The curves of temperature for the different winds have also been worked out with much elaboration, and give most interesting results.

"On the average of all the months the N. wind is the coldest, the SW. the warmest; the order as regards temperature, beginning with the coldest, is N., NE., NW., E., SE., W., S., SW.; an order, however, which differs in different months.

"In a large number of years the third barometric maximum, first noted by Rikatscheff as occurring in certain regions of the globe a little after midnight, appears in the Greenwich diurnal curves for December, January, and February, less frequently in March, and seldom or not at all in the other months. The somewhat rough method which has been adopted in reducing the barometric observations to 32° unfortunately renders the evidence furnished by the Greenwich results regarding the more refined inquiries of meteorology such as this, and the mean diurnal inequality of the barometer in the lunar months, not so satisfactory and conclusive as might have been wished."

Published by order of the Secretary of War.

ALBERT J. MYER,
Brigadier General (Brevet Assigned), Chief Signal Officer, U. S. A.

PAPER 37.

MONTHLY WEATHER REVIEW, NOVEMBER, 1879.

INTRODUCTION.

In preparing this review the following data, received up to November 14, have been used, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 158 Signal Service stations and 12 Canadian stations, as telegraphed to this office; monthly journals and means 147 and 144, respectively, from the former; reports from 29 sunset stations; 230 monthly registers from voluntary observers; 40 monthly registers from the United States Army post surgeons; marine records; international simultaneous observations; monthly reports from voluntary observers in, and the Local Weather service of Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

The general distribution of atmospheric pressure, as reduced to sea-level, is shown by the isobaric lines on chart No. II. The area of highest pressure was over the South Atlantic states; the pressure was also apparently high off the Central Pacific coast region.

Departures from normal values for the month.—By comparison with the average of the past seven years, it is found that the barometric pressure during the present November has been above the average in California, New Mexico, the Southwest, Illinois, Michigan and thence eastward to the Atlantic states, where the excess has been greatest; it amounts to 0.09 inch at Eastport, Boston, and New York; 0.10 at Cape May, Washington, Charleston, and Savanah; (and also at Knoxville, Tenn.), 0.11 at Lynchburg and Jacksonville; and 0.12 at Norfolk, Wilmington, and Augusta. A small deficiency occurs over the Northwest, which apparently extends to the coast of Oregon; it amounts to 0.07 inch at Omaha; 0.06 at Pembina; 0.03 at Denver and Virginia City; 0.02 at Salt Lake City; and 0.05 at Portland, Oreg.

General barometric range.—The *general range* for the whole country was about 2.00 inches, as may be seen from the following table, which gives the greatest departures of the actual barometric readings, as compared with the normal values for the month and the hour of observation. These departures refer only to the tri-daily telegraphic reports. An examination of the table shows that the greatest departures were +0.70 at 11 p. m. of the 19th, at Bismarck, within the high area No. VIII and — 1.31 at 3 p. m. of the 20th, at Halifax, in low area No. XII.

HIGH AREAS.

No.	Location.	Date.	Departures from normal.
I	Illinois	Nov. 1, 7.00 a. m.	+ 0.44 inch.
II	Minnesota	Nov. 3, 7.00 a. m.	+ 0.46 inch.
	Washington, D. C	Nov. 5, 7.00 a. m.	+ 0.48 inch.
III	Portland, Oreg	Nov. 6, 11.00 p. m.	+ 0 30 inch.
IV	Lower Lake region	Nov. 10, 3.00 p. m.	+ 0.34 inch.
V	Halifax, N. S	Nov. 14, 7.00 a. m.	+ 0.47 inch.
VI	Lynchburg, Va	Nov. 17, 7.00 a. m.	+ 0.27 inch.
VII	Salt Lake City	Nov. 17. 11.00 p. m.	+ 0.57 inch.
VIII	Bismarck	Nov. 19, 11.00 p. m.	+ 0.70 inch.
IX	Pittsburgh	Nov. 24, 7.00 a. m.	+ 0.36 inch.
	North Carolina coast	Nov. 24, 11.00 p. m.	+ 0.36 inch.
X	Halifax	Nov. 27, 7.00 a. m.	+ 0.60 inch.
XI	Ohio	Nov. 30, 7.00 a. m.	+ 0.50 inch.
	North Carolina coast	Nov. 30, 11.00 p. m.	+ 0.50 inch.

LOW AREAS.

No.	Location.	Date.	Departures from normal.
I	Kingston	Nov. 3, 7.00 a. m.	— 0.34 inch.
II	Olympia, Oreg	Nov. 4, 11.00 p. m.	— 0.34 inch.
	Pembina	Nov. 7, 7.00 a. m.	— 0.66 inch.
III	Dubuque	Nov. 8, 3.00 p. m.	— 0.54 inch.
	Milwaukee and Escanaba	Nov. 8, 11.00 p. m.	— 0.54 inch.
IV	San Francisco	Nov. 9, 3.00 p. m.	— 0 78 inch.
V	Omaha	Nov. 11, 7.00 a. m.	— 0.55 inch.
VI	Olympia	Nov. 12, 7.00 a. m.	— 0.43 inch.
VII	Parry Sound	Nov. 14, 3.00 p. m.	— 0.64 inch.
VIII	Chatham	Nov. 15, 11.00 p. m.	— 0.70 inch.
IX	Olympia	Nov. 13, 3.00 p. m.	— 0.65 inch.
X	Northern Texas	Nov. 16, 11.00 p. m.	— 0.27 inch
	Sydney	Nov. 19, 7.00 a. m.	— 0.22 inch.
XI	Parry Sound	Nov. 19, 3.00 p. m.	— 0.53 inch.
XII	Halifax	Nov. 20, 3.00 p. m.	— 1.31 inch.
XIII	Marquette	Nov. 22, 3.00 p. m.	— 0.56 inch.
XIV	Pembina	Nov. 24, 7.00 a. m.	— 0.53 inch.
XV	Davenport	Nov. 27, 7.00 a. m.	— 0.34 inch.
XVI	Salt Lake City	Nov. 26, 7.00 a. m.	— 0.42 inch.
XVII	Olympia	Nov. 29, 3.00 p. m.	— 0.36 inch.
XVIII	Pembina	Nov. 30, 3.00 p. m.	— 0.32 inch.

Local barometric ranges for the month.—The monthly barometric ranges of actual pressure have been greatest in the extreme Eastern states, viz: Portland, 1.40 inch and Eastport, 161. The ranges have also been large for the Eastern Rocky Mountain slope—apparently increasing as we go northward—and at Pembina the range was 1.37. Monthly ranges for San Francisco 1.10 inches, for Sacramento 1.02, and for Visalia 1.02 inches are also very large for that region.

Areas of high barometer.—Eleven areas of high barometer have been recorded, none of which have been distinguished by particularly high pressures or very low temperatures. Areas Nos. VII, VIII and XI were accompanied by severe "northers" on the Texas coast, for which off-shore signals were ordered on the 17th and 28th at Indianola and Galveston.

No. I.—This is a continuation of No. VII of the preceding month, which was central on the 1st in Illinois, extending over the Ohio valley and Missouri, whence it moved rapidly eastward and disappeared on the 2d off the Middle Atlantic coast.

No. II was central on the 1st northwest of Manitoba, moved slowly southeastward over the Upper Mississippi and Ohio valleys, was central over the latter on the 4th, and was over the Middle Atlantic states on the 5th. It was then apparently reinforced by an extensive area of cold air flowing south from the Gulf of Saint Lawrence, and high pressure continued off the Atlantic coast until the 12th.

No. III.—This is a small area of high pressure that was off the coast of Oregon on the 5th, and continued during the 6th and part of the 7th.

No. IV.—Pressure rose on the 9th over the Missouri valley and an area of high barometer moved eastward over the Lake region and Middle states, where it was central on the 11th, after which it rapidly disappeared.

No. V.—On the 13th the barometer began to rise rapidly in the Saint Lawrence valley, while the lowest pressure was off the New England coast. The highest pressure moved southward over Nova Scotia and disappeared on the 14th.

No. VI.—The low barometer which was over the Upper Lake region on the 15th was immediately followed by a slight rise in the northwest, and on the morning of the 16th the pressure was highest over Kentucky and Tennessee, whence it moved rather rapidly to Virginia, and on the 17th disappeared off the Middle Atlantic coast.

No. VII.—On the 15th the barometer rose over California, and an area of high pressure seems to have prevailed northwest of California, while the barometer was low over British America and Oregon. On the 16th the highest pressure moved southeastward, and on the morning of the 17th the barometer was very high over the northern Rocky Mountain Plateau region. Salt Lake City reported a temperature of 15°, the lowest for the month. By the morning of the 18th high pressure had extended over the whole of the Upper Lake region, Texas and the eastern Rocky Mountain slope, being apparently highest in Wyoming Territory. The lowest temperature of the month occurred on the 18th at Stockton, 25° and Escanaba, 17°. The barometer continued high over the Northwest and Southwest and Rocky Mountain regions, and on the morning of the 19th the highest pressure may be located in Central Texas. The lowest temperatures of the month were reported, on the 19th, as follows: 29° at Castroville; 32° at San Antonio; 25° at Fort Sill; 27° at Brackettville; 28° at Eagle Pass; 32° at Rio Grande; 23° at Boerne; 21° at Fort Davis; and 19° at Uvalde.

No. VIII.—The great extension of the preceding area, No. VII, was probably connected with the development of the low area, which was central over Lake Superior on the morning of the 19th, and which was immediately followed by a still more decided high pressure, moving rapidly southward from Manitoba into the Missouri valley, where it was central on the morning of the 20th; lowest temperatures of the month are reported on the 20th, as follows: -9° at Pembina; -4° at Breckenridge; 0° at Duluth; 1° at Bismarck; 1° at Yankton; 8° at Omaha; 8° at La Crosse; 10° at Saint Paul; 14° at Dubuque; 14° at Grand Haven; 15° at Davenport; 16° at Leavenworth; 17° at Keokuk; 21° at Saint Louis. On the 21st, in the morning, the pressure was highest over the Ohio valley and Gulf states, and lowest temperatures of the month occurred in the morning, very generally in the East Gulf states, from 29° to 38°; in the South Atlantic states, from 20° to 33°; in Tennessee and the Ohio valley, from 21° to 27°; in the Lower Lake region, from 9° to 19°. At this time high northwest winds prevailed over the Middle states and New England, attending the very low pressure over the Gulf of Saint Lawrence; consequently, in these regions, the lowest temperatures of the month also occurred on the 21st, although the pressure was low and the weather snowing or clearing. The minima were from New England, from 7° to 17°, except Mount Washington, -20°; for the Middle Atlantic states, from 15° to 22°. This area of high pressure, No. VIII, after reaching the Middle Atlantic coast on the 22d, seems to have pushed northeastward and disappeared on the 23d. The lowest temperatures of the 22d were about the same as those of the 21st.

No. IX.—The high barometer, No. VII, continued with slowly diminishing pressure over the Rocky Mountain region while a second low pressure moved southeastward to the Lake region and was followed by high barometer, No. IX, whose origin is therefore similar to that of No. VIII. It was central in Dakota on the 22d, in the morning, moved rapidly southeastward over the Lower Missouri and Ohio valleys, was central in Virginia on the 24th, in the morning, and over the South Atlantic States on the 25th, in the morning, after which it disappeared. The lowest temperatures accompanying this area were not so low as those accompanying No. VIII.

No. X.—The low pressure over the northern portion of the Lake region on the 24th was followed by an area of moderately high pressure, central in the Missouri valley on the morning of the 25th. The barometer generally rose during that day, with southerly winds over the Ohio valley and East Gulf states. On the morning of the 26th, highest pressure was central over Pennsylvania, and on the morning of the 27th, over Maine and the Lower Saint Lawrence valley, and on the morning of the 28th, was east of Nova Scotia.

No. XI.—A severe storm which passed northeastward over the Lake region on the 28th, was followed by a rising barometer from Texas northward to Manitoba, but as a storm was at that time also central near Vancouver's Island, the barometric rise in Manitoba was checked, and the area of highest pressure remained in Texas, whence it extended northeastward, and was by the morning of the 29th central from Missouri to Minnesota; on the morning of the 30th it was central in the Ohio valley, and disappeared on the 1st of December off the Middle Atlantic coast.

Areas of low barometer.—Eighteen areas of low pressure have passed over or near the region covered by the charts, of which one (No. XII) came from the West India Islands, six (Nos. III, IV, V, X, XV, and XVI) originated in the Rocky Mountains, or to the westward thereof, passed southeastward to Southern Colorado, and thence east and northeastward to the Gulf of Saint Lawrence. Four, namely, Nos. XI, XIII, XIV, and XVIII, passed southeastward over Manitoba, thence to the Lower Lake region, and thence northeastward. Three, namely, Nos. II, VI, and IX, passed from British Columbia eastward to the Gulf of Saint Lawrence.

No. I.—This area began in Iowa, 3 p. m. of the 1st, and was accompanied by extensive snow and high winds over the Lake region and New England, disappearing, on the 4th, off the coast of Nova Scotia. This storm produced the first snow of the season over the southern portion of the State of New York and along the New England coast; in the interior the snowfall was quite heavy, a fall of 12 inches being reported at several places in Ontario, New York, Vermont, and New Hampshire; at Brattleborough, Vt., 20 inches were reported. Cautionary signals were ordered on the 2d, at 4 p. m., from Milwaukee to Oswego, and were generally justified. Off-shore signals were ordered from New York to Lewes, 2d, 11 p. m., and from Cape Henry to Macon, on the 3d, at 7 a. m., and were generally justified. Cautionary signals were ordered, 3d, 7 a. m., from New Haven to Eastport, and were partly justified. Several disasters to shipping occurred on the Lakes; schooner *Leesburg* went ashore on Cape Elizabeth, Maine, and broke up; her crew of five men are supposed to have been lost.

No. II.—The pressure fell on the 4th in Washington Territory, and an extensive area of low pressure moved from Vancouver's Island nearly due eastward, and disappeared north of the Lake region on the 7th. Rain occasionally fell at our northern stations, and the disappearance of the low area was attended by the formation of a trough apparently extending from James's Bay to Texas, into which low area No. III was rapidly merged. No high winds accompanied area No. II, unless previous to its arrival on the Pacific coast. Cautionary signals were ordered on the 4th, at 7 a. m., from Duluth to Chicago, and were not justified by high winds accompanying this area, but were partially justified by the high winds accompanying low area No. III.

No. III was, on the morning of the 7th, central in Utah, and on the 8th moved from Kansas northeastward to the Upper Lakes, where rain and occasional high winds prevailed. On the 9th, as it passed to the northward, high southwest winds continued on the Lower Lakes. It disappeared on the 10th near Newfoundland. On the 8th, in the afternoon, as it passed over the Upper Mississippi valley, a tornado occurred near Lee's Summit, Mo., and a terrific hail storm in Crawford County, Arkansas, which places were at that time apparently at the southwest extremity of a very elongated area of low pressure. Cautionary signals were ordered up on Lake Michigan on the 8th, at 4 p. m., and were partially justified; also from Mackinaw to Buffalo on the 8th, at 11 p. m., and were justified. Cautionary signals were ordered at Rochester and Oswego on the 9th, at 7 a. m., and were not justified; also from Sandy Hook to Lewes on the 9th, at 7 a. m., which were partly justified.

No. IV.—This area of low pressure appears to have moved southward along the California coast, or was possibly a trough of low pressure trending northeastward and approaching the coast from nearly due west. It passed eastward over California on the 9th, with high winds off the coast and heavy rains over the southern portion of the state; at San Francisco the barometer fell to 29.26, with a high SE. wind, which is the lowest reading recorded at this station during the past nine years. Snow and rain were general throughout Arizona; snow covered all the mountain tops and in the ridges south of Prescott, drifted to a depth of 1⅓ and 2½ feet. Thence over Colorado on the 10th, northeast to Lake Superior on the 11th, and eastward to Maine on the 12th, where it disappeared. Brisk and high winds prevailed over the Lakes on the 11th in its advance.

No. V began in Utah on the 11th, and followed area No. IV by about twenty-four hours, keeping somewhat to the southward. A few stations reported high northerly winds on Lake Michigan on the 11th, in its advance, and severe winds prevailed on the 12th over the Lake region. At 5 p. m. of the 12th (local time) a tornado passed over Detroit, Mich., which city was at that time evidently at the center of lowest pressure, as shown by the tri-daily telegraphic isobars. At night severe wind and rain storms, accompanied by thunder and lightning, prevailed over the southern part of New York state. Cautionary signals were ordered for Lake Michigan on the 11th, at 11 p. m., and were partially justified on the 12th; and were ordered from Port Huron to Sandusky on the 12th, at 7 a. m., and were generally justified. They were ordered from Cleveland to Oswego on the 12th, at 4 p. m., and were not justified. Off-shore signals were ordered on the 12th, at 11 p. m., from Sandy Hook to Cape Hatteras, and were only partially justified.

No. VI.—Pressure fell in British Columbia and Washington Territory on the 10th, and was apparently lowest at Vancouver's Island at 11 p. m. This area moved westward along our northern border, and disappeared north of the Lake region on the 13th. Its track was too far north to be charted on our Map No. I. No high winds are reported in connection with it, but abundant rains in the North Pacific region.

No. VII appears to have originated in Iowa, between extensive areas of northwest and easterly winds. It passed rapidly northeastward, and between the hours of 10 a. m. and 2 p. m., high southwesterly gales, with heavy rains, thunder and lightning prevailed from Southern Illinois to Ohio, and considerable damage was done to buildings, &c., in over 25 cities in these states, Indiana and Kentucky. On the afternoon of the 14th, high Southerly winds with rain prevailed over the Lower Lake region. It disappeared on the 15th, north of the Saint Lawrence river. Cautionary signals were ordered on the 14th, at 7 a. m., from Mackinaw to Oswego, about half of which were justified; also at 7 a. m., from New York to Lewes, which were justified; also from New Haven to Eastport, on the 14th, at 4 p. m., which were partly justified.

No. VIII began on the 15th, at 7 a. m., over the Lower Lake region, as a branch of the preceding, and kept a little south of the track of that one, passing over the Gulf of Saint Lawrence, and reaching Newfoundland on the morning of the 16th. High southwest winds were occasionally reported on the 15th from the stations on the Middle and East Atlantic coasts, and brisk northwest winds prevailed on the 16th on the Lower Lakes. Cautionary signals were ordered on the 15th, at noon, from Baltimore to Cape Hatteras, and were generally justified by high southwest winds.

No. IX.—The pressure fell on the 13th in the North Pacific region, with southerly winds and rain; the lowest pressure evidently passed over British Columbia, and continued within the northern limit of our stations until it disappeared on the 15th, in the afternoon, north of the Upper Lake region, where the barometer had fallen quite low. A heavy wind and snow storm was reported as occurring on the 14th between Denver and Leadville, Colo., during which several men were frozen to death; and high southwest winds were reported from Lake Michigan on the afternoon of the 15th.

No. X was located on the 15th in Wyoming, and snow with occasional high winds prevailed during the night in Wyoming, Colorado, and Utah. The central depression extended rapidly southeastward into Northern Texas, where it was central on the 16th, at 11 p. m., whence it moved eastward, followed by increasing rain or snow, which by midnight of the 17th prevailed on the Lower Lakes and over the Ohio and Mississippi valleys, while the severe "norther" had swept down to Texas and the Gulf coast. On the 18th the lowest pressure passed northeastward from Virginia to Nova Scotia, preceded by northeast winds and snow or rain, while the West India hurricane No. XII was advancing northward toward the Bahamas, and northwest gales were prevailing in the eastern portion of the Gulf of Mexico. Cautionary signals were ordered up on the 17th, while the storm center was passing from Missouri to Virginia, as follows: at 7 a. m., from Milwaukee to Erie, which were justified on Lake Erie; at 4 p. m. from Buffalo to Oswego, which were not justified; also at 4 p. m. from Wood's Holl to Wilmington, which were subsequently justified by off-shore winds; at 11 p. m. from Eastport to Boston, which were justified. Off-shore signals were ordered at 7 a. m. of the 17th, for Indianola and Galveston, which were justified by northerly gales. Off-shore signals were ordered from New York to Baltimore, the 18th, at 4 p. m., which were generally justified. During the night of the 17th a severe NE. snow storm prevailed over Lake Ontario, during which a steam-tug and several scows were sunk and nine persons drowned off Sackett's Harbor, New York; on the 18th schooner *Sasco* left Erie during the display of signals, was driven ashore near Fairport, and became a total wreck.

No. XI.—The pressure fell very rapidly on the morning of the 18th in Manitoba, preceding low area No. XI, which seems to have moved southeastward toward the Upper Lake region, over which it passed on the 19th, accompanied by snow and severe gales from the southwest and northwest. On Lake Michigan a heavy sea from the southwest prevailed, driving six vessels ashore along the east coast. It was central in the Upper Saint Lawrence valley on the morning of the 20th, at which time cold northwest gales prevailed over the Lake region, West Gulf, and Middle Atlantic coasts, and high northwest winds at intermediate points. At this time the West India hurricane, No. XII, was central east of Long Island, and by 3 p. m. of the 20th, both of these severe storms had merged into one, which was then central near Halifax, where the pressure was 28.59. Cautionary signals were ordered on the 19th, at 7 a. m., from Duluth to Oswego, which were all justified, but were late for Lakes Michigan and Huron. They were ordered on the 19th, at 4 p. m., from Eastport to Cape Henry, which were justified by winds attending the hurricane No. XII. The following remarks from Lake stations indicate the severity of this storm: Milwaukee, 19–20, storm considered one of the severest on the Lakes for years; schooners *North Star* and *Elida* ran ashore near Little Sturgeon Bay; on the east shore of the lake the disasters were serious and many. Port Huron, 19th and 20th, storm very severe on the lake; a number of shipwrecks, and several lives lost, reported from Sand Beach Harbor; several vessels sailed during display, but meeting with a rough sea were obliged to put back. Toledo, 19th and 20th, storm very severe on lake; much damage to fishing nets, &c.; numerous disasters reported on lakes. Erie, 20th, schooner *Wancousta* driven ashore in attempting to enter harbor. Cleveland, 20th, storm very severe; schooner *Sumatra* was driven ashore near Union depot. Oswego, 19th to 20th, schooner *Dominion* sailed on the 19th, encountered the storm, and in attempting to put back lost her bearings and went ashore; vessel a total loss.

No. XII.—This hurricane, from the West Indies, first appears on the Signal Service tri-daily maps, in the falling barometer and increasing winds at Havana, Key West, and Punta Rassa, at midnight of the 18th, at which time the center was evidently some distance to the eastward; then it moved very rapidly north and northeastward, passing Cape Hatteras at 11 p. m. of the 19th and Halifax at 3 p. m. of the 20th. It was preceded by heavy rain on the South Atlantic coast, and snow in the Canadian Provinces and followed by snow in New England. The lowest pressures recorded were at Cape Hatteras, 29.47, at 11 p. m. of the 19th, and Halifax, 28.59, at 3 p. m. of the 20th. Cautionary signals were ordered in advance of this hurricane, as follows: On the 20th, at 7 a. m., from Cape Lookout to Smithville, which were, however, already late. Off-shore signals were ordered on the 20th, at 7 a. m., from New York to Baltimore, which were justified. Among the reports from vessels are the following: The schooner O. S. Bailey, from Dominica November 8th, on the 17th, encountered a furious gale; 20th, tremendous seas boarded vessel; crew were taken off and landed at Baltimore on November 27th; exact location not given. Steamer Hermod, 39° N. 66° W., hurricane 5 hours from SE. to NW. Steamer Llanarthan, 50° 50′ N. and 32° 10′ W., from the 18th to the 21st, SE. to NE. gales and high sea. Steamship Leipsic, 19th, 40° N. and 69° W., barometer 29.05; wind NNE. to NW. force 10, heavy NW. sea. Brig Una, 19th, 33° N. 73° W., heavy NW. gale, barometer 29.25. Schooner Victor Ping, 19th, in the Gulf Stream, NW. gale. Schooner Kit Carson, 19th, in Gulf Stream, NNE. gale; decks swept by high sea. Ship Stewart Freeman, 200 miles east of Henlopen, 19th, NW. gale. Bark Lincoln, 39° N. 68° W., 19th, ESE. to WSW. heavy gale. Steamer Albert, between Magdalen Islands and Pleasant Bay, November 20th, 3.30 p. m., wind suddenly rose to violent gale; 8.30 p. m., veered to NE., hurricane; barometer 27.60 (?). Bark Susan A. Blaisdall, 20th, 31° N. 72° W., severe WNW. gale for forty-eight hours. Bark Grasmere, 29th [19th (?) or 20th (?)], 39° N. 66° W., terrific east hurricane for two hours; then south hurricane four hours; then calm half an hour, then hurricane more severe than at first. Schooner Addie Fuller on the 19th, in 36° 03′ N. 74° 33′ W., and 20th in 34° 20′ N. 74° 39′ W., reports during the night between the 19th and 20th had a severe hurricane, lowest barometer 29.30 about midnight as read off; highest force of wind 80 to 90; wind commenced from NNE. and backed gradually to NW. Baltimore, November 20th, bay steamers delayed and reported heavy NW. gales and cold weather; harbor very rough and tide unusually low; steamer Mystic driven ashore and bilged near Queenstown. Several smaller vessels capsized and sunk in bay and some lives lost.

No. XIII apparently moved southeastward into Manitoba where the barometer fell very rapidly on the evening of the 21st. The area of lowest pressure moved east-southeastward from over Lake Superior into the Upper Saint Lawrence valley, where it was central 3 p. m. of the 23d, having been accompanied over the Lake region by snows and high southerly, veering to northwest winds which had generally subsided by 11 p. m. of the 23d. The storm-center reached Newfoundland by 3 p. m. of the 24th. Cautionary signals were ordered on the 21st, at 11 p. m., from Duluth to Milwaukee which were partly justified; also on the 22d, at 7 a. m., from Chicago to Oswego which were generally justified, and on the 22d, at 11 p. m., from Eastport to Cape Henry which were justified, but rather late for the Middle Atlantic coast. Off-shore signals were ordered on the 23d, at 7 a. m., from Cape Lookout to Cape Henry which were justified, and also, at 11 p. m., from Lewes to Portland, Me., which were mostly justified.

No. XIV.—This area pursued a path nearly parallel to that of the preceding, but lying slightly to the northward. It was central in Manitoba 7 a. m. of the 24th, and in the Lower Saint Lawrence valley at 3 p. m. of the 25th, having been accompanied over the Lake region by high SW. to NW. winds and occasional light snows. It disappeared on the 26th, in the morning, over the Gulf of Saint Lawrence. Cautionary signals were ordered on the 24th, at 7 a. m., from Duluth to Port Huron which were partly justified; at 4 p. m. from Detroit to Oswego which were generally justified, and at 11 p. m. from Sandy Hook to Cape May, only partly justified. November 25th, Buffalo, nearly all vessels that left port were forced to put back and reported a terrific storm on the lake.

No. XV.—An extensive area of low pressure prevailed over the Rocky Mountain region on the 25th, in the morning, and the low center No. XVI was at that time well marked in the Northern Plateau region, and on the next day the low center No. XV developed on the Eastern Rocky Mountain slope. No. XV passed slowly northeastward over Iowa, where it was central at 3 p. m. and 11 p. m. of the 26th, while the area of southerly winds, rain or snow, extended over the entire Lake region and still farther to the northeastward. High winds prevailed on the Lakes on the afternoon of the 27th, and by 11 p. m. a trough of low pressure extended from the center of No. XV, which was then near Grand Lake, Canada, to the center of No. XVI, which was then in the Missouri valley. Cautionary signals were ordered on the 26th at noon from Duluth to Chicago, and at 3 p. m. from Grand Haven to Buffalo, and at 11 p. m. from Rochester to Oswego, all of which were gradually justified. On the 27th, at 11 p. m., while the storm was central in the valley of the Ottawa river, cautionary signals were ordered at Eastport.

No. XVI.—This area appears to have moved southward into Idaho on the morning of the 25th, areas of cloud and rain having preceded it according to the reports from stations in the British Possessions. It moved slowly southeastward into the northern portion of New Mexico, where it was central on the morning of the 27th, and thence eastward through Indian Territory, where it turned northeast, and at 3 p. m. of the 27th a trough of low pressure extended from Indian Territory northeastward to Lake Huron, where No. XV was then central. The subsequent path of No. XVI lay a little to the south of the path of No. XV, and on the morning of the 28th, when No. XVI was central in Michigan, No. XV had apparently disappeared, and a severe storm of wind, with rain and snow, prevailed over the Lake region throughout the day. High southerly winds were also reported from the Middle and East Atlantic coasts. The storm passed over the mouth of the Saint Lawrence on the 29th and disappeared over the Gulf on the 30th. Cautionary signals were ordered on the 28th at noon from New York to Lewes, and at 4 p. m. from Lewes to Smithville, and from New York to Portland, which were generally justified as cautionaries, and were subsequently changed to off-shore and again justified. In the rear of this storm northerly winds prevailed over the Southwest, and cautionary off-shore signals were ordered on the 28th, at 7 a. m., at Indianola and Galveston, and were justified. November 28th, Cleveland, "The most severe storm of the season; fences and trees blown down; lake very rough."

XVII.—This was an indefinite area of low pressure which appeared off the coast of British Columbia on the 29th and 30th, where it was accompanied by southerly winds and rain. It appears to have passed eastward into British America. Its track is too indefinite to be chartered on Map No. I.

No. XVIII.—This depression appears to have been central north of Dakota on the morning of the 30th, and was probably a branch of No. XVII. By midnight it was north of Lake Superior, while high southerly winds and occasional light snows were reported at several stations in the Lower Lake region. Its path is too indefinite to be traced on Map No. I.

INTERNATIONAL METEOROLOGY.

Three international charts, Nos. IV, V, and VI, accompany the present Review. No. IV indicates the probable course of low-pressure areas over the North Atlantic Ocean and neighboring waters and continents during the month of October, 1879, and is based upon data received at this office up to November 30th, 1879. Nos. V and VI are charts for the month of April, 1878, and are based upon international simultaneous observations, as described in the Review for July, 1879, supplemented by such other observations as have been considered specially applicable and trustworthy.

Since the publication of the October Review valuable reports of observations relating to low area No. V made at Cienfuegos, Baracoa, and Sagua le Grand, Cuba, have been received through Mr. Vines, of Havana, but which do not change the track of center as already given on chart No. I for that month.

On chart No. IV, the tracks of fifteen areas of low pressure are traced, which, during a portion of their existence, were located over the North Atlantic and North Pacific Oceans or neighboring waters. Portions of areas Nos. I, V, VI, XIII, and XIV appeared on chart No. I of October Review. No. II was over the eastern portion of the Gulf of Mexico during October 5th and 6th. There are decided indications of its existence during the 3d and 4th, in the positions, as shown; on the 7th it merged with an extensive depression over the Northwest. No. IV originated about mid-ocean, and on the 11th, 12th, and 13th, moved northward off the banks of Newfoundland as a very severe storm. It is probable that the depression which appeared to the northwest of the British Isles on the 16th was a continuation of this area. Nos. V and VI appeared on chart I of the October Review and are here reproduced as it is probable that the area formed by their union moved over the northern portion of the Atlantic from the 20th to the 25th. Nos. I, III, and from VII to XV can only, as yet, be traced over the area shown.

TEMPERATURE OF THE AIR.

The general distribution of temperature for November, 1879, is shown by the isothermal lines upon chart No. II, accompanying which is a table of comparative temperatures. Like the preceding month the average temperature of the present month has been above the normal in the districts east of the Rocky Mountains and below the normal in those to the westward. The departure from the normal, however, over the eastern portions of the country has not been so marked as it was for October. The excess is greatest from the Gulf coast to the Ohio and Upper Mississippi valleys, over which region it amounts to 4° or 5°; in the Atlantic states, Lake region, and along the eastern slope of the Rocky Mountains it varies from a half to one and a half of a degree. West of the Rocky Mountains the departure from the normal has been greater than last month and has amounted to —2.5° along the Pacific coast and from —3° to 5° in Utah and Idaho.

Minimum and maximum temperatures.—An examination of the minimum temperatures shows that they occurred, with few exceptions, from the 17th to the 22d during the régime of high areas Nos. VII and VIII, and ranged during these days from –9° at Pembina, Dak., to 39° at Brownsville, Tex.; from 0° at Alpena, Mich., to 32° at Pensacola, Fla.; and from 11° at Eastport, Me., to 60° at Key West. On the summit of Pike's Peak the minimum (–15°) occurred on the 17th and 18th, and on the summit of Mount Washington (–20°) on the 20th. The exceptions to the above generalization occurred on the 4th in the Lake region; from the 24th to the 28th over the Pacific states, Plateau districts, and Montana, and from the 28th to the 30th over the eastern slope of the Rocky Mountains of Texas. An examination of the maximum temperatures shows that they occurred, almost without exception, during the first half of the month. In the Pacific states, Plateau districts, Eastern Rocky Mountain slope, and northern part of the Northwest they occurred from the 3d to the 6th, and varied as follows: 65° at San Francisco, Cal.; 80° at Red Bluff, Cal.; 67° at Winnemucca, Nev., and Salt Lake City, Utah; 76° at Denver, Colo., and North Platte, Nebr., and 44° at Breckenridge, Minn. Over the eastern portion of the United States, they occurred chiefly from the 8th to the 15th, and varied from 54° at Escanaba, Mich., and 55° at Eastport, Me, to 92° at Laredo, Tex., and 84° at Key West, Punta Rassa, and Augusta. The maximum on the summit of Pike's Peak (33°) occurred on the 6th, and on the summit of Mount Washington (44°), on the 9th, 10th, and 15th.

Minimum temperatures, given by States.—Maine: 2° at *Orono and 13° at Portland. *New Hampshire:* –20° on Mount Washington and –8° at Dunbarton. *Vermont:* –10° at *Woodstock and 7° at Burlington. *Massachusetts:* –2° at Billerica and 16° at Wood's Holl. *Rhode Island:* 14° at Newport. *Connecticut:* 7° at *Mystic and 17° at New Haven. *New York:* –2° at *Schroon Lake, 2° at *Plattsburg Barracks, and 17° at New York City. *Pennsylvania:* –1° at *Dyberry and 19° at Philadelphia. *Delaware:* 20° at *Dover. *Maryland:* 8° at *Woodstock and 20° at Baltimore. *District of Columbia:* 15° at Washington. *Virginia:* 8° at *Mount Solon and *Wytheville and 25° at Cape Henry. *West Virginia:* 8° at Helvetia and 13° at Morgantown. *North Carolina:* 10° at Highlands and 28° at Cape Hatteras. *South Carolina:* 25° at *Aiken and 30° at Charleston. *Georgia:* 20° at Gainesville and 33° at Savannah. *Florida:* 27° at *Houston and 60° at Key West. *Alabama:* 25° at *Green Springs and 33° at Mobile: *Mississippi:* 30° at *Fayette and 31° at Vicksburg. *Louisiana:* 25° at *Okalooska and 38° at New Orleans. *Texas:* 19° at Uvalde and Graham and 43° at Indianola and Galveston. *Ohio:* 8° at *Ruggles and 21° at Cincinnati. *Kentucky:* 20° at *Bowling Green and 22° at Louisville. *Tennessee:* 18° at Knoxville and 27° at Memphis. *Arkansas:* 19° at *Mount Ida and 30° at Little Rock. *Michigan:* 0° at Alpena and 14° at Grand Haven. *Indiana:* 12° at *New Corydon and 18° at Indianapolis. *Illinois:* 6° at *Riley and 25° at Cairo. *Missouri:* 10° at *Oregon and 21° at Saint Louis. *Kansas:* 7° at Dodge City and 16° at Leavenworth. *Wisconsin:* –3° at *Neillsville and 11° at Madison. *Iowa:* 4° at *Ames and Boonsborough and 17° at Keokuk. *Nebraska:* –10° at *Sidney and 8° at Omaha. *Indian Territory:* 24° at Fort Gibson. *Minnesota:* –4° at Breckenridge. *Dakota:* –9° at Pembina and 8° at Fort Abraham Lincoln. *Colorado:* –15° at Pike's Peak and 11° at Denver. *New Mexico:* 15° at Santa Fé and 28° at La Mesilla. *Wyoming:* –1° at Fort Fred Steele and 11° at

Cheyenne. *Utah:* -4° at Coalville and 15° at Salt Lake City. *Nevada:* 5° at Winnemucca. *Arizona:* 14° at Prescott and 38° at Yuma. *Idaho:* 16° at Boise City. *Montana:* -5° at Virginia City. *California:* 32° at Visalia and 45° at San Francisco. *Oregon:* 24° at Roseburg.

Maximum temperatures.—Maine: 55° at Eastport and 63° at *Cornish. *New Hampshire:* 44° on summit of Mount Washington and 70° at *Dunbarton. *Vermont:* 63° at Burlington and 66° at *Woodstock. *Massachusetts:* 62° at Wood's Holl and 76° at *Somerset. *Rhode Island:* 64° at Newport. *Connecticut:* 71° at New London. *New York:* 66° at Buffalo and 74° at *Ardenia. *Pennsylvania:* 70° at Erie and 79° at *Milton. *Delaware:* 76° at *Dover. *Maryland:* 78° at Baltimore. *District of Columbia:* 80° at Washington. *Virginia:* 79° at Lynchburg and Fort Whipple, 83° at *Accotink and *Wytheville. *West Virginia:* 77° at *Helvetia and 76° at Morgantown. *North Carolina:* 74° at Fort Macon and 36° at *Weldon. *South Carolina:* 82° at Charleston. *Georgia:* 76° at Atlanta and 90° at *Forsyth. *Florida:* 79° at Pensacola and Key West and 86° at Houston. *Alabama:* 83° at Montgomery. *Mississippi:* 83° at Vicksburg and 86° at *Brookhaven. *Louisiana:* 84° at Shreveport and 86° at *Okalooska. *Texas:* 80° at Galveston and 92° at Laredo. *Ohio:* 75° at Sandusky and Cincinnati and 80° at *Ringgold. *Kentucky:* 82° at Bowling Green and 78° at Louisville. *Tennessee:* 82° at Memphis. *Arkansas:* 82° at Little Rock. *Michigan:* 74° at *Hudson and 62° at Alpena. *Indiana:* 78° at Indianapolis and 81° at *Laconia. *Illinois:* 80° at *Anna and *Decatur and 69° at Chicago. *Missouri:* 82° at Saint Louis. *Kansas:* 73° at Leavenworth and 80° at *Cedar Vale, *Holton and Independence. *Wisconsin:* 67° at Madison and Milwaukee. *Iowa:* 65° at Des Moines and 75° at *Ames. *Nebraska:* 65° at Omaha and 76° at North Platte. *Indian Territory:* 83° at Fort Sill. *Minnesota:* 44° at Breckenridge and 61° at Saint Paul. *Dakota:* 44° at Pembina and 73° at Yankton. *Colorado:* 76° at Denver and 80° at *Fort Lyon; 33° on summit of Pike's Peak. *New Mexico:* 82° at La Mesilla and 61° at Santa Fé. *Wyoming:* 67° at Cheyenne. *Utah:* 67° at Salt Lake City. *Nevada:* 67° at Winnemucca and 70° at Carson City. *Arizona:* 71° at Prescott and 91° at Yuma. *Idaho:* 62° at Boise City. *Montana:* 57° at Virginia City and 69° at Fort Custer. *California:* 84° at Los Angeles, 80° at Red Bluff, and 65° at San Francisco. *Oregon:* 61° at Portland.

Ranges of temperature at Signal Service stations.—The general range of temperature for the whole country has been from —20° on summit of Mount Washington, —15° on Pike's Peak, and —9° at Pembina Dak., to 92° at Loredo, Tex., or a total range of 112°.

The monthly ranges have been as follows: largest 78° at North Platte, 77° at Fort Custer, and 72° at Yankton. The smallest has been 20° at San Francisco, 24° at Key West, and 37° at Galveston.

The greatest daily ranges vary in New England from 21° at Portland to 40° at Burlington and 47° on Mount Washington; Middle Atlantic states, from 24° at Barnegat to 35° at Albany; South Atlantic states, from 18° at Portsmouth to 36° at Augusta and Wilmington; Eastern Gulf states, from 9° at Key West to 30° at Montgomery; Western Gulf states, from 18° at Galveston to 34° at Corsicana; Ohio valley and Tennessee, from 23° at Columbus, 24° at Cairo to 37° at Morgantown; Lower Lakes, from 22° at Erie to 34° at Rochester; Upper Lakes, from 23° at Grand Haven and Milwaukee to 28° at Duluth; Upper Mississippi valley, from 22° at La Crosse to 33° at Saint Louis; Red River of the North valley, from 38° at Pembina to 39° at Breckenridge; Lower Missouri valley, from 22° at Fort Stevenson to 42° at Yankton; Texas, from 37° at Henrietta and Laredo to 52° at Uvalde; Eastern Rocky Mountain slope, from 36° at Deadwood, 45° at Fort Custer to 46° at Dodge City; Rocky Mountains, from 31° at Virginia City, 36° at Santa Fé, 35° on Pike's Peak to 43° at Denver; Northern and Middle Plateau districts, from 28° at Boise City and Salt Lake City to 43° at Winnemucca; California, from 14° at San Francisco, 31° at Visalia to 36° at Los Angeles.

Frosts.—Occurred very generally in all States and Territories north of the thirty-seventh parallel. In Florida they were reported on the 19th, 20th, 21st, 22d, 23d, 30th; Eastern Gulf States, 2d, 3d, 4th, 5th, 7th, 9th, 10th, 12th, 14th, 16th, 18th to 30th; Western Gulf States, 2d, 8th, 11th, 18th, 19th to 23d, 28th to 30th; Indian Territory, 2d, 15th, 18th to 22d, 29th; New Mexico, 2d, 5th, 6th, 12th to 15th, 17th to 30th; heavy white frost in Northern Arizona on the 12th; California, 1st, 7th, 8th, 10th to 28th.

Ice has been reported throughout all districts north of Tennessee and Kansas. In the Eastern Gulf States it formed on the 4th, 5th, 21st, 22d, 23d, 29th and 30th; in Western Gulf States, on the 4th, 18th, 19th, 20th, 21st, 29th; in Texas and Indian Territory, on the 18th, 19th, 20th, 21st, 29th; at Princeton, Cal., on the 18th and 19th.

Ground frozen.—Ames, Iowa, 27th to 30th; Nora Springs, Iowa, 3d; Tabor, Iowa, 30th; Cedar Vale, Kans., 20th, 21st, 24th, 29th; Oregon, Mo., 18th, 19th; Ashley, Mo.,

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*Those marked with (*) are reported by voluntary observers.

19th; Flushing, Wyo., 3d; West Charlotte, Vt., 1st, 2d, 19th, 21st, 30th; Fort Gibson, Ind. T., 19th, 29th; Keokuk, Iowa, 19th, 29th; Springfield, Ill., 20th.

PRECIPITATION.

The general distribution of rainfall for the month is illustrated as accurately as possible on chart No. III from about 500 reports; this chart is accompanied by a table giving the average precipitation for the month of November by districts. This table shows the rainfall to have been decidedly below the normal throughout the Atlantic and Gulf states and at Portland, Oreg. In the Middle Atlantic and Eastern Gulf States this deficiency amounts to more than two inches, and the severe droughts previously reported have continued throughout the present month from New Jersey to North Carolina and in Southern Texas. A small deficiency is reported in the Upper Missouri valley and Minnesota. In the Lake region, Upper Mississippi, and Lower Missouri valleys there is a large excess, amounting in the last district to more than three inches. The combined reports from San Francisco and San Diego show an excess of nearly two inches, which is due to the heavy rains attending low areas Nos. IV and XVIII. Regarding the rainfall in Missouri, Professor Nipher states in the Missouri Weather Review that "the greater portion of the rain fell between the 10th and 20th, and was followed by a marked rise in the rivers; these rains occurred as frequent and moderate showers, and were of great benefit to fall crops, checking also the ravages of the Hessian fly.

Special heavy rainfalls.—3d, Holton, Kans., 3 inches. 6th, Fort Barrancas, Fla., 3.83 inches. 8th, Howard, Nebr., 2.44 inches; Leavenworth, 2.56 inches; Manhattan, Kans., 2.31 inches; Waterville, Kans., 2 inches in eight hours. 9th, Okalooska, La., 5.20 inches; Los Angeles, Cal., 3.41 inches; Calistoga, Cal., 2.60 inches; San Diego, 2.75 inches. 9th and 10th, San Gorgonio, Cal., 3.92 inches. 10th, Pierce City, Mo., 2 inches in 2 hours and 40 minutes. 10th and 11th, Sterling, Ill., 3.40 inches; Holton, Kans., 2.75 inches; Howard, Nebr., 3.50 inches; Plattsmouth, Nebr., 3.58 inches; Lawrence, Kans., 2.65 inches. 11th, Des Moines, 2.58 inches; Leavenworth, 2.58 inches; Guttenburg, Iowa, 2.60 inches; Litchfield, Mich. (10th to 12th), 3 inches. 11th and 12th, Kansas City, Mo., 2.69 inches; Glenwood, Iowa, 2.95 inches; Thornville, Mich., 2.50 inches; Manhattan, Kans., 4.81 inches; Brookhaven, Miss., 2.60 inches; Waterville, Kans., 4.18 inches. 14th and 15th, Arlington, Ind., 3 inches. 15th, Vicksburg, 1.82 inches in 20 minutes. 17th and 18th, Murphy, N. C., 2.70 inches. 18th, Thatcher's Island, 3.14 inches; Northport, Mich., 2.90 inches. 18th and 19th, Fayetteville, N. C., 3 inches. 27th and 28th, Highlands, N. C., 2.80 inches. 28th, Vicksburg, 1.81 inches in 1 hour 20 minutes. 29th and 30th, Calistoga, Cal., 3.20 inches; Red Bluff, 3.15 inches; San Francisco, 2.24 inches; Princeton, Cal., 1.98 inches.

Largest monthly rainfalls, including melted snow.—Mount Washington, 9.53 inches; Savannah, Mo., 8.90 inches; Alta, Cal., 9.13 inches; Fort Barrancas, Fla., and Ironton, Mo., 8.72 inches; Saint Joseph, Mo., 8.45 inches; Erie, 8.35 inches; Okalooska, La., 8.03 inches; New Hope Township, Union County, Iowa, nearly 8 inches; Leavenworth, 7.85 inches; Manhattan, Kans., 7.83 inches; Oregon, Mo., 7.81 inches; Grafton, N. H., 7.70 inches; Holton, Kans., 7.65 inches; Litchfield, Mich., 7.25 inches; Calistoga, Cal., 7.24 inches; Grand Haven, 7.23 inches; Northport, Mich., 6.93 inches; Thatcher's Island, Mass., 6.91 inches; Milan, Mo., 6.72 inches; Centerville Mo., 6.82 inches; College Hill, Ohio, 6.75 inches; Des Moines, 6.49 inches; Howard, Nebr., and Grand Rapids, Mich., 6.46 inches; Port Stanley, 6.43 inches; Coldwater, Mich., and Quebec, Canada, 6.36 inches; Independence, Iowa, 6.30 inches; Fort Leavenworth, Kans., 6.26 inches; Neosho, Mo., 6.22 inches; Niles, Mich., 6.14 inches; Madison, Wis., and New Corydon, Ind., 6.02 inches; Memphis, 6.01 inches; Pierce City, Mo., and Fort Wayne, Ind., 6 inches; Redding, Cal., 5.96 inches.

Smallest monthly rainfalls, including melted snow.—At Randall, Dak., La Mesilla, N. Mex., Concho, Davis, Laredo, Rio Grande and Edinburg, Tex., none; Fort Hartsuff, Nebr., Castroville and Stockton, Tex., trace; El Paso and Uvalde, Tex., 0.01 inch; Salt Lake City, 0.02 inch; Socorro, N. Mex., and Eagle Pass, Tex., 0.03 inch; Fort Abraham Lincoln, Dak., Fort Griffin, Tex., and Dodge City, 0.04 inch; Camp Sheridan, Nebr., Boerne and Brackettville, Tex., 0.05 inch; Fort Stevenson, Dak., 0.06 inch; Olivet, Dak., 0.07 inch; Coleman, Tex., 0.08 inch; Fort Lyon, Colo., Fort McPherson, Nebr., and North Platte, 0.10 inch; Fort Keogh, Mont., 0.11 inch; Indianola, 0.13 inch; Pilot Point and Brownsville, Tex., 0.14 inch; Bismarck, 0.16 inch; Sidney, Nebr., and Castroville, Tex., 0.18 inch; Fort Custer, Mont., 0.19 inch; Denver, 0.21 inch; Yankton and Cheyenne, 0.23 inch; Cedar Keys, Fla., and Sumner, Cal., 0.24 inch; Fort Fred Steele, Wyo., and Graham, Tex., 0.25 inch; Deadwood and Fort Sill, 0.27 inch; Silver City, N. Mex., 0.28 inch; Fort Monroe, Va., and Breckenridge, 0.29 inch; Fort McHenry, Md., Gulf Hammock, Fla., 0.30 inch; Henrietta, Tex., Pembina, Dak., and Tulare, Cal., 0.34 inch; Punta Rassa, 0.35 inch; Fort Buford, Dak., 0.37 inch; Fredericksburg, Tex., 0.38 inch; Johnsontown, Va., 0.40 inch; Weldon, N. C., 0.41 inch; Norfolk, 0.42 inch; Jacksborough and Decatur, Tex., 0.45 inch; Fort Garland, Colo., 0.48 inch; Dover Mines, Va., 0.55 inch; Fort McKavett, Tex., 0.57 inch.

Rainy days: The number of days on which rain or snow has fallen varies as follows: New England, 12 to 24; Middle Atlantic states, 2 to 15; South Atlantic states, 5 to 12; Eastern Gulf states, 3 to 14; Western Gulf states, 6 to 13; Lower Lake region, 17 to 25; Upper Lake region, 13 to 23; Ohio valley and Tennessee, 8 to 20; Upper Mississippi valley, 10 to 14; Missouri valley, 3 to 11; Red River of the North valley, 4 to 8; Eastern Rocky Mountain slope, 2 to 8; Texas, 0 to 9; Rocky Mountains, 1 to 10; California, 3 to 10; Oregon, 12 to 16.

Cloudy days: The number varies in New England from 11 to 21; Middle Atlantic states, 2 to 14; South Atlantic states, 3 to 12; Eastern Gulf states, 3 to 14; Western Gulf states, 6 to 13; Lower Lake region, 11 to 26; Upper Lake region, 12 to 19; Ohio valley and Tennessee, 5 to 14; Upper Mississippi valley, 6 to 17; Missouri valley, 3 to 10; Red River of the North valley, 11 to 17; Eastern Rocky Mountain slope, 3 to 8; Texas, 0 to 10; Rocky Mountains, 2 to 12; California, 2 to 9.

Hail: Fort Sill, Ind. T., 16th; Fort Gibson, Ind. T., 8th; Keokuk, N. C., 14th; Saint Louis, Mo., 18th; Oswego, N. Y., 29th; Buffalo, N. Y., 23d; Louisville, Ky., 5th; Indianapolis, Ind., 5th; Cairo, Ill., 14th; Logansport, Ind., 5th; Burlington, N. H., 16th; Lyndon, Ill., 11th; Cresco, Nora Springs, Monticello, and Fort Dodge, Iowa, 26th; Fort Madison and Ames, Iowa, 27th; Iowa City, Iowa, 29th and 30th; Monticello, Iowa, 20th and 23d; Fort Dodge, Iowa, 10th; Holton Kans., 26th; Independence, Kans., 8th; Cedarville, Kans., 8th; Yates Center, Kans., 16th; Bowling Green, Ky., 28th; Fall River, Mass., 23d; Grand Rapids, Mich., 3d, 10th, and 24th; Ypsilanti, Mich., 26th; Hudson, Mich., 15th; Oregon, Independence, and Pierce City, Mo., 27th; Somerville, N. J., 25th; Weldon, N. C., 19th; Cincinnati, Ohio, 17th; Jacksonburg, Ohio, 5th and 17th; North Lewisburg, Ohio, 14th; Dyberry, Pa., 27th; Embarrass, Wis., 19th; Red Bluff, Cal., 12th.

Snow fell frequently in the Lake region, Ohio Valley, Middle states, and New England, and in other regions on the following dates: In North Carolina, on the 19th and 20th, at Fayetteville, 5 inches fell, the first, so early in the season, for 35 years; South Carolina and Georgia, on the 19th; Upper Mississippi valley, from 1st to 5th, 15th, 17th to 24th, 26th, 27th, and 28th; Middle Eastern Rocky Mountain slope, on 1st, 2d, 8th, 9th, 15th, 16th, 18th, 21st, 26th, 27th, and 28th; North Rocky Mountain slope, on the 1st, 2d, 7th, 8th, 9th to 20th, 22d, 25th to 28th; New Mexico, 8th, 10th, 11th, 16th, 17th, 18th, 27th and 30th; Middle Plateau district, 6th to 9th, 11th to 16th, 21st, 25th, 26th, 27th, and 29th; California, at San Gorgonia, 4,000 feet above sea-level, on the summit of the San Bernardino range, on the 9th and 10th.

Largest monthly snow-falls: Summit, Cal., 56 inches; Mount Washington, 48.90 inches; Grand Haven, 26.40 inches; Grafton, N. H., 26 inches; Antrim, N. H., 24.20 inches; Emigrant Gap, Cal., and Pike's Peak, 24 inches; Contoocookville, N. H., and West Charlotte, Vt., 22 inches; Hermosa, Cal., 21.50 inches; Little Mountain, Ohio, 19.40 inches; Strafford, Vt., 19 inches; Northport, Mass., 18.40 inches; Alpena, Mich., 18.30 inches; Rowe, Mass., 18 inches; Gardiner, Me., 17.50 inches; Cornish, Me., 17 inches; Truckee, Cal., 16.75 inches; Oswego, N. Y., 16.05 inches; Rochester, N. Y., and Woodstock, Vt., 16 inches; Nile, N. Y., 15.75 inches; Lima, N. Y., 15.60 inches; Clinton, Mass., 15 inches; Cleveland, Ohio, 14.70 inches; Palermo, N. Y., 14.25 inches; Coldwater, Mich., 14 inches; Westborough, Mass., and Kalamazoo, Mich., 13.50 inches; Penn Yan, N. Y., 13 inches; Hudson, Ohio, 12.90 inches; Buffalo, N. Y., 10.80 inches; Orono, Me., and Starkey, N. Y., 10 inches.

The *depth of snow on surface of ground at end of month,* was reported as follows: In Utah at Coalville, from a trace to one-quarter of an inch; in Montana at Fort Custer, 1 inch; in Dakota at Fort Stevenson and Pembina, and in Minnesota at Breckinridge and Saint Paul, a trace; in Nevada at North Platte, trace to 1 inch; in Iowa at Nora Springs, a trace, and at Fort Madison and Davenport, half an inch; in Wisconsin at Madison, half an inch, and at Beloit, Milwaukee, and Embarrass, 1 inch; in northern Illinois and Lyndon 1, and at Riley 1½ inch; in Michigan at Litchfield half, at Thornville, Hudson, and Grand Haven 1, at Kalamazoo 1½, at Escanaba 1½ inch, and at Alpena 5 inches; in New York at Oswego, Waterburg, and Albany a trace, at Rochester one-quarter of an inch, and at North Volney three-quarters of an inch; in Vermont at Strafford, 1 inch; and in New Hampshire, on the summit of Mount Washington, 1, and at Grafton 2 inches; on the summit of Pike's Peak, Colo., from 5 to 60 inches.

Snow from a cloudless sky: Burlington, Vt., 6th.

Drought continued in the States of New York, New Jersey, West Virginia, Maryland, Virginia, North Carolina, and Texas, and is commented upon as follows: In New York at Port Jervis on the 7th the continued dry weather was causing considerable alarm. Throughout southern part of New Jersey such an extended drought as the present has not been known for many years; on the 29th wells had given out and springs were dried up that were never known to fail before; mills have been compelled to stop or greatly curtail operations. In Maryland at Fallston and Sandy Springs month dry throughout, springs and wells failing. In West Virginia at Morgantown, on the 24th, farmers and river men were complaining and wells drying up, &c. In Virginia at Petersburg, on the 11th, the dry and mild weather had caused the wells to dry up; mills were compelled to stop running, and farmers had to come a distance of 50 miles to procure breadstuff and have their grain ground; at Snowville, month very dry; Dover Mines, drought throughout month causing a great scarcity of water. In North Carolina, at Weldon, month remarkably dry, severe drought from the 1st to the 14th, during which time wells failed; in the Dismal Swamp region, swamp fires continued, no rain having fallen for two months. In the southern part of Texas the drought has been severely felt; the observers at Fredericksburg, Boerne, Uvalde, Graham, and Coleman report stock suffering severely and farmers unable to sow seed. In Erath County, Texas, on the 8th, the earth of the prairies was cracked so as to make it dangerous to ride across them. The last rain fell here on the evening of July 29th. In Hood County, Texas, the drought and dust were extremely bad; on public roads the dust was a foot in depth. The Springfield Daily Union (Ill.) of November 24, states that the "drought in some parts of the West was so severe that the water was carried from the Mississippi River at Louisiana, Mo., both east and west into Illinois and Missouri for a distance of 75 miles and nearly all railroads running from the river to the interior had a water train."

Floods: Kansas City, Mo., on the 13th, the Kaw River rose five feet in 24 hours, "heaviest freshet ever known" at that place.

RELATIVE HUMIDITY.

The percentages of mean relative humidity for the month range as follows: New England, 69 to 83; Middle Atlantic states, 59 to 75; South Atlantic states, 61 to 77; Eastern Gulf states, 66 to 79; Western Gulf states, 58 to 75; Ohio valley and Tennessee, 59 to 69; Lower Lake region, 70 to 77; Upper Lake region, 67 to 82; Upper Mississippi valley, 63 to 69; Lower Missouri valley, 52 to 73; Red River of the North valley, 77 to 84; Northern Rocky Mountain slope, 48 to 56; Texas, 16 to 88; Western Plateau, 47 to 64; California, 61 to 73; Oregon, 78 to 86. *High stations* report the following averages, not corrected for altitude: Mount Washington, 90.4; Pike's Peak, 52.7; Santa Fé, 46.7; Denver, 49.3; Cheyenne, 39.7; Virginia City, 56.8.

WINDS.

The prevailing winds, at Signal Service stations, are shown by the arrows, flying with the wind, on chart No. II. The general direction along the Atlantic coast has been northerly, but at the interior stations, Atlanta, Augusta, Charlotte, Lynchburg, Albany, and Burlington, and thence to the Southwest, Missouri, Illinois, and Michigan, southerly. North and west of this region northwesterly winds predominated. On the Pacific coast they were southerly at Portland and Olympia, and northerly in California. Below are given some of the maximum velocities, in miles per hour, and some of the larger and smaller total monthly movements, registered at the Signal Service stations.

Maximum velocities of winds: 3d, Thatcher's Island, E., 64 miles per hour; 6th, Fort Custer, NW., 48; 9th, San Francisco, SE., 36; 10th, Key West, NW., 36; 11th, Red Bluff, SE., 42; Winnemucca, SW., 45; Salt Lake City, S., 28; 14th, Cheyenne, W., 48; Denver, NW., 34; North Platte, W., 54; Cairo, SW., 56; 16th, Dodge City, N., 48; 17th, Coleman, Tex., N., 48; 18th, Kittyhawk, N., 50; Indianola, N., 52; Galveston, N., 38; 19th, Fort Stevenson, Dak., W., 60; Bismarck, N., 46; Pembina, NW., 40; Saint Paul, NW., 46; Madison NW., 40; Grand Haven, W., 42; Punta Rassa, NW., 46; 20th, Cape Henry, NW., 52 miles; Cape May, NW., 83; Sandy Hook, NW., 60; Sandusky, NW., 62; Morgantown, NW., 45; Atlanta, NW., 36; Cape Lookout, NW., 46; Albany, NW., 44; 24th, Breckenridge, NW., 44; 25th, Virginia City, NE., 36; 26th, Sacramento, N., 36; 28th, Pike's Peak, N., 80; Wood's Holl, S., 40; 29th, Cape May, NW., 50; 30th, Mount Washington, NW., 108.

Total movements of the air: The following are largest total movements recorded in miles at the Signal Service stations, during the month: On the summit of Pike's Peak, 18,192 miles; Cape May, 14,347; Portsmouth, N. C., 12,103; Thatcher's Island, 12,068; Sandusky, 11,940; Cape Lookout, 11,561; Kittyhawk, 11,396; Sandy Hook, 11,367; Cape Henry, 10,642; Wood's Holl, 10,416; Indianola, 10,052; Erie, 10,056; Cape Hatteras, 9,938; Cleveland, 9,809; Key West, 9,589; Barnegat, 9,231. On the summit of Mount Washington, the working of the anemometer was interfered with by frost-work. The *smallest* are, Visalia, Cal., 1,457 miles; Socorro, N. Mex., 1,596; Deadwood, Dak., 1,659; La Mesilla, N. Mex., 1,744; Salt Lake City, 2,222; Lynchburg, 2,312; Nashville, 2,646; Uvalde, Tex., 2,652; Augusta, 2,781; Virginia City, 2,858; Fort Davis, Tex., 2,888; Cedar Keys, Fla., 2,953; Dubuque, 2,976.

Local storms: Pageville, Cass County, Mo., 8th, 2.15 p. m., a severe tornado passed over the town from the southwest, destroying the depot building of the Pacific Railroad, several stores and dwellings and a blacksmith's shop, all which was done in less than one minute. Several persons seriously and two fatally injured. An empty wagon, team, and driver were carried about 100 yards. Near Fort Smith, Crawford County, Ark., 8th, about 3 p. m., a severe tornado accompanied with hail (stones 2 or 3 inches in diameter), passed to the northeastward. "The storm cloud looked like black smoke from a large furnace, and its shape was like a funnel with its inside red as fire; the roaring was terrible and the cloud was filled with pieces of timber, branches of trees and fragments of clothing; everything was swept clean over the path of the storm, which was very narrow; one person killed and several seriously injured." Detroit, Mich., 12th, 5 p. m., "a very destructive 'tornado' visited the northwestern part of the city, creating considerable havoc. The sky suddenly became overcast, a gale sprung up from the west and southwest which soon reached the velocity of a hurricane and swept houses, fences, gates, &c., before it; the path was not over 500 feet wide." Rapides Parish, Louisiana, 14th, "on Elmwood plantation, 10 miles below Alexandria, twelve buildings were destroyed by a severe tornado. The track of the storm was about 250 yards wide and swept all objects before it; no lives were lost; the plantation bell, weighing 300 pounds, and numerous plows and parts of wagons were lifted up and transported long distances; entire loss estimated at $10,000." In Ouachita Parish, Louisiana, probably on the 14th, "a tornado passed over Fisher's Landing, on Black River, destroying two or three houses and injuring several people." Cairo, Ill., 14th, a "tornado accompanied by hail and heavy rain struck the city at 1 p. m., demolishing several buildings and unroofing many others; one child was blown some distance and killed." Terre Haute, Ind., 14th, a. m., a violent wind and rain storm passed to the northeast, a few miles south of the city, demolishing buildings and fences and uprooting trees. At Paoli and Princeton, Ind., 14th, a. m., a heavy "tornado" passed northeastward, unroofing houses and blowing down fences. Norwalk, Huron County, Ohio, 14th, about 11 a. m., a "terrible windstorm or tornado" passed over the central portion of the county in a northeasterly direction, "tearing houses to pieces and scattering the contents in every direction; straw stacks, orchards, fences, and barns were demolished, trees uprooted and animals killed." Louisville, Ky., 28th, 5.45 a. m., "a severe tornado swept over the southeastern portion of the city, marking its pathway by a broad track of demolished fences, uprooted trees, and injured houses. The storm was a fearful one and passed directly from the southwest to the northeast. The cloud was an immense dark, whirling, tossing mass, which seemed to possess a wrenching, spiral motion, to which much of the damage was in all probability due. The wind was terrific, and caried every obstacle before it; coming at first in heavy gusts, it soon reached a steady hurricane velocity." Greensburg, Ind., 28th, a. m., a heavy wind and rain storm visited this place, blowing off roofs and tearing up trees. Madison, Ind., 28th, about 5 a. m., a heavy wind and rain storm, accompanied with severe thunder and lightning passed over the city, causing considerable damage. Seymour, Ind., 28th, "about noon a dark and angry looking cloud rose in the west causing such intense darkness that it became necessary to light lamps. As it came up it rolled over and over making one revolution after another in quick succession. As it approached the town it rose and fell, sometimes coming below the tree tops shaving off every limb it came in contact with as if it had been done with an ax. When above the trees the sound of the wind resembled that of a mighty cataract. Its path was not over 200 yards wide and direction from southwest to northeast."

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily weather indications for November with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of omissions to be 0.03 per cent., and of verifications to be 90.8 per cent. The percentage for the four elements have been—weather, 94.0; direction of the wind, 88.9; temperature, 92.4; barometer, 87.8. The percentages of verification by geographical districts, have been: New England, 93.1; Middle states, 91.5; South Atlantic states, 90.6; Eastern Gulf states, 92.3; Western Gulf states, 88.7; Lower Lake region, 91.2; Upper Lake region, 92.4; Tennessee and the Ohio valley, 92.4; Upper Mississippi valley, 87.2; Lower Missouri valley, 87.6; Northern Pacific coast region, 95.0; Central Pacific coast region, 98.3; Southern Pacific coast region, 97.5. Of the 3,689 predictions that have been made, 95, or 2.58 per cent., are considered to have entirely failed; 92, or 2.49 per cent.,.were one-fourth verified; 268, or 7.26 per cent., were one-half verified; 159, or 4.31 per cent., were three-fourths verified; 3,075, or 83.36 per cent., were fully verified, so far as can be judged from the tri-daily weather maps.

Cautionary signals.—Two hundred and thirty-six cautionary signals were displayed during the month, of which 219, or 92.8 per cent., were justified by wind of 25 miles per hour or over, at or within a radius of 100 miles of the station. Eighty-two off-shore signals were displayed, of which 80, or 97.6 per cent., were fully justified. Of the cautionary off-shore signals 58 were changed from cautionary. Three hundred and eighteen of both kinds were displayed, of which 299, or 94 per cent., were fully justified. The above does not include signals ordered at 52 display stations, where the velocity is only estimated. Six signals were reported somewhat late; 67 cases were reported of winds of 25 miles or over where signals were not ordered.

NAVIGATION.

In the table on the right-hand side of chart No. III are given the highest and lowest readings of the Signal Service river gauges for the month, with the dates of the same. During the first half of the month the rivers in general continued quite low. From the 24th to the 25th higher readings were generally reported, but in no case did they approach near the danger-marks. The heavy rains previous to the 15th made a good navigable river in the Ohio at Pittsburgh for the first time since the early part of August. On the 18th low water on the lower Fox River, Wis., compelled manufactories to run on short time.

Ice in rivers and harbors.—The mild weather prevalent throughout October and the first half of November delayed the formation of ice to such an extent as not to interfere with navigation, except on the Upper Missouri and Red River of the North, until the last few days of the present month. The following notes on the formation of ice are of interest: The *Missouri* was closed by ice at Fort Buford, Dak., on the 27th; at Fort Stevenson, Dak., floating ice passed down the river on the 2d, 3d, and 21st, and the river was closed by ice from the 23d to the 28th; at Bismarck, Dak., river froze over on the 2d, but ice broke up on the 4th, and on the 27th the river was closed by ice; at Fort Randall, Dak., floating ice passed down on the 22d; at Yankton, Dak., floating ice was observed during the entire month; on the 20th the ferry-boat was frozen in; on the 29th the channel was frozen over for eight hours and navigation closed; at Plattsmouth, Nebr., floating ice passed down on the 3d and 4th, and on the 20th and 21st—on the 22d it gorged at the railroad pile-bridge, and on the 24th and 25th the gorge lifted out the piles and destroyed bridge; 26th, river was free of ice, but on the 29th and 30th floating ice was again reported. The *James River* at Morristown, Dak., was frozen over on the 1st; on the 7th the ice had all disappeared, but by the 27th the river was again frozen over. *Red River of the North.*—At Pembina, on the 1st, large quantities of floating ice passed down, and on the 2d the river froze over and navigation closed, but on the 6th the ice was fast breaking up; at Winnepeg, Manitoba, on the 3d, an ice bridge had formed over the river and persons crossed on foot. *Mississippi.*—At Saint Paul, Minn., on the 2d and the 24th the river was partly frozen, on the 20th full of floating ice, and owing to the masses of anchor ice in the canal the leading flour-mills were compelled to close their gates; at La Crosse, Wis., on the 20th and 21st much floating ice; at Dubuque, Iowa, 22d, shore ice; 23d, river full of floating ice, "navigation suspended;" floating ice was also reported at Davenport, 25th to 30th; at Muscatine, 24th, and at Burlington on the 29th. *Rock River*, at Rockford, Ill., was covered with thin ice on the 4th; on the 21st it froze over and remained partly frozen until the 25th; on the 27th the ice had disappeared. The *Manitowoc River*, at Manitowoc, Wis., was closed by ice on the 20th, and the *Embarrass* River, at Embarrass, Wis., was frozen over on the 30th. The *Toledo River* was covered by thin ice the 24th and 26th at Toledo, Ohio; at Sandusky, 20th, ice formed along the docks, and on the 24th and 25th considerable floating ice was observed in the bay. The *Monongahela*, at Morgantown, frozen over on the 24th but opened on the 26th. On the 21st and 22d quite an ice blockade formed in the Erie Canal at Rome and Auburn, N. Y., but the ice was broken up on the 23d; on the 26th there was considerable floating ice in the canal at Whitehall, N. Y., and a tow of nine barges was frozen in on the 28th. *Lake Champlain*, West Charlotte, Vt., ice formed along the lake shores on the 21st and 30th. *Ottawa River.*—On the 24th navigation was practically closed by ice at Ottawa, Ontario, and the *Saint John River*, at Fredericton, N. B., was frozen over. *Saint Lawrence River*, on the 22d, was frozen over from above the rapids down to the Grand Trunk Railroad bridge; on the 26th ice was forming in considerable quantities along the shores of the lower Saint Lawrence, and two schooners were reported frozen in at Kamouraska; and, same date, steamer Bellona, the last boat of the season from Montreal to Liverpool, got fast in ice at Lake Saint Peter, near Three Rivers, but afterward got out and proceeded on the 29th.

High tides.—Eastport, 15th, 16th.

Low tides.—Baltimore, 21st, unusually low; Portsmouth, N. C., 9th, 10th, 11th, 26th, 27th, unusually low.

TEMPERATURE OF WATER.

The temperatures of water, as observed in rivers and harbors, with average depth at which the observations were taken, are given on chart No. II. At the following stations no observations were made on the dates indicated: At Cedar Keys, Fla., observations were commenced on the 16th; at Cleveland, the lake was too rough on the 3d, 18th, 20th, 23d, 25th, 28th, and 29th, and on the 21st and 22d the pier was covered with ice and snow; at Escanaba floating ice prevented observations being made during the last three days of month.

ATMOSPHERIC ELECTRICITY.

Thunder-storms were reported in the various districts, as follows: New England, on the 3d, 6th, 7th, 12th, 13th, 14th, 19th, 20th, 22d; Middle Atlantic states, 3d, 11th, 12th, 14th, 15th, 19th, 23d, 29th; South Atlantic states, 15th, 19th; Eastern Gulf states, 6th, 11th, 13th, 14th, 15th, 17th, 27th, 28th; Western Gulf states, 5th, 8th, 9th, 11th, 13th, 14th, 17th, 27th; Ohio valley and Tennessee, 2d, 9th, 10th, 12th, 13th, 14th, 15th, 16th, 17th, 27th, 28th, 29th; Upper Lake region, 8th, 9th, 10th, 11th, 12th, 14th, 15th, 26th, 27th, 28th; Lower Lake region, 2d, 9th, 12th, 14th, 15th, 23d; Upper Mississippi valley, 8th, 10th, 11th, 12th, 13th, 14th, 16th, 17th, 18th, 21st, 24th, 26th, 27th, 28th; Lower Missouri valley, 8th, 10th, 11th, 13th, 14th, 16th, 26th, 27th, 28th; Middle Eastern Rocky Mountain slope, 8th, 10th, 11th, 13th, 14th, 16th, 17th, 26th, 27th.

Auroras,—Cambridge, Mass., regularly looked for 8 p. m.; none seen during the month; decidedly cloudy on the 2d, 3d, 6th, 8th, 9th, 11th, 12th, 13th, 14th, 15th, 17th, 18th, 19th, 20th, 27th, 28th; some clouds, with moonlight, 22d, 25th; moonlight, 1st, 21st, 23d, 24th, 26th, 29th, 30th; if present, might have been seen 4th, 5th, 7th, 10th, 16th. Calistoga, Cal., 26th, 8.30 p. m., extended from WNW. to NNE.; diffuse yellow light; no streamers. Olivet, Dak., 6th, slight diffuse light. Augusta, Ill., 30th. Fort Wayne, Ind., 13th, 14th. Iowa City, Iowa, 5th, 14th, 30th. Fall River, Mass., 1st. Vineland, N. J., 12th. Starkey, N. Y., 3d, 13th, 21st. Ringgold, Ohio, 3d, 10th. Milton, Pa., 15th, 5.30 p. m., two arches, colors dark, tinged with red; disappeared at 6 p. m. Bismarck, 11th, from 6 to 10 p. m., white nebulous light. Toledo, 1st, 10 p. m., single arch. Port Huron, 28th.

OPTICAL PHENOMENA.

Solar halos were reported from the various districts on the following dates: New England, on the 2d, 10th, 11th, 21st, 22d, and 27th; Middle states, 2d, 10th, 19th, 26th, and 30th; South Atlantic states, 5th, 6th, 11th, 12th, 22d, 28th, and 29th; Lake region and Ohio valley, 2d, 7th, 8th, 10th, 15th, 16th, 21st, 22d, 24th, 26th, 27th, 29th, and 30th; Gulf states, 4th, and from the 23d to the 27th; Northwest, 4th, 5th, 7th, 9th, 11th, 13th, 16th, 17th, 19th, 20th, 21st, 23d, 25th, 26th, 27th, and 30th; New Mexico, on the 3d; Nevada, 6th and 25th; California, on the 1st and 2d.

Lunar halos were reported from the various districts on the following dates: New England, from the 22d to the 29th, inclusive; Middle states, 1st and 2d, and from the 20th to the 30th; South Atlantic states, 2d, 3d, and 5th, and from the 21st to the 30th; Florida, 24th, 25th, and 29th; Alabama, 24th; Mississippi, 5th and 24th; Southwest, 19th to 30th; Tennessee, 22d to 26th, and on the 30th; Ohio valley, 1st to 3d, 22d to 27th, and on the 30th; Lower Lake region, 1st, 24th, and 30th; Upper Lake region, 1st to 3d, 21st, 24th, 25th, and 29th; Northwest, 2d to 5th, and from the 20th to the 30th; Colorado, 25th, 28th, 29th, and 30th; New Mexico, 2d, 28th, and 29th; Nevada, 24th, 25th, and 29th; Idaho, 4th, 19th, and 23d; California, 1st, 2d, 27th, 29th, and 30th.

MISCELLANEOUS PHENOMENA.

Prairie and forest fires.—Creswell, Kans., 3d, 5th, 7th, 12th, 14th, 15th, 18th, 19th, 20th, 21st, 22d, 23d, and 25th; Mount Solon, Va., 6th, 7th, and 17th on mountains; Pike's Peak, 5th and 6th; Fort Sill, 7th, 8th, 10th, 24th, 26th, and 30th; Fort Gibson, 2d, 3d, 4th, 5th, 6th, 7th, 19th, 21st, 23d, and 25th; Dodge City, 19th; Henrietta, Tex., 7th; Pembina, 4th, 7th, 8th, 10th; Boerne, Tex., 23d.

Meteors.—Mr. Charles G. Boerner, of Vevay, Ind., ina special report upon the November meteors, states that observations were made from the 10th to 16th, inclusive. "The nights of the 10th, 11th, and 12th were more or less cloudy and foggy, but that of the 13th presented a clear, bright sky, attended by a mild and dry atmosphere, without any obstacle to interpose the most favorable opportunity for observations. The display did not, in anywise, approximate, either in numbers or brilliancy, those of former years. The total number counted, in 6 hours, on the night of the 13th was 44; 7 of the 1st magnitude, 15 of the 2d, 18 of the 3d, and 4 of the 4th. During the night of the 14th, threatening and rainy weather prevailed, and the nights of the 15th and 16th were not marked by any special phenomena. Many of our people who have been misled by the predictions and speculations of Professor Tice, of Saint Louis, after having sacrificed several nights, watching in vain for the expected shower, feel chagrined over their disappointment, and are now very emphatic in expressing grave doubts about the wisdom and ability of their great favorite weather oracle." Trenton, N. J., 24th, 3.45 a. m., "Very brilliant meteor passed from north to south, looking nearly as large as a barrel and accompanied by a hissing noise; as it neared the earth it exploded like a rocket"; Southington, Conn., 16th; Anna, Ill., 13th and 22d; Lyndon, Ill., 15th; New Corydon, Ind., 1st, 3d, 4th, 12th, 13th, 14th, 25th, and 26th; Saint Meinrad, Ind., 7th and 13th; Fort Dodge, Iowa, 24th; Yates Center, Kans., 3d; Woodstock, Md., 3d, 4th, 7th, 12th, 13th, 14th, 15th, 16th, 20th, 29th, and 30th; Emmittsburg, Md., 21st; Sandy Springs, Md., 30th; New Bedford, Mass., 10th, 16th, and 30th; Rowe, Mass., 7th and 22d; Ypsilanti, Mich., 1st and 9th; Brookhaven, Miss., 8th; Fayette, Miss., 2d, 15th, and 16th; Oregon, Mo., 12th, 15th, and 29th; Independence, Mo., 8th; Plattsmouth, Nebr., 2d, 13th, 14th, and 15th; Genoa, Nebr., 11th; Vineland, N. J., 16th; Linden, N. J., 17th; Waterburg, N. J., 7th and 9th; Ithaca, N. Y., 13th and 14th; Hector, N. Y., 11th; North Lewisburg, Ohio, 13th; McMinnville, Tenn., 6th; Pike's Peak, Colo., 20th; Indianola, Tex., 5th (13th, counted 48 from 2 to 4 a. m.); Pensacola, Fla., 12th and 13th; Springfield, Ill., 20th; Davenport, Iowa, 13th; Saint Louis, Mo., 12th, several; Louisville, Ky., 14th and 29th; Savannah, Ga., 12th, 13th, 20th, and 24th; Smithville, N. C., 14th; Boise City, Idaho, 14th and 21st; Punta Rassa, Fla., 13th. The Bucyrus (Ohio) Journal, November 15, states: "During the early morning, a farmer of White's Township was struck by an ærolite, which passed entirely through his body, causing instant death. The meteor appeared to come from the south-southwest and fell obliquely at an angle of about 60°." Syracuse, N. Y., 28th, about 5 a. m., "A heavy explosion was heard and a bright light was seen in the northwestern sky, which was supposed to have resulted from the passage of a meteor." On the North Fork of the Canadian River, Indian Territory, 13th, between 1 and 3 a. m., meteors were seen to fall like hail. In Missouri, "Very few meteors were seen on the 13th and 14th, although the sky was favorable at many stations; on the 18th, 15 faint meteors were observed at Corning, Mo., between 7.30 and 10.30 p. m., which appeared to radite from near Aquilla."

Earthquakes.—"At Arequipa, Peru, on the morning of October 2, 1879, a strong shock was felt, lasting 30 seconds; it is described as being the strongest felt since the great earthquake of 1868; the walls of many churches and buildings were cracked." "The North China Herald publishes a translation of a memorial written by the governor-general of Kansu, regarding the disastrous earthquakes in that province and Shense. The shocks extended from June 29 to July 11, 1879, and reports of loss of life and destruction of property have been received from nearly thirty cities and districts. On July 1 a violent shock occurred causing the ground to open; city walls, public and other buildings were leveled, and a large number of people (varying from 10 in some places to 200 or 300 in others) were crushed to death. In some places only one shock was felt, in others several in succession, while in others the shocks continued for ten days." November, 1879, Costa Rica, C. A., 18th, 10.40 a. m., slight shock. Beirut, Syria, 15th, 8.35 p. m., slight shock. Boise City, Idaho, 25th, 2.04 p. m., slight shock lasting about two seconds, vibration from east to west; this shock was also felt at Idaho City, 35 miles north of station; 26th, a second shock was felt in the latter city, but very faint. Burlington, Vt., 3d, 7.15 a. m., slight shock lasting several seconds; some people reported the occurrence of a second shock several minutes later. Contoocookville, N. H., 4th, 7.10 a. m., slight shock causing windows to rattle.

Sunsets.—The characteristics of the sky at sunset, as indication of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from 132 stations show 3,939 observations to have been made, of which 37 were reported doubtful; of the remainder 3,245 or 82.5 per cent. were followed by the expected weather.

Grasshoppers.—Fort Sill, 21st, disappearing, very few to be seen; Erath County, Texas, 8th, "The grasshoppers have destroyed what little wheat there was up"; Bosque County, Texas, 8th, "Large fields of wheat have been destroyed, and the grasshoppers are still remaining"; Denton County, Texas, 8th, "Grasshoppers have moved southward"; Hood County, Texas, 8th, 65 acres of wheat were destroyed on one farm.

Polar bands.—New Corydon, Ind., 16th, 21st, 24th; Guttenburg, Iowa, 3d; Yates Center, 9th; Gardiner, Me., 10th, 22d; Freehold, N. J., 2d, 23d; Ringgold, Ohio, 1st; Wytheville, Va., 1st, 3d, 5th, 21st, 22d, 26th, 27th, 30th; Pembina, 27th; Detroit, 24th.

Mirage.—Pembina, Dak., 3d, 25th.

Rainbow.—Burlington, Vt., 6th, during a light fall of snow the flakes were particularly noticeable for their perfect symmetry, and while the sun was still above the horizon a beautiful rainbow was formed in two segments, one in the ESE. and the other in the ENE.

Zodiacal light.—Cambridge, Mass., regularly looked for at 8 p. m., suspected on the 4th and somewhat visible on the 7th, 10th, 16th; observations on other evenings hindered by moonlight or clouds. New Corydon, Ind., 21st, 22d, 23d, 24th, 25th; Monticello, Iowa, 15th; Oregon, Mo., 15th; Waterbury, N. Y., 17th; Brookhaven, N. Y., 26th.

Sun spots.—The following record of solar phenomena by Mr. D. P. Todd, assistant in the nautical almanac office, is communicated by him for publication in this review:

Date.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	
Nov., 1879.									
4th, 8 a. m..	1	1	0	0	0	0	1	1	
4th, 4 p. m..	0	0	0	0	0	0	1	1	
5th, 3 p. m..	0	0	0	0	0	0	0	0	Faculæ.
7th, 8 a. m..	4	25	0	0	0	0	4	25	Do.
7th, 3 p. m..	0	0	0	0	0	0	4	25	Do.
9th, 1 p. m..	0	0	2	10	0	0	2	11	
10th, 8 a. m..	0	0	0	0	0	0	2	11	
11th, 4 p. m..	0	4	1	1	0	0	1	14	
13th, 8 a. m..	0	4	0	0	0	0	1	18	
14th, 4 p. m..	0	0	0	0	0	0	1	4	Spots of considerable size.
16th, 8 a. m..	0	0	0	0	0	0	1	3	Broad areas of faculæ.
16th, 10 a. m..	0	0	0	0	0	0	1	3	
17th, 8 a. m..	0	0	0	0	0	0	1	3	
21st, 8 a. m..	0	0	1	3	0	0	0	0	Spots probably disappeared by solar rotation.
26th, 8 a. m..	0	0	0	0	0	0	0	0	Faculæ.
27th, 9 a. m..	1	3	0	0	0	0	1	3	Do.
29th, 8 a. m..	1	3	0	0	0	0	2	6	Do.
30th, 11 a. m..	0	0	0	0	0	0	1	3	

NOTE.—On the 1st, at 5 p. m.; 2d, 5 p. m.; 22d, 8 p. m.; 23d, 9 a. m.; 24th, 8 a. m.; 25th, 4 p. m., the sun was also observed by Mr. Todd, but was entirely free from spots or faculæ.

Professor Hinrichs, Iowa City, Iowa, reports, "Sun spots large, indicating that the very protracted period with few or no spots is now definitely closed."

Mr. William Dawson, at Spiceland, Ind., observed no spots on the 2d and 3d; sky very poor. 4th, one small spot midway between the center and eastern edge of the sun. 6th, a group of four spots, one large with penumbra close to the southeast margin. 12th, a large group of about 25 spots (definition poor) in the southwest quadrant; one spot—or rather two very close together—appeared to be five or six thousand miles across; it had a large penumbra. 13th, one group of 25 spots. 16th, one group of three spots close to western edge. 18th, one spot and a considerable number of faculæ at the eastern and western edges. 19th, 21st, 24th, no spots. 28th, two spots close to each other near the eastern edge, faculæ. 30th, nine spots, one group, about half way from the center to southern edge of the sun bearing eastward; 1 spot quite large, with penumbra.

Mr. David Trowbridge, at Waterburg, N. Y., observed the sun on the following dates, but saw no spots: 3d, 4th, 5th, 20th, 23d, 25th, 27th, 30th. On the 7th, at 8.30 a. m., 1 spot near eastern margin of the sun's disk; 8th, 25 spots; 9th, 25 spots, in a large and small group; 10th, 7.30 a. m., 3 spots visible in one group, and a fourth one very faint; 13th, 1 large spot; 16th, 1 spot still visible, but quite faint, and situated near the western margin. The last group has undergone many changes during its visibility.

Mr. F. Hess, of Fort Dodge, Iowa, observed spots as follows: 6th, 1 p. m., one large oblong spot with a partial penumbra, and one small one without penumbra near the southeastern limb of the sun; 7th, 8 a. m. one large round spot surrounded by a penumbra and four smaller ones with white faculæ, all very distinct and lying in the southeastern quadrant; 1 p. m., one largea nd one small spot surrounded by a common penumbra, four others and faculæ all in the southeast qundrant; 9th, 10 a. m., one large and ten smaller spots in the southeast quadrant; 14th and 15th, 1 p. m., one large and ten smaller spots in the southwest quadrant; 16th, 3 p. m., only two spots but close together and surrounded by a common penumbra in the southwest quadrant; 28th, 8 a. m., one large faint spot near the sun's lower limb; 29th. 7 a. m., one large spot with penumbra and one small spot in the southeast quadrant; 9 a. m., one large spot with penumbra and two small ones, and faculæ in the southeast quadrant; 30th, 10 a. m., three spots were visible, but the weather was too hazy and windy for distinct vision. The sun was examined all other days of the month but no spots were seen.

Observations were made at Fort Whipple, Va., each day during the month but no spots observed.

NOTES AND EXTRACTS.

Meteorological observations on the Swedish Northeast Passage Expedition.—The Vega, in command of Professor Nordenskiold, was frozen in on September 28, 1878, in 67° 7′ N. and 173° 30′ W. From letters dated up to April 1, 1879, and later, the following abstract is made (see Nature, November 13, 1879): The *thickness of ice* between the Vega and shore was as follows: 1878, September 28, too thin to bear a man; October 3d, thick enough for the Tchuktches natives; December 1, 56 centimeters or 22.04 inches. 1879, January 1, 92 centimeters or 36.22 inches; February 1, 108 centimeters or 42.52 inches; February 15, 120 centimeters or 47.24 inches; March 1, 123 centimeters or 48.42 inches; April 1, 127 centimeters or 50 inches; May 1, 154 centimeters or 60.63 inches; June 1, 154 centimeters or 60.63 inches; July 1, 103 centimeters or 40.55 inches. Open water always existed a short distance to the northward.

The temperature during the winter was as follows:

Month.	Minimum.		Maximum.		Mean.	
	Centigrade.	Fahrenheit.	Centigrade.	Fahrenheit.	Centigrade.	Fahrenheit.
1878—October	—20°.8	— 5°.44	+0°.8	33°.44	— 5°.21	22°.62
November	—27 .2	—16 .96	—6 .3	20 .66	—16 .59	2 .14
December	—37 .1	—34 .78	+1 .2	34 .16	—22 .81	— 9 .06
1879—January	—45 .5	—49 .90	—4 .1	24 .62	—25 .05	—13 .09
February	—43 .8	—46 .84	+0 .2	32 .36	—25 .08	—13 .15
March	—39 .8	—39 .64	—4 .2	24 .44	21 .65	— 6 .97
April	—38 .0	—36 .40	—4 .6	23 .72	—18 .93	— 2 .07
May	—26 .8	—16 .24	+1 .8	35 .24	— 6 .97	19 .45
June	—14 .3	— 6 .26	+6 .8	44 .24	— 0 .60	30 .92

The barometric pressure was high, 1878, December 22, 6 a. m., 782.0^{mm}, or 30.79 inches, and 1879, February 17, 6 a. m., 788.1^{mm}, or 31.03 inches; it was lowest 1873, December 31, 2 a. m., 723.3^{mm}, or 28.48 inches.

The surface winds were almost constantly between NW. and NNW., but the lower clouds moved with similar regularity from SE., which latter current, when it sank to the ground, brought heat and comparatively dry air. The natives say that mountain heights exist in the Tchuktche peninsula, and this may explain the *föhn-like* properties of the SE. wind. The coldest winds come from the SW. and W., or from the Siberian plain.

Snowfall was not particularly great, but it drifted remarkably during high winds. Snow was precipitated from the stratum of air within a few inches of the ground on clear nights, and was drifted from NW. to SE. over the north coast of Siberia to more southerly regions.

Auroras were at a minimum of frequency and brilliancy, but the faint auroral arches were studied with great success. These remained unaltered in position hour after hour, and day after day they were constantly visible in clear weather. The average height of these arches Nordenskiold determined to be about .03 of the earth's radius, or about 120 miles, and a very interesting theory is broached by him in this connection.

Tidal observations gave a maximum range of 18 centimeters, or 7 inches, while the wind affected the water by nearly 2 meters, or 6 feet.

Aeronautics.—In Nature, November 20, 1879, p. 64, Dr. B. W. Richardson describes the successful method of Mr. Fleuss for living under water, and concludes as follows: "In whatever way Mr. Fleuss gets breathing room under the water, he has, without a doubt, achieved a great practical success. He has learned how to live independently for a long time shut off from all external access of air. He has learned, if I may so say, to become artificially amphibious, and if his plan succeeds, the cumbrous diving-pumps are done away with and the art of diving is vastly simplified.

"Again, if he can live so long on the small reserve which he carries down with him in his dress, he has only to enlarge the dress, to expand it, that is to say, into a submerged vessel, to be able to go anywhere under the sea and do with intelligence what is now left to unintelligent mechanism. What such an intelligent direction might do with torpedoes it is not at all pleasant to contemplate.

"The plan may be used for the purposes of deep-sea exploration, and the suggestion I made respecting my Salutlanders, that they sought for discoveries on the floors of the great oceans, may be so much nearer to accomplishment than the time which I assign to it, that I may happily live to have the return laugh at what was called 'the most visionary of speculative fancies. It is equally probable that the aeronaut may be able to rise much higher than he has yet done in this dress, or in a car specially constructed on a similar plan.

"The apparatus may almost certainly be applied at once to another service very different in kind, and on land instead of water. When a man can move about with an air-supply in his pockets, so to speak, he can go into fire as well as water. In a fire-proof non-conducting dress, provided with a Fleuss breathing apparatus, a fireman could enter a burning house, and without danger of suffocation go wherever the weight of his body could be borne.

"Lastly, in wells charged with foul air, or in mines charged with choke-damp and other poisonous gases, the Fleuss apparatus will, I feel certain, prove of the greatest practical service, and I am happy in being the means of introducing it at length to the notice of my *confrères* in science."

A balloon liberated October 7, at Waukesha, Wis., fell near Milwaukee, Wis., on October 10. It had been driven eastward and then westward to its landing place.—*Nature, November* 20.

Atmospheric electricity.—The following extract from Nature, November 20th, p. 72, is based on an article in the Journal de Physique for October: "For observation of atmospheric electricity M. Mascart uses a Thomson electrometer connected with a vessel having continuous outflow of water. The deflections of the needle are transmitted every two and a half minutes to a pencil which records them on a sheet of paper. The series of traces forms a curve, not continuous, indeed, but nearly so. This apparatus was put in action at the College of France in the end of February this year, and the curves obtained during the following five months present several interesting features. The potential of the air is shown to be generally positive, with more or less rapid variations. In bad weather the curves become more irregular; rain nearly always produces very great negative deflections. The change of sign appears before the rain comes, and sometimes rain is followed by very high positive indications. There are also some very rare cases of positive rains, and of great negative deflections without apparent rain in the neighborhood. (This predominance of negative electricity in rain clouds M. Mascart regards as an important point in the question of the origin of atmospheric electricity.) Neglecting accidental variations one is struck by the fact that the electricity is much more uniform at night and more variable by day. The potential is also considerably higher at night than in the day. The maximum seems to occur about 9 or 10 p. m.; the curve descends slowly toward 6 a. m., then more rapidly; reaches a minimum about 3 p. m., and then rises again in a nearly uniform manner. The indications by the curves are confirmed by numerical tables of monthly averages of eight daily observations at three hours' interval. The results thus obtained are in contradiction with ideas commonly adopted. M. Mascart remarks that the continuous maximum of positive electricity observed at night may be of an exceptional character, owing to the anomalous season; he also suggests the possibility of previous observations having been vitiated through defective insulation."

Clouds and cyclones.—Prof. J. K. Laughton, in Fraser's Magazine, August, 1879, gives the following summary of the views of Rev. W. C. Ley: "This simple theory is to some extent in accordance with fact; but to the recent and still continuing investigations of the Rev. W. Clement Ley we owe not only a more comprehensive description of cyclonic weather, but a singularly ingenious interpretation of it.

"It has long been the custom amongst meteorologists to conceive the cyclone as divided into two halves by the line of its advance, named right and left in the same way as the banks of a river, looking, that is, in the direction in which it is traveling. Mr. Ley now proposes another division, that, namely, by the diameter drawn at right angles to the line of its advance; and these halves he would call the front and the rear. According to this division, a cyclone is quartered into right and left front, right and left rear; and Mr. Ley believes that he has established the fact that the different types of weather belong not so much to the different winds as to the different quarters of the cyclone. He describes the front as being preceded by a fringe of cirrus and very high cirro-stratus, extending in streaks to a distance of perhaps 100 miles; these, as they advance, curl upward and outward, as though kept asunder by electrical repulsion; but as they come over the observer, they are then 'seen to be more or less reticulated, forming a filmy sheet, the structure of which becomes less and less discernible.' In other cases the threads are but faintly marked from the first, and 'the sky seems simply to become gradually overspread with a milky looking film of whitish cloud matter.' Bit by bit as it advances, this sheet seems to grow downward, until it is shut out from our view by the interposition of dark masses of lower cloud; the barometer, till then slightly on the rise, begins to fall; the sky becomes covered with nimbus, and rain is more or less general, the right front being the quarter of heaviest precipitation. As the center or the transverse diameter approaches, the nimbus breaks; on the right side, the blue sky begins to peep through, and with broken showers and shower clouds, cumulus, cirro-stratus, cirrus, and a rising barometer, the cyclone passes away; while on the left, the sky is frequently overcast and hazy to the last.

"In explanation of these appearances, Mr. Ley considers that, in general terms, the air throughout the front of the cyclone has a slight upward movement, the expansion due to which is of itself enough to account for the heavy rainfall frequent in that half; the excess in the right front depending perhaps on its geographical position. He considers that a large portion of the air which has so ascended in front, having been whirled round and having its moisture squeezed out of it, is forced downward in the rear, appearing as a northerly wind, cold and dry by reason not of its coming from the north, but of its coming from above. It is from this condensation of vapor and the comparative vacuum so formed in front, this pressure of a descending current in the rear, that Mr. Ley would attribute the onward march of a cyclone, which he conceives as continually dying out, and being continually reformed in advance."

Published by order of the Secretary of War.

ALBERT J. MYER,
Brigadier-General (Brevet Assigned), Chief Signal Officer, U. S. A.

PAPER 38.

MONTHLY WEATHER REVIEW, DECEMBER, 1879.

INTRODUCTION.

In preparing this Review the following data, received up to November 14th, have been used, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 134 Signal Service stations and 15 Canadian stations, as telegraphed to this office; 145 monthly journals and 145 monthly means from the former, and 13 monthly means from the latter; reports from 31 sunset stations; 240 monthly registers from voluntary observers; 26 monthly registers from United States Army post surgeons; marine records; international simultaneous observations; monthly reports from voluntary observers in, and the local weather service of, Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

Upon chart No. II is shown the general distribution of the atmospheric pressure for the month, as reduced to sea level, by the isobaric lines. The mean pressure for the present month, when compared with the average for December of the past seven years, is higher for the Atlantic states, Lake region, Minnesota and Eastern Dakota, being greatest for New England—from 0.11 to 0.22 of an inch. It is about normal for Florida and California. For the remaining sections it is generally lower, especially in the Rocky Mountain regions. It varies from 0.14 of an inch below on Pike's Peak to 0.19 at Virginia City.

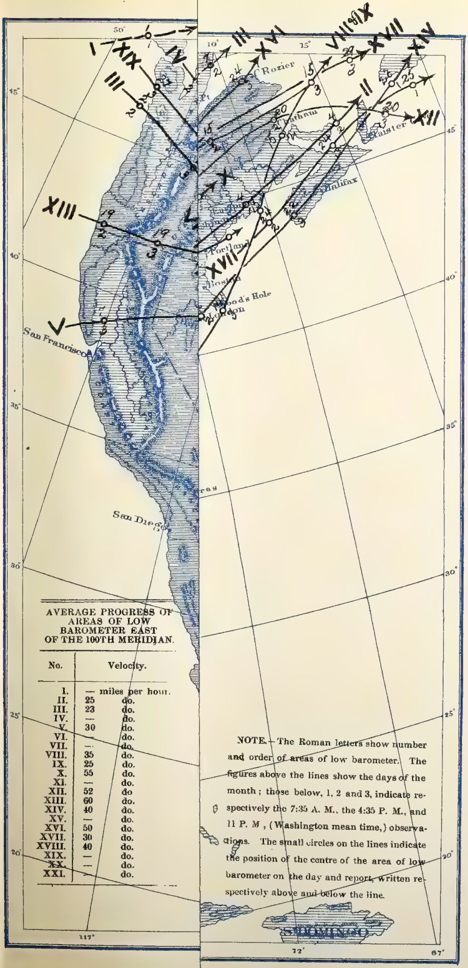
Local barometric ranges.—These have been least in Florida, New Mexico, and Southern California. They have been greatest over the western portions of Kansas and Nebraska, Northwestern Dakota, Lake Superior, Maine, Idaho, and Northern California. By districts they are as follows: New England, 1.01 to 1.40 inch; Middle Atlantic states, 0.83 to 1.12 inch; Lower Lake region, 1.08 to 1.20 inch; Tennessee and the Ohio valley, 0.74 to 1.05 inch; Upper Lake region, 1.04 to 1.54 inch; Upper Mississippi valley, 1.08 to 1.34 inch; Red River of the North valley, 1.19 to 1.40 inch; Lower Missouri valley, 1.43 to 1.45 inch; Upper Missouri valley, 0.95 to 1.54 inch; Eastern Rocky Mountain slope, 0.70 to 1.60 inch; Virginia City, 0.94 inch; Salt Lake City, 1.29 inch; Winnemucca, 1.16 inch; Boise City, 1.34 inch; Portland, Oreg., 1.25 inch; Central Pacific Coast region, 0.95 to 1.37 inch; Los Angeles, 0.75 inch; New Mexico, 0.64 to 0.79 inch; Western Texas, 0.56 to 1.58 inch; Western Gulf states, 0.74 to 1.15 inch; Eastern Gulf states, 0.71 to 0.77 inch; South Atlantic states, 0.59 to 0.87 inch; Key West, 0.32 inch.

Areas of high barometer.—Of these eleven are described. Nos. IV, IX, and X are the most interesting on account of the low temperatures accompanying them, especially No. IX.

No. I.—On the 1st this high area approached the Northwest from British America. Its progress southward was prevented by low pressure, No. II, then advancing eastward; in fact it was forced to remain north of the Lake region on the 2d. North of Pembina the temperature fell below zero. During the afternoon of the 3d the barometers at Chatham, N. B., and Sydney, C. B., rose to 0.55 and 0.56 inch, respectively, above the normal. On the following day it disappeared over the Gulf of Saint Lawrence in advance of low No. II.

No. II.—It advanced southeastward on the 4th toward the Saint Lawrence valley,

No. 1.



AVERAGE PROGRESS OF AREAS OF LOW BAROMETER EAST OF THE 100TH MERIDIAN.

No.	Velocity.	
I.	—	miles per hour.
II.	25	do.
III.	23	do.
IV.	—	do.
V.	30	do.
VI.	—	do.
VII.	—	do.
VIII.	35	do.
IX.	25	do.
X.	55	do.
XI.	—	do.
XII.	52	do
XIII.	60	do.
XIV.	40	do.
XV.	—	do.
XVI.	50	do.
XVII.	30	do.
XVIII.	40	do.
XIX.	—	do.
XX.	—	do.
XXI.	—	do.

NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7:35 A. M., the 4:35 P. M., and 11 P. M., (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above and below the line.

"In explanation of these appearances, Mr. Ley considers that, in general terms, the air throughout the front of the cyclone has a slight upward movement, the expansion due to which is of itself enough to account for the heavy rainfall frequent in that half; the excess in the right front depending perhaps on its geographical position. He considers that a large portion of the air which has so ascended in front, having been whirled round and having its moisture squeezed out of it, is forced downward in the rear, appearing as a northerly wind, cold and dry by reason not of its coming from the north, but of its coming from above. It is from this condensation of vapor and the comparative vacuum so formed in front, this pressure of a descending current in the rear, that Mr. Ley would attribute the onward march of a cyclone, which he conceives as continually dying out, and being continually reformed in advance."

Published by order of the Secretary of War.

ALBERT J. MYER,
Brigadier-General (Brevet Assigned), Chief Signal Officer, U. S. A.

PAPER 38.

MONTHLY WEATHER REVIEW, DECEMBER, 1879.

INTRODUCTION.

In preparing this Review the following data, received up to November 14th, have been used, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 134 Signal Service stations and 15 Canadian stations, as telegraphed to this office; 145 monthly journals and 145 monthly means from the former, and 13 monthly means from the latter; reports from 31 sunset stations; 240 monthly registers from voluntary observers; 26 monthly registers from United States Army post surgeons; marine records; international simultaneous observations; monthly reports from voluntary observers in, and the local weather service of, Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

Upon chart No. II is shown the general distribution of the atmospheric pressure for the month, as reduced to sea level, by the isobaric lines. The mean pressure for the present month, when compared with the average for December of the past seven years, is higher for the Atlantic states, Lake region, Minnesota and Eastern Dakota, being greatest for New England—from 0.11 to 0.22 of an inch. It is about normal for Florida and California. For the remaining sections it is generally lower, especially in the Rocky Mountain regions. It varies from 0.14 of an inch below on Pike's Peak to 0.19 at Virginia City.

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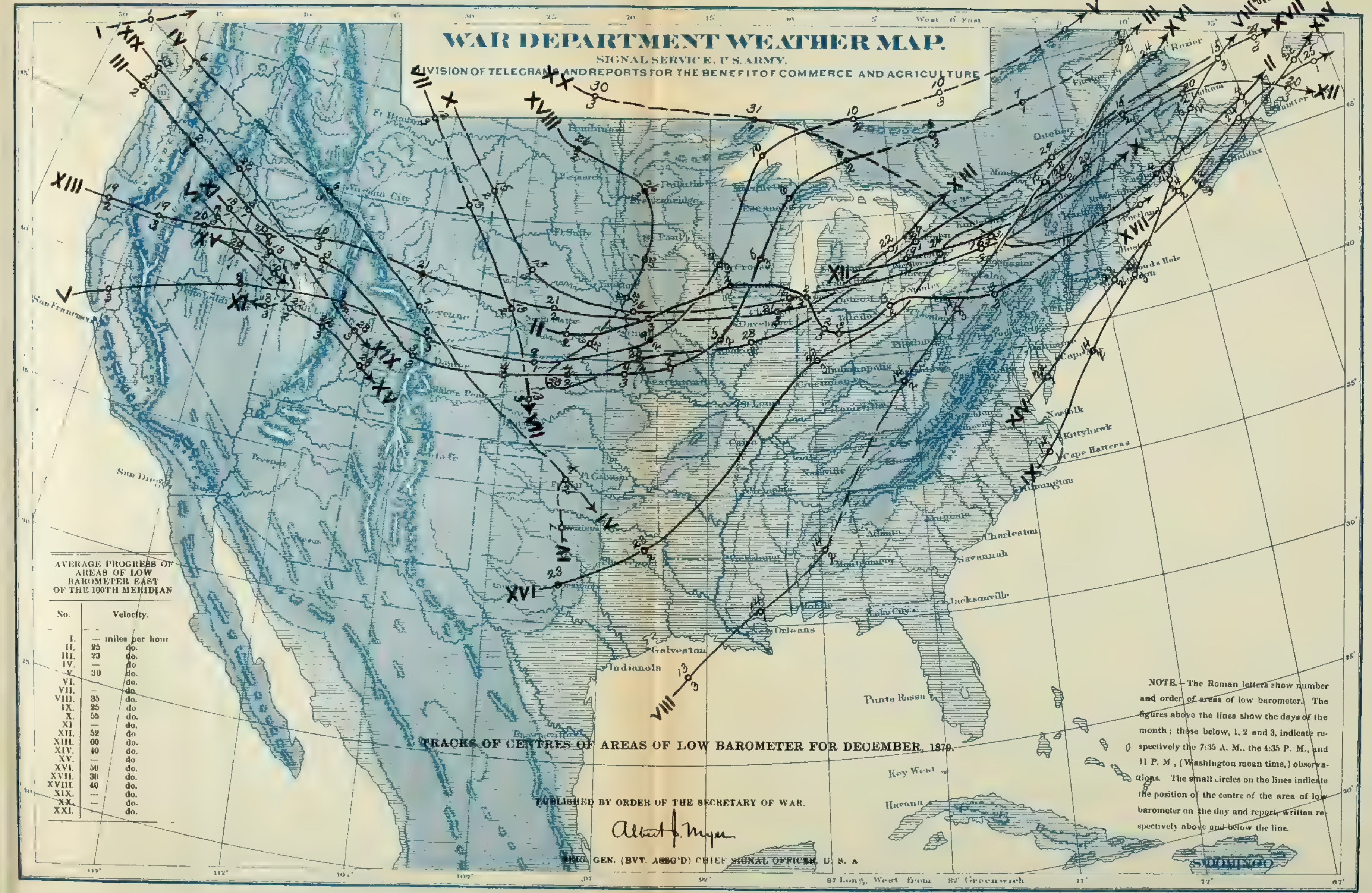
No. II.—It advanced southeastward on the 4th toward the Saint Lawrence valley,

THE PREPARATION OF CHARTS OF THIS SERIES COMMENCED NOVEMBER 8, 1870



WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE

TRACKS OF CENTRES OF AREAS OF LOW BAROMETER FOR DECEMBER, 1879.

AVERAGE PROGRESS OF AREAS OF LOW BAROMETER EAST OF THE 100TH MERIDIAN

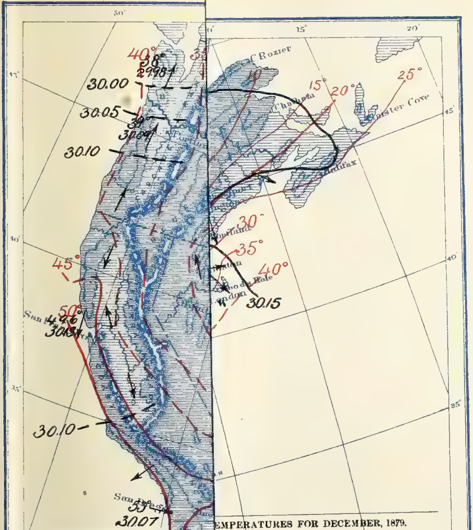
No.	Velocity.	
I.	—	miles per hour
II.	25	do.
III.	23	do.
IV.	—	do
V.	30	do.
VI.	—	do.
VII.	—	do.
VIII.	35	do.
IX.	25	do
X.	55	do.
XI	—	do.
XII.	52	do
XIII.	60	do.
XIV.	40	do.
XV.	—	do
XVI.	50	do.
XVII.	30	do.
XVIII.	40	do.
XIX.	—	do.
XX.	—	do.
XXI.		do.

NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7:35 A. M., the 4:35 P. M., and 11 P. M., (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above and below the line.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.



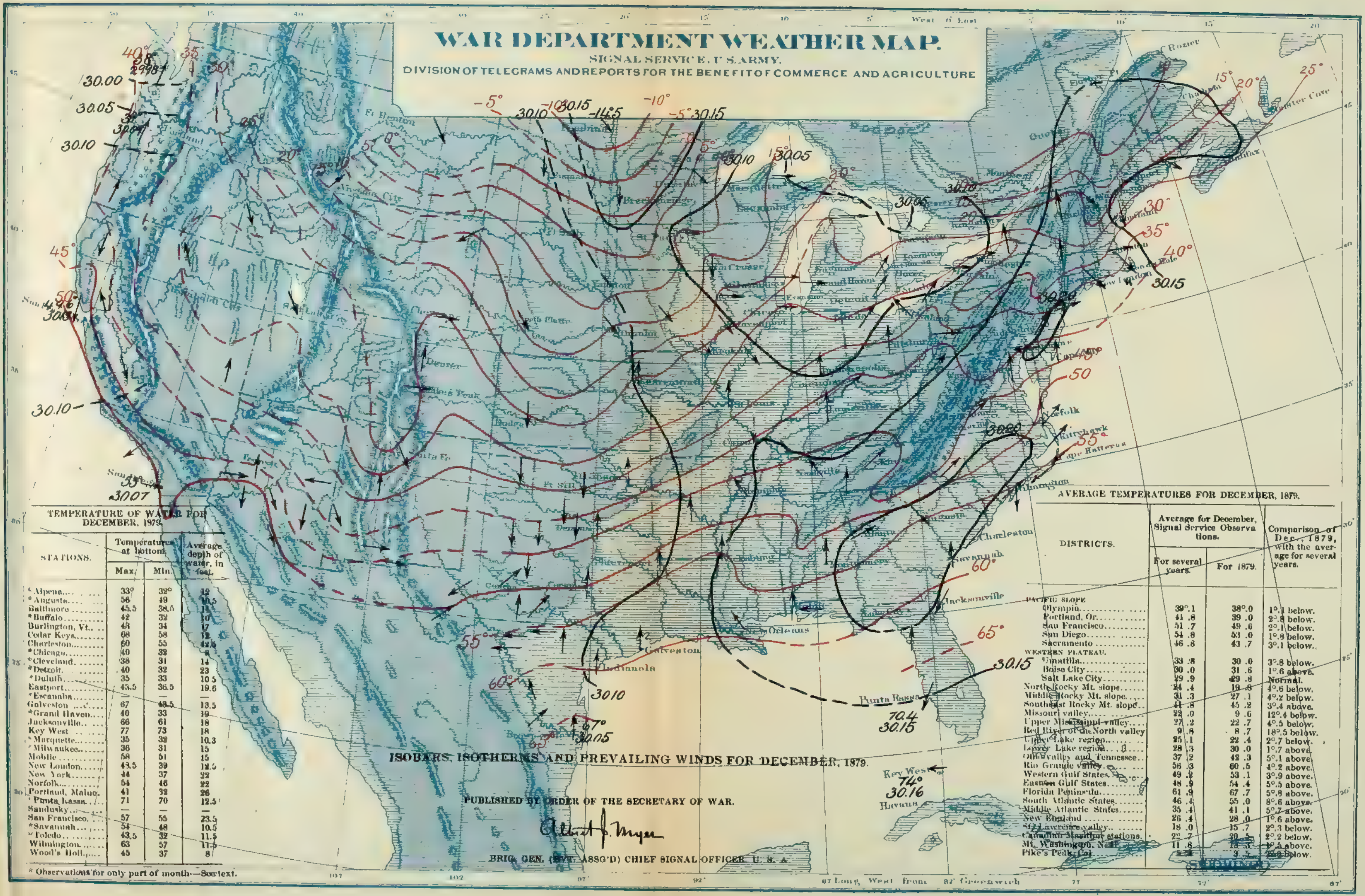
TEMPERATURE OF WATER FOR DECEMBER, 1879.

STATIONS.	Temperatures at bottom.	
	Max.	Min.
*Alpena	33°	32°
*Augusta	56	49
Baltimore	45.5	38.5
*Buffalo	42	32
Burlington, Vt.	48	34
Cedar Keys	68	58
Charleston	60	55
*Chicago	40	32
*Cleveland	38	31
*Detroit	40	32
*Duluth	35	33
Eastport	43.5	36.5
*Escanaba	—	—
Galveston	67	43.5
*Grand Haven	40	33
Jacksonville	66	61
Key West	77	73
*Marquette	35	32
*Milwaukee	36	31
Mobile	58	51
New London	43.5	39
New York	44	37
Norfolk	54	46
Portland, Maine	41	32
*Punta Rassa	71	70
Sandusky	—	—
San Francisco	57	55
*Savannah	54	48
*Toledo	43.5	32
Wilmington	63	57
Wood's Holl	45	37

* Observations for only part of month

EMPERATURES FOR DECEMBER, 1879.

	Average for December, Signal Service Observations.		Comparison of Dec., 1879, with the average for several years.
	For several years.	For 1879.	
	39°.1	38°.0	1°.1 below.
	41 .8	39 .0	2°.8 below.
	51 .7	49 .6	2°.1 below.
	54 .8	53 .0	1°.8 below.
	46 .8	43 .7	3°.1 below.
	33 .8	30 .0	3°.8 below.
	30 .0	31 .6	1°.6 above.
	29 .9	29 .8	Normal.
	24 .4	19 .8	4°.6 below.
ne.	31 .3	27 .1	4°.2 below.
slope	41 .8	45 .2	3°.4 above.
	22 .0	9 .6	12°.4 below.
ley.	27 .2	22 .7	4°.5 below.
valley	9 .8	8 .7	18°.5 below.
	25 .1	22 .4	2°.7 below.
	28 .3	30 .0	1°.7 above.
essee	37 .2	42 .3	5°.1 above.
	56 .3	60 .5	4°.2 above.
	49 .2	53 .1	3°.9 above.
	48 .9	54 .4	5°.5 above.
	61 .9	67 .7	5°.8 above.
	46 .4	55 .0	8°.6 above.
	35 .4	41 .1	5°.7 above.
	26 .4	28 .0	1°.6 above.
	18 .0	15 .7	2°.3 below.
ations.	22 .7	20 .5	2°.2 below.
	11 .8	[illegible]	1°.5 above.
	[illegible]	3 .5	[illegible] below.



WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE

ISOBARS, ISOTHERMS AND PREVAILING WINDS FOR DECEMBER, 1879.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

TEMPERATURE OF WATER FOR DECEMBER, 1879.

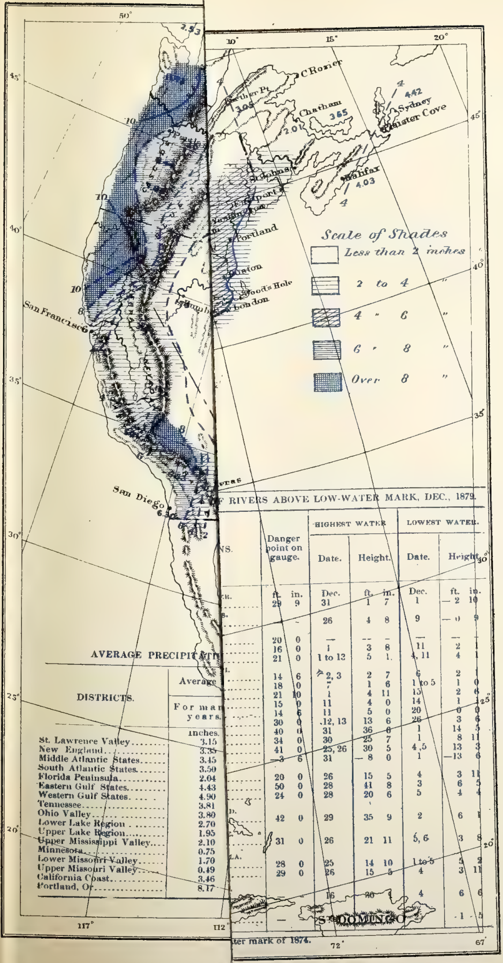
STATIONS.	Temperature at bottom. Max.	Temperature at bottom. Min.	Average depth of water, in feet.
*Alpena	33°	32°	12
*Augusta	56	49	10.5
Baltimore	45.5	38.5	14
*Buffalo	42	32	10
Burlington, Vt.	43	34	17
Cedar Keys	68	58	12
Charleston	60	55	42.6
*Chicago	40	32	8
*Cleveland	38	31	14
*Detroit	40	32	23
*Duluth	35	33	10.5
Eastport	43.5	36.5	19.6
*Escanaba	—	—	—
Galveston	67	48.5	13.5
*Grand Haven	40	33	19
Jacksonville	66	61	18
Key West	77	73	18
*Marquette	35	32	10.3
*Milwaukee	36	31	15
Mobile	58	51	15
New London	43.5	39	12.5
New York	44	37	22
Norfolk	54	46	22
Portland, Maine	41	32	26
*Punta Rassa	71	70	12.5
Sandusky	—	—	—
San Francisco	57	55	23.5
*Savannah	54	48	10.5
*Toledo	43.5	32	11.5
Wilmington	63	57	11.5
Wood's Holl	45	37	8

* Observations for only part of month.—See text.

AVERAGE TEMPERATURES FOR DECEMBER, 1879.

DISTRICTS.	Average for December, Signal Service Observations. For several years.	Average for December, Signal Service Observations. For 1879.	Comparison of Dec., 1879, with the average for several years.
PACIFIC SLOPE.			
Olympia	39°.1	38°.0	1°.1 below.
Portland, Or.	41 .8	39 .0	2°.8 below.
San Francisco	51 .7	49 .6	2°.1 below.
San Diego	54 .8	53 .0	1°.8 below.
Sacramento	46 .8	43 .7	3°.1 below.
WESTERN PLATEAU.			
Umatilla	33 .8	30 .0	3°.8 below.
Boise City	30 .0	31 .6	1°.6 above.
Salt Lake City	29 .9	29 .8	Normal.
North Rocky Mt. slope	24 .4	19 .8	4°.6 below.
Middle Rocky Mt. slope	31 .3	27 .1	4°.2 below.
Southeast Rocky Mt. slope	41 .8	45 .2	3°.4 above.
Missouri valley	22 .0	9 .6	12°.4 below.
Upper Mississippi valley	27 .2	22 .7	4°.5 below.
Red River of the North valley	9 .8	- 8 .7	18°.5 below.
Upper Lake region	25 .1	22 .4	2°.7 below.
Lower Lake region	28 .3	30 .0	1°.7 above.
Ohio valley and Tennessee	37 .2	42 .3	5°.1 above.
Rio Grande valley	56 .3	60 .5	4°.2 above.
Western Gulf States	49 .2	53 .1	3°.9 above.
Eastern Gulf States	48 .9	54 .4	5°.5 above.
Florida Peninsula	61 .9	67 .7	5°.8 above.
South Atlantic States	46 .4	55 .0	8°.6 above.
Middle Atlantic States	35 .4	41 .1	5°.7 above.
New England	26 .4	28 .0	1°.6 above.
St. Lawrence valley	18 .0	15 .7	2°.3 below.
Canadian Maritime stations	22 .7	20 .5	2°.2 below.
Mt. Washington, N. H.	11 .8	[illegible]	[illegible] above.
Pike's Peak, Col.	[illegible]	3 .5	[illegible] below.

No. III.



F RIVERS ABOVE LOW-WATER MARK, DEC., 1879.

NS.	Danger point on gauge.		HIGHEST WATER			LOWEST WATER.		
			Date.	Height.		Date.	Height.	
	ft.	in.	Dec.	ft.	in.	Dec.	ft.	in.
ER.	29	9	31	1	7	1	— 2	10
S.	—	-	26	4	8	9	— 0	9
	20	0	—	—	—	—	—	—
	16	0	1	3	8	11	2	1
	21	0	1 to 13	5	1	4, 11	4	1
I.	14	6	2, 3	2	7	6	2	1
	18	0	7	1	6	1 to 5	1	0
	21	10	1	4	11	15	2	6
	15	0	11	4	0	14	1	1
	14	6	11	5	0	20	0	0
	30	0	12, 13	13	6	26	3	6
	40	0	31	36	6	1	14	5
	34	0	30	25	7	1	8	11
	41	0	25, 26	30	5	4, 5	13	3
	—3	6	31	— 8	0	1	—13	6
	20	0	26	15	5	4	3	11
	50	0	28	41	8	3	6	5
	24	0	28	20	6	5	4	4
D.	42	0	29	35	9	2	6	1
	31	0	26	21	11	5, 6	3	8
LA.	28	0	25	14	10	1 to 5	5	2
	29	0	26	15	5	4	3	11
	—	—	16	30	1	4	6	6
	—	—				2	-1	-5

ter mark of 1874.

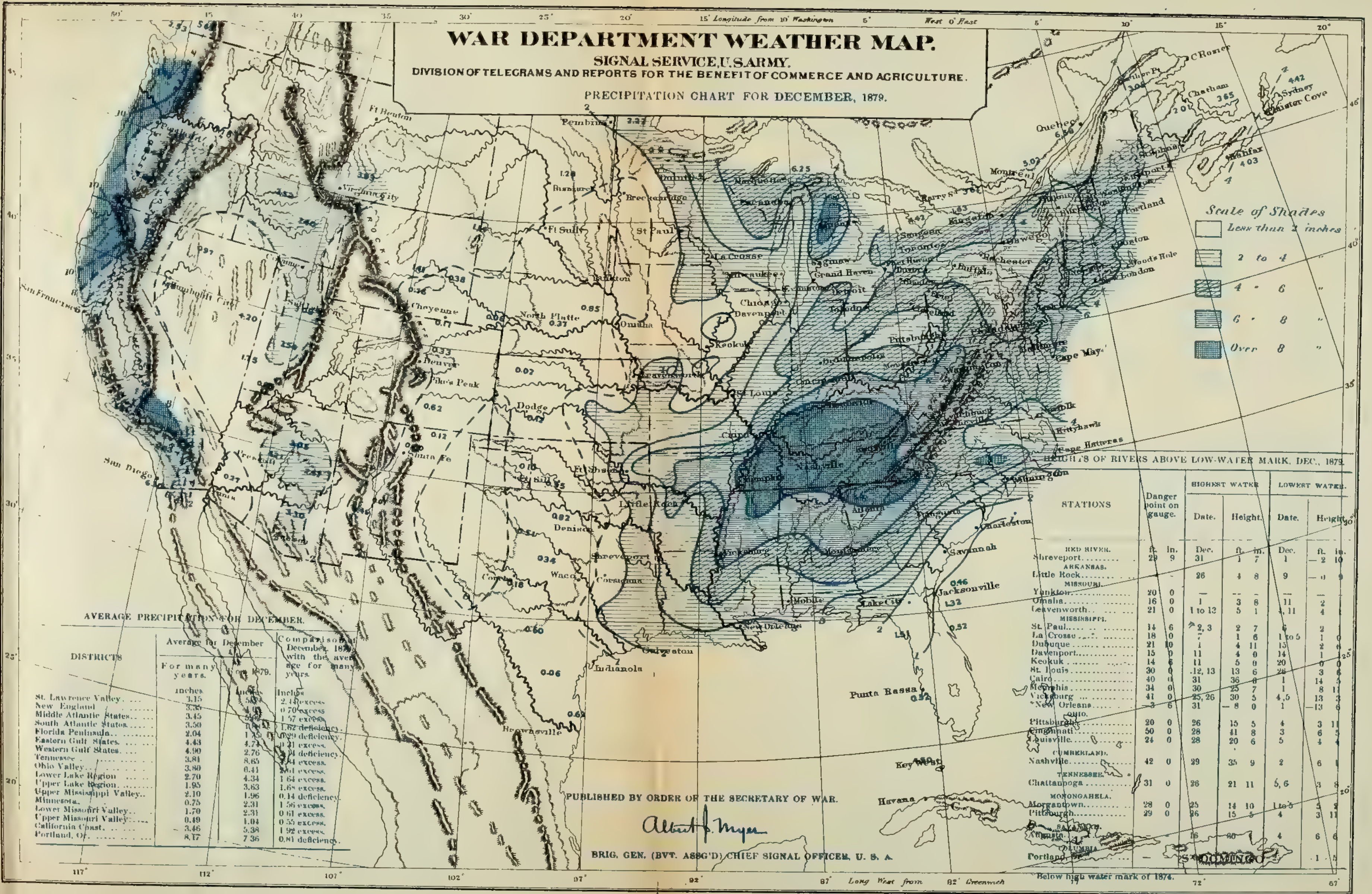
AVERAGE PRECIPITATI

DISTRICTS.	Average
	For man years.
	inches.
St. Lawrence Valley	3.15
New England	3.35
Middle Atlantic States	3.45
South Atlantic States	3.50
Florida Peninsula	2.04
Eastern Gulf States	4.43
Western Gulf States	4.90
Tennessee	3.81
Ohio Valley	3.80
Lower Lake Region	2.70
Upper Lake Region	1.95
Upper Mississippi Valley	2.10
Minnesota	0.75
Lower Missouri Valley	1.70
Upper Missouri Valley	0.49
California Coast	3.46
Portland, Or	8.17

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

PRECIPITATION CHART FOR DECEMBER, 1879.



AVERAGE PRECIPITATION FOR DECEMBER.

DISTRICTS	Average for December For many years.	Average for December For 1879.	Comparison of December, 1879, with the average for many years.
	inches	inches	Inches
St. Lawrence Valley	3.15	[illegible]	[illegible] excess
New England	3.35	[illegible]	0.70 excess
Middle Atlantic States	3.45	[illegible]	1.57 excess
South Atlantic States	3.50	[illegible]	1.62 deficiency.
Florida Peninsula	2.04	1.75	0.29 deficiency.
Eastern Gulf States	4.43	4.74	0.31 excess.
Western Gulf States	4.90	2.76	[illegible] deficiency.
Tennessee	3.81	8.65	[illegible] excess.
Ohio Valley	3.80	6.41	[illegible] excess.
Lower Lake Region	2.70	4.34	1.64 excess.
Upper Lake Region	1.95	3.63	1.68 excess.
Upper Mississippi Valley	2.10	1.96	0.14 deficiency.
Minnesota	0.75	2.31	1.56 excess.
Lower Missouri Valley	1.70	2.31	0.61 excess.
Upper Missouri Valley	0.49	1.04	0.55 excess.
California Coast	3.46	5.38	1.92 excess.
Portland, Or.	8.17	7.36	0.81 deficiency.

HEIGHTS OF RIVERS ABOVE LOW-WATER MARK, DEC., 1879.

STATIONS	Danger point on gauge.		HIGHEST WATER.			LOWEST WATER.		
			Date.	Height.		Date.	Height.	
	ft.	in.	Dec.	ft.	in.	Dec.	ft.	in.
RED RIVER.								
Shreveport	29	9	31	1	7	1	— 2	10
ARKANSAS.								
Little Rock	-	-	26	4	8	9	— 0	9
MISSOURI.								
Yankton	20	0	—	—	—	—	—	
Omaha	16	0	1	3	8	11	2	
Leavenworth	21	0	1 to 13	5	1	1, 11	4	
MISSISSIPPI.								
St. Paul	14	6	2, 3	2	7	6	2	
La Crosse	18	0	7	1	6	1 to 5	1	0
Dubuque	21	10	1	4	11	15	2	6
Davenport	15	0	11	4	0	14	1	
Keokuk	14	6	11	5	0	20	0	0
St. Louis	30	0	12, 13	13	6	26	3	6
Cairo	40	0	31	36	8	1	14	5
Memphis	34	0	30	25	7	1	8	11
Vicksburg	41	0	25, 26	30	5	4, 5	13	3
*New Orleans	—3	6	31	— 8	0	1	—13	6
OHIO.								
Pittsburgh	20	0	26	15	5	4	3	11
Cincinnati	50	0	28	41	8	3	6	5
Louisville	24	0	28	20	6	5	4	4
CUMBERLAND.								
Nashville	42	0	29	35	9	2	6	
TENNESSEE.								
Chattanooga	31	0	26	21	11	5, 6	3	8
MONONGAHELA.								
Morgantown	28	0	25	14	10	1 to 5	5	[illegible]
Pittsburgh	29	0	26	15	5	4	3	11
SAVANNAH.								
Augusta	-	-	16	[illegible]		4	6	6
COLUMBIA.								
Portland, Or.	—						1	5

*Below high water mark of 1874.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

with its southwestern side covering the Lake region. Morning of the 5th it covered the lower Saint Lawrence valley and New England; a. m. barometer at Quebec, 30.56 inches, or 0.61 inch above the normal; midnight at Sydney, 0.71 above. During the 6th it passed eastward as low pressure No. III approached.

No. III made its appearance in the extreme Northwest on the 7th. The morning minimum temperatures were below zero from northeastern Montana to northwestern Minnesota; —15° Fah. at Fort Stevenson, Dakota, and —29° at Humboldt, B. A. During the 8th it progressed eastward with the central highest pressure north of the lakes. The a. m. minimum temperature at North Platte was —13°. It crossed the Saint Lawrence valley on the 9th. The midnight barometer at Chatham was 30.69 or 0.86 inch above the normal. 10th.—During the approach of low pressure No. V, it withdrew to the eastward.

No. IV.—On the 10th the pressure, which had been below the normal from the North Pacific coast east and southeast beyond the Mississippi valley, began increasing. By midnight it was highest in Dakota. 11th, a. m. barometer at Yankton, 0.39 above the normal; minimum temperatures below zero from Colorado and Western Kansas to Montana, Dakota, Minnesota, and northwestern Wisconsin, and —23° at Fort Stevenson. Cold, high, northerly winds, and at places gales, marked its advance; on the Texas coast quite a severe "norther," with a maximum hourly wind velocity of 40 miles at Indianola. 12th, in the morning heavy frosts occurred over the interior of the Gulf states, and light frosts at places along the coast. The central highest pressure moved from the Northwest to the Ohio valley by midnight. At Pembina the a. m. minimum temperature was —41°. During the 13th, with increasing central pressure, it moved to New England, Nova Scotia, and Brunswick; midnight barometer at Chatham, 30.78, or 0.95 above the normal. Excepting the Pacific, Gulf, and South Atlantic coasts, the morning minimum temperatures were below freezing, and below zero in the lower Saint Lawrence Valley. 14th, a. m. barometer at Halifax 30.80, or 0.96 above the normal. During the day it passed eastward beyond Nova Scotia, and the pressure rapidly decreased as low pressure No. IX advanced.

No. V.—From the 10th to the 15th the pressure continued considerably above the normal in the Middle Pacific coast region. The central highest pressure was, apparently, at some distance off the coast and oscillating northward to the North Pacific coast, and southward to the South Pacific coast. On the 14th it extended southeastward, and on the 15th and 16th it gradually disappeared over Arizona.

No. VI appeared night of the 13th in the extreme Northwest. The a. m. minimum temperature at Pembina on the 14th was —28°. It moved southward very rapidly during the day. Morning of the 15th it appeared as a narrow barometric ridge extending from the Red River of the North Valley to Texas, with decreasing pressure and minimum temperature of —30° at Breckenridge. Upon this and the following days it gradually passed south and eastward across the Southern states, and disappeared off the South Atlantic coast.

No. VII.—Following low pressure No. X, it rapidly advanced southward from British America over the Northwest on the 16th, with brisk to high northerly winds and cold weather. Morning of 17th the barometer at Breckenridge read 30.66, or 0.43 above the normal. The a. m. minimum temperature was below zero from the northern portions of Iowa and Nebraska to Wisconsin, Minnesota, Dakota and Montana; —28° at Fort Keogh, —30° at Fort Buford, and —38° at Fort Garry. During the day it advanced southeastward to the Upper Mississippi valley, with a pressure slightly above 30.50 inches. During the 18th it began breaking up as it passed eastward on account of the development of low pressure No. XI in the Rocky Mountain region. Morning of the 19th the pressure was highest in the South Atlantic states and Saint Lawrence valley. The former was dissipated during the day, while the latter rapidly passed southeastward over Nova Scotia in advance of low pressure No. XII. Cautionary off-shore signals were ordered on the morning of the 17th along the Texas coast for a "norther;" afternoon, for the New Jersey and northern North Carolina coasts. Morning of the 18th for the central North Carolina coast; afternoon, they were changed to cautionary along the North Carolina coast. Excepting for the last section, the signals were only justified at scattering stations.

No. VIII.—The southern portion of this extensive high pressure area was felt throughout the Northwest on the 19th, the center having been in Manitoba. Morning of the 20th the minimum temperature at Pembina and Fort Garry was —40°; barometer at Fort Garry, 30.71, and 0.47 above the normal at Duluth. As it moved eastward to the north of the lakes it produced cold weather from the Northwest eastward over the Lake region to the Saint Lawrence valley and New England, with brisk to high northerly winds. 21st, a. m. minimum temperature generally below zero from New England to the northern portion of the Upper Lake region and —34° at Ottawa, Canada. By midnight it was central in the lower Saint Lawrence valley; barometer at Father Point, 30.88, and 0.85 above the normal at Quebec. 22d, as low pressures Nos. XIII and XIV approached it moved eastward beyond Nova Scotia.

No. IX.—The pressure began to increase throughout the Northwest on the 22d, with cold weather. The midnight temperature at Humboldt, B. A., was —40°. 23d, the advance of low pressure No. XVI caused it to divide into two portions, one of which moved over the Middle states, New England, and the Gulf of Saint Lawrence. The other advanced southward over the Northwest toward the Southwest, with high northerly winds and gales and very cold weather. On the morning of the 24th the minimum temperature was below zero from northern Indian Territory to western Wisconsin, Minnesota, Dakota, Montana, Idaho, the eastern portions of Washington Territory, Oregon, Nevada, and probably northern portions of Arizona and New Mexico; at Dodge City, —10°; Pioche, —13°; Dayton (Wash.), —17°; Cheyenne, —24°; Bismarck, —38°; Pembina, —59°. Afternoon barometer at Breckenridge, 30.83, or 0.59 above the normal. During the day its advance reached the Texas coast as a severe "norther;" maximum hourly wind velocity at Indianola, 46 miles. In the North Pacific coast region the pressure rose to about 0.60 above the normal. 25th, the highest pressure was central over Indian Territory and eastern Oregon in the morning; minimum temperature, 29° at Yuma, —10° at Prescott, Arizona, and —13° at Santa Fé. Unusually cold weather prevailed from the Pacific coast to the Mississippi valley. In Texas and New Mexico it was particularly severe. Morning of the 26th, it was central in Texas. During this and the following days it gradually passed eastward over the Southern states, with diminishing central pressure.

No. X.—There were indications of the approach of this high area on the 28th from British America. At Battleford (52° 41′ N., 108° 30′ W.), the temperature was reported as —44°. During the 29th it rapidly extended southeastward over the Northwest and Upper Lakes, with cold northerly winds. Minimum temperatures of —40° and —43° were recorded in the morning at Pembina and Fort Garry, respectively. On the 30th it moved toward the Saint Lawrence Valley, producing low temperatures in New York and New England; minimum —38° at Rockliffe, Canada. It passed over and beyond the Gulf of Saint Lawrence on the 31st. Cautionary signals were ordered for northerly winds on the North Carolina coast, and off-shore signals from New Jersey to Maine. They were generally justified. Warnings were sent for Nova Scotia, but too late.

No. XI.—The deviations of the barometric readings from the normal figures indicate that this high area crossed the Middle and South Pacific coast regions on the 30th, and rapidly extended southeastward across the Plateau districts toward the Southwest. At midnight of the 31st the pressure continued high from California to the Lower Ohio valley, and highest over southern Illinois.

Areas of low barometer.—Twenty-one areas of low barometer are described below. Of these, three have crossed the entire country from the Pacific to the Atlantic. Three came from the North Pacific coast and died out in the Rocky Mountain region; four from British America and to the westward of Manitoba; one developed in Texas; one off the Texas coast; one on the North Carolina coast; one over Chesapeake Bay; one on the coast of Maine.

No. I.—On the morning of the 1st the pressure was below the normal from the Pacific coast eastward to the northwest, and decidedly so in the North Pacific coast region. This disturbance passed northeastward, as shown on Chart No. I, accompanied by numerous light rains from the Pacific coast to Montana, but changing to snow in latter section.

No. II developed on the 1st from the same low pressure as No. I. By midnight the barometer at Omaha had fallen 0.31 inch below the normal, and snow was reported from Dakota to northern Michigan. During the 2d light rains and snow were frequent from the lakes to the northwest, with occasionally high northerly winds over the Upper Lakes. At night its progress eastward was very much delayed by the high pressure to the northward. 3d, numerous light rains fell from the Gulf states to the lakes and Saint Lawrence valley, partly as snow in two last sections. An easterly gale prevailed in Lower Saint Lawrence valley. 4th, its movement over New England and the Gulf of Saint Lawrence was very rapid, accompanied by rain to the southward, and by snow, with high northerly winds, on its northern side. Maximum hourly wind velocities were recorded as follows: Pike's Peak, W. 54; Duluth, NE. 28; Escanaba, N. 30: Indianola, SE. 35; Quebec, E. gale; Father Point, E. 30 miles. Cautionary signals were ordered midnight of the 1st to be displayed at the stations along the Upper Lakes and Lake Erie, and warnings telegraphed to Toronto for the Canadian stations along Lakes Huron and Erie, but were only partly justified over the northern portion of the Upper Lakes.

No. III crossed the North Pacific coast region on the 2d, producing southerly gales on coast, and rainy weather thence to Idaho and the northern half of California. The midnight barometer at Olympia was 0.46 below the normal. During the 3d it passed into western Colorado, with cloudy and rainy weather from California, Nevada, and Utah northward, turning to snow in Montana and Dakota. 4th, as it advanced toward the Mississippi valley, with threatening and rainy weather, partly as snow in Minnesota and Dakota, it increased in energy, and developed into a narrow barometric trough, reaching from Minnesota to Texas at midnight. Thunder-storms were frequent from Texas to the Lower Missouri valley. Before recovering the normal the pressure again rapidly diminished on this date in the North Pacific coast region; p. m. barometer at Olympia 29.45, or 0.65 below the normal. Rainy weather and high southerly winds prevailed from thence to Idaho, Nevada, and northern California. During the 5th this second disturbance rapidly advanced southeastward and united with the first, which explains the northeastward movement to Wisconsin, as shown upon the chart. Rainy weather accompanied them from the Southern states to the Upper Lake region, and partly as snow in the Northwest, and gales occasionally occurred. At Madison, Wis., the barometer fell to 29.30, and at La Crosse to 0.63 below the normal at midnight. 6th, as it passed into Canada the rain area extended to New England, followed by clearing weather from the Southern states to the northwest. Marquette a. m. barometer 29.27, or 0.66 below normal. 7th, the central depression apparently crossed the mouth of the Saint Lawrence, with frequent gales thence to New York, New England, and Nova Scotia. Maximum wind-velocities: Red Bluff, SW. 32; on Pike's Peak, W. 56; Indianola, NW. 40; Denison, S., 33; Fort Griffin, S. 40; Dodge City, N. 40; North Platte, SE. 42; Cheyenne, W. 50; Breckenridge, SE. 34; Saint Paul, SE., and Duluth, E. 32; Alpena, SE. 30: Erie, S. 30; Barnegat, SE. 32; Sandy Hook, NE. 32; Wood's Holl, S. E. 40; Portland, SE. 34; Eastport, SE. 36; Father Point, W. 45; Mount Washington, S. 84 miles. Morning of the 4th cautionary signals were ordered for Duluth; afternoon for the remaining stations on Lake Superior, those along Lake Michigan, the Texas coast, and Port Eads, mouth of the Mississippi; midnight for Lakes Huron and Erie, and warnings for Canadian stations on Lakes Huron, Erie, and Ontario. Morning of the 5th, for New Orleans, Mobile, and Pensacola; midnight for Lake Ontario, Cedar Keys, Fla., and along the Atlantic from Florida to Massachusetts, and warnings for Montreal, Quebec, and Ottawa, Canada. Afternoon of the 6th, for the remaining portion of the New England coast, and warnings for the Canadian maritime provinces. On the morning of the 7th those from New Jersey to Massachusetts were changed to off-shore signals, and warnings dispatched for Newfoundland. They were well justified, except from Florida to South Carolina.

No. IV.—The center of this low pressure rapidly passed southeast over Washington Territory on the 6th. The 7th it united with a depression in the Southwest, which had developed from storm No. III, and was slowly dissipated over Texas. Rainy weather accompanied it in the North Pacific coast region, changing to snow toward Utah and the Northwest, with high winds at places. In anticipation of increasing northeasterly winds, with snow, from southern Lake Michigan to Lake Erie, cautionary signals were ordered at midnight of the 7th, but lowered next morning, having been not justified.

No. V —During the afternoon of the 7th the pressure rapidly diminished over the northern half of California. By midnight the storm center was between San Francisco and Red Bluff, with heavy rain and gales. Heavy snow fell in the northern portions of Nevada and California. Sacramento barometer 0.49 below the normal. 8th, the snow-area extended eastward into Dakota and Nebraska; a. m. barometer at Salt Lake City 0.66 below normal. 9th, it advanced northeastward toward Wisconsin; the barometric gradients became quite steep, with resulting high winds and gales; a deep barometric trough formed to the Southwest, in which, as the wind shifted suddenly from southerly to northerly, a tornado was caused at Renick, Mo., at 4 p. m. At midnight the rain area extended from the central Gulf States to the Lakes and Northwest, partly as snow in last district. 10th, a. m. barometer at Duluth 29.17, or 0.82 below normal. Between 12 and 1 a. m. a tornado also occurred at Parker's Station, Scott County, Missouri. As the depression passed into Canada rainy weather, with frequently high winds and gales, prevailed to the Gulf and Atlantic coasts, but clearing at night to the Southwest and Northwest to the Ohio valley. 11th, the center passed north of the mouth of the Saint Lawrence, but with a deep trough extending southwestward toward the Gulf, in which heavy rains fell. Maximum wind velocities: San Francisco, S. 34; Sacramento, SE. 32; Pike's Peak, W. 44; North Platte, NW. 36; Fort Sill, S. 32; Indianola, N. 39; Bismarck and Pembina, N. 40; Breckenridge and Duluth, NW. 36; Saint Paul, W. 40; Milwaukee, E. and W. 36; Alpena, SW. 36; Sandusky, SW. 38; Erie, S. 38; Saugeen, W. 45; Burlington, W. 35; Mount Washington, SW. 84 miles. On the 9th and 10th thunder-storms occasionally occurred from Iowa, Wisconsin, Michigan, and Ohio to Texas and Mississippi. Cautionary signals were ordered midnight of the 8th for the Upper Lakes and Lake Erie. Morning of the 9th for the Texas and North Carolina coasts, the latter in anticipation of increasing northeast winds in connection with high pressure No. III, while warnings were telegraphed for the Canadian stations on Lakes Huron, Erie, and Ontario; afternoon, for Lake Ontario; midnight, for the New Jersey coast, and warnings for the Saint Lawrence valley. Morning of the 10th, for Port Eads, Norfolk, Baltimore, and the New England coast; midnight and following morning, warnings for New Brunswick and Nova Scotia. Afternoon of the 10th, they were changed to off-shore at Indianola, Galveston, and Port Eads; afternoon of the 11th, from New Jersey to Maine. The signals were fully justified. Those on the North Carolina coast were continued for several days on account of the northeasterly gales, produced by high pressure No. IV, as it passed eastward.

No. VI.—There was a slight depression, which quickly passed southeastward over the North Pacific coast on the 9th, and died out over Utah on the 10th. It was accompanied by rainy weather along the Middle and North Pacific coasts and snow thence toward Colorado and Wyoming.

No. VII.—The southern edge of this disturbance produced rain on the 11th along the North Pacific coast and snow thence to Utah and Montana. 12th and 13th, cloudy weather, with generally light snow, was reported from Nevada to Dakota, Montana, and changing to rain toward Idaho and Washington Territory. On the latter date it apparently lost its identity southwest of the Lower Missouri valley. Maximum velocity on Pike's Peak NW. 56 miles.

Nos. VIII and IX.—The former developed off the western Gulf coast on the 13th, producing rainy weather in the Southern states with increasing northeasterly winds, and on the Texas coast northerly gales. 14th, by afternoon it appeared as a narrow barometric trough extending from the Upper Ohio valley southwest over Alabama into the Gulf, and by midnight it was central in western Pennsylvania. The latter rapidly formed in the morning over eastern North Carolina and moved northeast along the coast, causing northeasterly gales in advance of it. Heavy rains fell from the Lower Mississippi valley to the Atlantic coast and Lower Lakes, and changing to snow in the northern portions of New England and the Lake region. 15th, by midnight the two had united over the Gulf of Saint Lawrence, with diminishing pressure at the center; Chatham, 29.20, or 0.63 below the normal. During the day it was succeeded by clearing weather, except in the Lake region and Saint Lawrence valley, where it cleared away at night. Maximum velocities: Indianola, N. 36; Cape May, NE. 32; Atlantic City, NE. 37; Barnegat, NE. 36; Sandy Hook, NE. 48; Boston, E. 30; Eastport, NE. 35; Duluth, N. 32; Sandusky, SW. 34; Buffalo, W. 37; Mount Washington, SE. 84 and NW. 96 miles. Cautionary signals which had been ordered on the 13th for the preceding disturbance along Lakes Superior and Michigan were continued, as well as along the North Carolina coast. Morning of the 14th they were ordered from New Jersey to Maine, and warnings sent for the Canadian stations in Nova Scotia and New Brunswick; afternoon for Lake Huron. Noon of the 15th, for Lake Erie; afternoon they were changed to off-shore from North Carolina to New Jersey. Except over northern Lake Huron, they were generally justified, as shown by the preceding velocities. There was a failure to order signals for the Texas coast.

No. X.—On the 15th this disturbance advanced southeast from British America over the extreme Northwest, producing light snows and occasional high winds. 16th, a. m. barometer at Omaha 0.50 below normal. It passed eastward over the Lake region with diminishing energy, and snow fell from Idaho eastward over the Lake region. Maximum velocities: Umatilla, W. 32; Virginia City, W. 32; Cheyenne, W. 50; on Pike's Peak, W. 62; Sandusky, NW. 27 miles. Cautionary signals were ordered morning of the 16th for the Upper Lakes, and warnings sent for Canadian stations on Lakes Huron and Erie; afternoon for Lake Erie; midnight for the New Jersey coast (late). For the larger number of stations the signals were not justified.

No. XI slowly developed on the 17th east of the North Pacific coast. By midnight of the 18th the pressure at Boise City and Salt Lake City was 0.40 below the normal. It was accompanied by light rains along the Middle and North Pacific coasts, and snow thence toward Dakota. On the 19th, as storm No. XIII advanced it lost its identity, but sent out to the Southern states a slight depression. Afternoon of the last date signals were ordered for the New Jersey coast and partly justified.

No. XII was a slight disturbance which developed over the Upper Lake region on the 19th. As it progressed eastward it was accompanied by numerous light snows. Cautionary signals were ordered midnight of the 20th for the New Jersey coast. Morning of the 21st, for the North Carolina coast. The latter were late. High northerly winds were produced along the coast from North Carolina to Nova Scotia, due to the advance of high pressure No. VIII, with a steep barometric gradient.

Nos. XIII and XIV.—The former was an unusually extensive and severe storm, and effected the entire country during its passage, except from Florida to South Carolina. During the day of the 18th the pressure, which had been left below the normal by low pressure No. XI, remained stationary, but at night fell rapidly, with heavy rain in northern California. 19th, early in the morning southeasterly gales prevailed in the northern half of California, which during the day backed to southwesterly and extended to Nevada; in Oregon and part of Washington Territory, northeasterly gales. Rain became general in California, unusually heavy in northern portion, turning to snow toward Montana, Idaho, and Washington Territory. By midnight the barometer at Red Bluff fell to 29.32, or 0.76 below normal. 20th, the rain area extended to New Mexico and snow to Dakota, with high winds and gales at many points. 21st, its movement to the lakes was very rapid, with generally light rains in Tennessee and the Ohio valley, but turning to snow thence to the Northwest, Lakes, and Middle States. 22d, the main depression was gradually dissipated as it passed toward the Saint Lawrence valley. No. XIV developed on the Middle Atlantic coast, and moved northeastward. The gradient became very steep, owing to the presence of high pressure No. VIII in front of it, and northeast gales with heavy snow resulted along the coast. During this and the preceding day thunder-storms occurred from Missouri, Illinois, Indiana, and Iowa to Tennessee. Maximum velocities: San Francisco, SE. 36; Sacramento, S. 39; Red Bluff, SE. 52; Los Angeles, SE. 27; Winnemucca, SW. 45; Umatilla, NE. 52; Pioche, S. 36; Salt Lake City, SE. 31; Pike's Peak, SW. 68; North Platte, SW. 40; Dodge City, N. 40; Indianola, S. 31; Milwaukee, E. 41; Alpena, SE. 40; Erie, S. 36; Barnegat, E. 32; Sandy Hook, E. 44; Boston, N. 30; Eastport, NE. 37; Quebec, E. gale; Mount Washington, NW. 84 miles. On the morning of the 21st, cautionary signals were ordered for Lakes Michigan, Huron, and Erie; afternoon for Lake Superior, and warnings sent for Canadian stations on Lakes Huron and Erie; midnight, for Lake Ontario, continued from North Carolina to New Jersey, and ordered up thence to Massachusetts, also warnings for Lake Ontario and Saint Lawrence valley. Morning of the 22d, for coasts of New Hampshire and Maine, and warnings for Nova Scotia. These signals were fully justified. Off-shore signals ordered morning of the 22d along the Texas coast for a "norther" were not justified.

Nos. XV, XVI, and XVII.—The first crossed the North Pacific on the 21st, and Utah the 22d. It was accompanied by rain along the Pacific coast, and by snow thence toward Utah. The barometric changes show that the second depression developed from the first and No. XIII, and appeared morning of the 23d in northeastern Texas. During the day, as it progressed northeastward, threatening and rainy weather prevailed from the Western Gulf states to the Middle states, Lake region, and Northwest, generally turning to snow in two last districts. 24th, the third developed on the New England coast, with rain and snow. Maximum velocities: Red Bluff, SE. 31; Winnemucca, SW. 34; Santa Fé, SW. 29; Fort Sill, N. 40; Duluth, NW. 40; Alpena, E. 29; Wood's Holl, SW. 34; Eastport, E. 28; Mount Washington, NW. 90 miles. Cautionary signals were ordered, morning of the 23d, for northern half of the North Carolina coast; afternoon, for New Jersey, Lakes Erie, Huron, and Michigan, and warnings for Lakes Huron, Erie, and Ontario; midnight, for Lake Superior, and off-shore signals for a severe "norther" along the Texas coast. Morning of the 24th for Lake Ontario and New England coast, and warnings for Nova Scotia. They were all lowered during the 24th, except on the Texas coast. Along the Lakes and southern New England coast they were justified at scattering stations, but in the other sections quite generally. During the 25th they were again hoisted from North Carolina to Maine, and in the afternoon changed to off-shore from New Jersey southward; also the remaining stations along the Gulf coast were ordered to display off-shore signals. The latter were reported not justified; the former, justified, except at scattering stations in New England.

Nos. XVIII and XIX.—The southern edge of the former produced rain along the North Pacific coast, and snow thence to Idaho on the 26th, also occasional snow in the Upper Lake region. On the 27th it moved southwestward toward Kansas, under the influence of No. XIX, which was central over the North Pacific coast at midnight; Olympia, barometer 0.64 below the normal. The pressure was decidedly below the normal from the Pacific coast to the Northwest and Southwest. Threatening and rainy weather prevailed in the North and South Pacific coast regions, Arizona, and western New Mexico. Snow occasionally fell from Nevada to eastern Washington Territory, Idaho, Montana, and Dakota. 28th, No. XIX lost its identity at night in the Rocky Mountain region, while No. XVIII moved toward the Lake region with increasing energy. Rainy weather accompanied it in the Pacific coast regions, Arizona, New Mexico, and the Ohio valley, and frequent snow to the northward. At Leavenworth the afternoon barometer read 29.31, or 0.70 below the normal. 29th, it rapidly passed northeast to the Gulf of Saint Lawrence, leaving a narrow barometric trough extending southwestward to Texas, in which rains were frequent, partly turning to snow to the northward. Maximum velocities: Pike's Peak, SW. 56; Cheynne, W. 44; Dodge City, SW. 45; Bismarck, E. 32; Duluth, NE. 28; Milwaukee, SW. 28; on Mount Washington, W. 105 miles. Cautionary signals were ordered morning of the 27th for Milwaukee, Grand Haven, and Ludington, on Lake Michigan (the display of signals being ceased at the other Lake stations), but reported as not justified. Warnings were also sent for the Canadian stations on Lakes Huron, Erie, and Ontario, and Saint Lawrence valley. Signals were also ordered the 28th for the Texas coast and Eastport, but not justified; also, warnings for Lake Huron.

No. XX.—This disturbance was central north of Minnesota and Dakota night of the 30th; its progress southeast over the Lower Lakes on the 31st was very rapid, accompanied by fresh to very brisk winds, except on Mount Washington, where a hurricane velocity (the highest for the month) was recorded. Snow frequently fell from the Northwest and Lake region to the Saint Lawrence valley and New England, and rain thence southwestward to New Mexico and the Southwest. Maximum velocities: Virginia City, N. 30; Pembina, S. 34; Cleveland, SW. 28; Mount Washington, W. 111 miles.

Cautionary signals were ordered the 31st from New Jersey to Maine, and warnings sent for the Saint Lawrence valley. They were only justified at scattered stations.

No. XXI.—The center of this storm passed eastward from the Pacific coast to the north of the limit of the Signal Service stations. On the 31st rainy weather prevailed along the North Pacific coast, while high southerly winds and gales were general from thence to Montana; at Portland, Oreg., S. 25 miles; at Forts Shaw and Assiniboine, Montana, southerly gales; North Platte, S. 33. Its subsequent history belongs to the January Review.

INTERNATIONAL METEROLOGY.

Three international charts, Nos. IV, V, and VI, accompany the present Review. No. IV indicates the probable course of low pressure areas over the north Atlantic ocean and neighboring waters and continents during the month of November, 1879. It is based upon observations made on board of nearly 200 vessels, and which have been collected from various sources or received directly at this office up to January 5th, 1880. Nos. V and VI are charts for the month of May, 1878, and are based upon the international simultaneous observations, as described in the Review for July, 1879, supplemented by such other observations as have been considered specially applicable and trustworthy.

On chart No. IV the tracks of seventeen areas of low pressure, which, during a portion of their existence, were located over the north Atlantic ocean or neighboring waters, are traced. Although the number of reports at present to hand is somewhat small, they are probably sufficient to enable a good idea to be formed of the meteorological conditions existing over the north Atlantic, between the 35th and 55th parallels, during the entire month. In the following *résumé* only the above area will be referred to unless specially noted. The month opened with areas of low pressure, central, respectively, to the north of Newfoundland and over Norway and Sweden, the former being a continuation of low area No. IX, shown on chart No. I of the October Review, while the latter had apparently advanced southeastwardly to the Norwegian coast. Areas of high pressure existed over the eastern portion of the United States, moving eastwardly, and over the eastern portion of the Atlantic, moving slowly southeastwardly. On the 1st brisk to high westerly winds or gales prevailed from 65° to 45° W., and light easterly winds from 35° W. to the Irish coast. On the 2d the pressure rose over the west Atlantic and British Isles as the high areas moved eastward and the low area north of Newfoundland northward. Westerly gales and high seas continued in the vicinity of the Banks of Newfoundland (bark Royal Arch was abandoned in 43° N., 59° W.), but thence eastward light or moderate southerly to easterly winds. 3d, area of highest pressure central over the eastern Atlantic to the west of Ireland, and extending its influence over all western Europe; light easterly winds between 10° and 25° W.; southwest winds and rain about 50° N., 35° W.; pressure over western Atlantic rapidly diminishing in advance of low area No. II (low area No. I, chart I, November review). 4th, area of highest pressure central over Ireland (Valentia, barometer 30.67 inches, or 778.2^{mm}, wind SW.); light southerly winds thence to 40° W.; low area No. II moved rapidly northeastward during the night of the 3d and 4th, accompanied by severe weather, with fierce squalls and heavy snow or rain from Labrador to the Banks of Newfoundland; large area of high pressure over the eastern portion of the United States, moving eastward. 5th, area of high pressure over the east Atlantic, slowly moved southward (Valentia barometer 30.69, or 779.5, wind calm), while low area No. III advanced southeastward over Norway; southerly gales from 30° to 45° W., in advance of low area No. II; high or rising pressure over the west Atlantic, preceded by cold northwesterly winds and heavy snow off Cape Sable. On this day, 5th, two vessels were dismasted in a hurricane (low area No. IV) in 21° N., 27° W., which probably moved in a northerly direction on the 6th and 7th, and was encountered on the latter day in 30° N., 25° W. 6th and 7th the center of highest pressure over the East Atlantic moved southward very slowly towards the Bay of Biscay (barometer at Valentia about 30.70, or 780.5, and at La Corogne and Bilboa, 30.55, or 774.7); low area No. II moved northeastward, and southerly squalls or gales veering to west and north were reported from 20° to 45° W.; high pressures prevailed over the West Atlantic, with high or variable winds. 8th and 9th, the area of high pressure previously existing over the east Atlantic moved eastward over Europe, followed over the British Isles and France by cloudy, dull, or foggy weather, in advance of low area No. II, which moved rapidly northeastward to the Norwegian coast, with heavy rains in the north of Scotland; extensive area of high pressure advanced eastward, and on latter day apparently extended across the Atlantic. 10th, area of high pressure moved eastward, while low area No. V rapidly moved eastward to Newfoundland; as on the two preceding days, light to moderate winds prevailed over the Atlantic. 11th, area of high pressure moving slowly southeastward; area of low pressure No. VII appeared to the north of Scotland, while low area No. V moved to the east of Newfoundland, preceded by light southerly winds to 30° W. 12th, low area No. VII covered central Europe; small area of high pressure still remaining central over the east Atlantic, preceded by northwesterly gales over the British Isles and Channel; low area No. V slowly advanced eastward to mid-ocean, with increasing energy, preceded by severe southerly gales between 30° and 35° W.; S. S. Leipzig (49° 53′ N., 31° 44′ W., at 7.35 a. m., Washington time) reported bar. 29.56, or 750.8, wind south, force 9, cloudy, heavy sea from south; S. S. Indiana (50° 34′ N., 31° 40′ W., 7.35 a. m., Washington time), bar. 29.36, SSE. 9, cloudy, heavy SSW. sea; in 38° N., 42° W., a northwest hurricane was reported, lasting 36 hours; vessel hove to under bare poles for 12 hours. 13th, the small area of high pressure (about 30.30, or 769.6) over the east Atlantic moved slowly southeastward toward the Bay of Biscay, while the low area No. V remained almost stationary, and with diminishing pressure at the center over mid-ocean; S. S. Leipzig (49° 4′ N., 36° 40′ W., 7.35 a. m., Washington time), bar. 29.43, or 747.4, wind N., force 7, cross-seas from N. and S., cloudy with much hail; S. S. Indiana (49° 03′ N., 38° 20′ W., 7.35 a. m., Washington time), bar. 29.20, or 741.7, NNW., force 9, heavy NW. sea, and cloudy; northwesterly winds prevailed thence to the Banks of Newfoundland, and northeasterly backing to northwesterly winds off the Nova Scotia coast, as low area No. VIII moved southeastwardly. 14th, as low area No. VII continued its eastward march toward Russia the pressure rose rapidly over Norway and Great Britain, and including the small area over the Bay of Biscay, formed an extensive area of high pressure covering the whole of western Europe, accompanied by quite low temperatures and clear, frosty weather; southeasterly winds and rising temperature along the Spanish and Irish coasts; the low areas Nos. V and VIII appeared to move southward, and possibly formed an extensive area of low pressure to the westward of the Azores; severe northerly gales between 40° and 50° W.; small area of high pressure over Nova Scotia, moving eastward during the day over the Banks of Newfoundland, with diminishing pressure. 15th, high area over western Europe, moved southward, accompanied by quite low temperatures over England, France, and northeastern Spain; low area No. V (and VIII?) central near the Azores (reports from the Azores not yet to hand) as a very severe storm; in 41° N., 36° W., the Warren Hastings was thrown on her beam ends during a heavy northerly gale and sea, the man at the wheel was washed overboard, and the vessel afterwards abandoned; in 27° N., 36° W., bark Alida had heavy gale from WSW., lasting 36 hours; and several vessels afterward put into Fayal for repairs, having had bulwarks stove, &c., during this storm. Falling pressure over the Banks of Newfoundland in advance of low area No. IX. 16th, highest pressures over western Europe (30.59, or 776.9, at Ushant); low pressure over the Atlantic, with centers of depression probably southwest of the Azores (falling pressure and rough sea at Funchal), and to the northeast of Newfoundland. 17th, high pressures over western Europe (30.56, or 776.1, at Rochefort). while a small area of low pressure passed eastward north of Scotland; falling pressure, with high southeasterly winds and rough sea at Funchal; low area No. IX to the northeast of Newfoundland, accompanied by SW. to NW. gales, high seas and heavy rain from 30° to 45° W., in about 51° N.; rising or high pressures and northerly winds thence to the coast of the United States. 18th, high pressures continued over western Europe (30.46 inches, or 773.6^{mm}, at Bordeaux); high southeasterly winds, falling barometer and high sea at Funchal; low area No. IX probably central about 55° N., 30° W., with increasing southwesterly winds to the southward; higher pressures and light variable winds thence to the Banks of Newfoundland; low area No. X rapidly moved northeastward from Cape Henry to south of Cape Sable as a very severe storm. S. S. Leipzig (on the 18th, at 7.35 a. m., Washington time, in 43° 1′ N., 59° 46′ W., and 19th, same time, in 41° 42′ N., 64° 40′ W.) reports 18th, 8 p. m., rapidly increasing SE. wind and sea, with heavy rain, barometer falling rapidly to 29.476, or 748.8; 19th, 3.00 to 3.20 a. m., fog; 6.30 a. m., wind shifting to NNE., with rapidly increasing northerly sea and rising barometer. 19th, high pressures over the whole of northern Europe (30.57, or 776.4 at Stockholm, and 30.40, or 772.2, at Mullaghmore); rapidly falling pressure over Spain and at Funchal, with continued high SSE. winds and rough sea at latter place; low area No. X rapidly moved eastward, accompanied by severe weather to 30° W., but it is hardly possible to locate its center for that day, owing to the large depression which existed over that portion of the Atlantic at the time. Low area No. XI moved northeastward at some distance off the coast of the United States as a very severe storm; it was described as low area No. XII, chart No. I, November review. 20th, highest pressure over northern Europe (Stockholm, 30.75, or 781.1^{mm}); extensive area of low pressure over the east Atlantic, and rapidly falling pressure over the whole of western Europe, with the center of depression probably near Funchal; steamer Roscommon is reported to have capsized and foundered at 1.20 p. m. in 37° 40′ N., 24° 12′ W. Low area No. XI moved rapidly over Nova Scotia as a very severe storm, the accompanying gales extending eastward to 37° W. 21st, the two large areas of low pressure over the Atlantic were probably central near Funchal, where the wind had shifted to a NNW. gale, with very high seas, and to the north of Newfoundland, separated by a ridge of higher pressure over mid-ocean; southerly to westerly gales attending the latter depression prevailed south and eastward to 38° N. and 40° W. On the night of the 20th a very severe "norther," accompanied by heavy rains, commenced at Aspinwall, C. A., which, according to reports, continued with great violence to the 24th, doing an immense amount of damage to shipping, wharves, and railroad stock. 22d, rising pressure over the Atlantic between 40° and 50° N., with easterly to southerly winds from the European coast to 40° W., and brisk to high westerly winds, gales, and high seas thence westward to the American coast; at Funchal the wind returned to the south. A subsidiary area of low pressure No. XIII moved from near Cape Lizard, England, northeastward. 23d, pressure probably about normal over the East Atlantic, with gentle or moderate winds; a large area of low pressure existed, however, to the southwest of Funchal, where high SSE. winds and rough seas continued; in 22° 35′ N., 18° 40′ W., bark Janet was abandoned during a gale from SW. to SSW. The record of this vessel in reference to the meteorological conditions over this part of the Atlantic is interesting; on the 7th, in 30° 30′ N., 24° 40′ W., the captain reports "a very heavy gale from the SE., which hauled to NW. (see area No. IV), vessel was hove down, lost portions of rigging, &c., and had decks swept; after gale, tried to make Canary Islands, but the wind coming out ahead, had to keep vessel south; went along at about 200 miles a day, and hoped to get the NE. trades, but there were none;" vessel abandoned on 23d, as above. An extensive area of high pressure (30.40, or 772.2, at Saint John's, Newfoundland), covered the western Atlantic, and light to moderate winds prevailed from Valentia to the American coast. 24th, large area of depression to the westward of Funchal, where fresh southerly winds and rough sea prevailed, while in 34° 27′ N., 28° 51′ W., a NE. gale and heavy sea were reported, during which bark Olive was abandoned, the crew being taken on board U. S. S. Constellation. The large area of high barometer moved eastward, and rapidly extended its influence to Great Britain and Norway, with northerly to easterly winds, thence over the Atlantic to 45° W. An area of low pressure (No. XIII, chart I, November review), moved northeastward over Newfoundland with stormy weather, followed by a high pressure area off the coast of the United States. 25th, large area of high pressure over Northern Europe (Stornoway, 30.50, or 774.7, and Stockholm, 30.66, or 778.7); large area of low pressure between the Azores and Canary Islands (Funchal, 29.57, or 751.0, SSE. winds, and very high sea); rising and moderately high pressures, with light winds over the west Atlantic. 26th, high but falling pressure over northern Europe and northern part of the Atlantic (Mullaghmore, 30.41, or 772.4); with easterly winds from Valentia to 45° W.; large area of low pressure near the Madeira Islands (Funchal, 29.34, or 745.1, S. gale and high sea); secondary depression, No. XVI, formed over the western Mediterranean; low area No. XV to the north of Newfoundland, moving eastward; higher pressures and northwesterly winds thence south and westward. 27th, large depression, central over the Atlantic north of Funchal, extending eastward over Spain and the western Mediterranean; high area to the northwest of Ireland, gradually diminishing in extent and pressure, with easterly winds from Valentia to 35° W.; low area No. XV probably moved southeastward, but with little energy, as shown on chart; rising pressure over Newfoundland and southward, with northwesterly winds extending eastward to 50° W. 28th, area of low pressure passed eastward over Spain, while the small area of high barometer to the west of Ireland diminished in extent and pressure. At Funchal, the wind changed to N. high, with rising pressure and moderating sea; easterly winds prevailed from the Irish and French coasts to 35° W., which increased to a fresh gale in 47° N., 15° W.; low area No. XV was probably central near 45° N., 40° W., but without much energy; high pressure and light winds over the western Atlantic. 29th and 30th, area of lowest pressure over the Mediterranean; high pressures north of 50° N., from 15° to 45° W., with easterly winds near that parallel; low area No. XV probably central about 40° N., 40° W., but with little energy; low area No. XVI, chart I, November Review, moved eastward north of Newfoundland on the 30th, followed by high pressures on the American coast.

TEMPERATURE OF THE AIR.

The general distribution of temperature for the month is shown by the isothermal lines and figures upon chart No. II. Upon the right side of the same chart will be found a table giving the average temperature by districts for December for several years and of this year. From New England, the Lower Lake region and Ohio valley, southwestward to the Gulf and southeastern Rocky Mountain slope, and for Boise City, Idaho, the average is higher than usual, the greatest difference being for the South Atlantic states. At Salt Lake City it has been normal. In all the other districts it has averaged lower than usual, especially in the Missouri and Red River of the North valleys.

Minimum temperatures.—Maine: —26° at *Orono and —15° at Eastport. *New Hampshire:* —26° on Mount Washington and —14° at *Grafton. *Vermont:* —28° at Newport and —19° at Burlington. *Massachusetts:* —6° at *Amherst and 0° at Boston and Springfield. *Rhode Island:* 7° at Newport. *Connecticut:* 2° at *Mystic and 4° at

New Haven. *New York:* —24° at *Madison Barracks and *Schroon Lake, —20° at *Plattsburg Barracks, —7° at Oswego, 1°.5 at Buffalo, and 11° at New York City. *Pennsylvania:* —7° at *Dyberry, 3° at *Catawissa, 5° at Pittsburgh, and 11° at Philadelphia. *Delaware:* 18° at *Dover. *Maryland:* 6° at *Emmittsburg and 13° at Baltimore. *District of Columbia:* 13° at Washington. *Virginia:* 10° at *Wytheville and 25° at Norfolk. *West Virginia:* 7° at *Helvetia and 18° at Morgantown. *North Carolina:* 8° at *Highlands, 24° at Wilmington, and 33° at Cape Hatteras. *South Carolina:* 26° at *Aiken and 34° at Charleston. *Georgia:* 17° at Atlanta and 33° at Savannah. *Florida:* 28° at Pensacola, 36° at Cedar Keys and Jacksonville, and 68° at Key West. *Alabama:* 16° at *Green Springs and 24° at Mobile. *Mississippi:* 18° at *Fayette and 19° at Vicksburg. *Louisiana:* 18° at Shreveport and 32° at New Orleans. *Texas:* —10° at Fort Elliott, 2° at Pilot Point and Graham, 9° at Denison and Mason, 10° at Stockton and Uvalde, 27° at Brownsville and Rio Grande, and 24° at Galveston. *Ohio:* —15° at *Wooster, —1° at Cleveland, 5° at Columbus, and 11° at Cincinnati. *Kentucky:* 12° at Louisville. *Tennessee:* 10° at *McMinnville and Knoxville. *Arkansas:* 10° at *Mount Ida and 16° at Little Rock. *Michigan:* —14° at Escanaba, —9° at Marquette, —5° at Alpena, — ° at Detroit and Port Huron, —3° at *Lansing, and 6° at Grand Haven. *Indiana:* 2° at *Wabash, 5° at Indianapolis, and 9° at *New Harmony. *Illinois:* —16° at *Riley and *Belvidere, —2° at Chicago, and 12° at Cairo. *Missouri:* —17° at *Oregon, —11° at *Kansas City, and —1° at Saint Louis. *Kansas:* —16° at *Fort Wallace, —13° at Dodge City, and —8° at Leavenworth. *Wisconsin:* —32° at *Neillsville, —26° at La Crosse, and 12° at Madison and Milwaukee. *Iowa:* —35° at *Cresco, —27° at *Vail, —19° at Dubuque, and —16° at Des Moines. *Nebraska:* —37° at *Fort Sydney, —27° at North Platte and *Genoa, and —17° at Omaha. *Indian Territory:* 2° at Fort Sill and 4° at Fort Gibson. *Minnesota:* —40° at Breckinridge, —39° at Saint Paul; and —34° at Duluth. *Dakota:* —59° at Pembina, —46° at Fort Buford and Fort Keogh, —38° at Bismarck, —34° at *Olivet, and 16° at Deadwood. *Colorado:* —31° on summit of Pike's Peak, —19° at *Fort Garland, and 17° at Denver. *New Mexico:* —22° at *Fort Union, —13° at Santa Fé, and 16° at La Mesilla. *Wyoming:* —34° at *Fort Fred Steele and —24° at Cheyenne. *Utah:* 22° at *Coalville and —10° at Salt Lake City. *Nevada:* —20° at Winnemucca, —13° at Pioche, and —11° at *Carson City. *Arizona:* —18° at Prescott, —2° at Apache, 0° at Phœnix, and 27° at Yuma. *Idaho:* —30 at *Fort Hall, and —4° at Boise City. *Montana:* —36° at Virginia City. *California:* 15° at San Gorgonio, 25° at Red Bluff, Sacramento, and Princeton, 32° at San Diego, and 34° at San Francisco. *Oregon:* —14° at Umatilla, 3° at Portland, and 7° at Roseburg. *Washington Territory:* —17° at Dayton and 10° at Olympia. In northern New York and New England, the minimum temperatures occurred on the 21st and 22d, accompanying high pressure No. VIII. In all the other sections they accompanied high pressure No. IX, and prevailed as follows: From the North Pacific coast to Dakota, on the 23d and 24th; from the Middle and South Pacific coasts to Minnesota, Iowa, Kansas, Indian Territory and New Mexico, on the 24th and 25th; from Texas to the Upper Lakes, Lake Erie, Ohio valley and Tennessee, on the 25th and 26th; from the Gulf states to the Middle states, except in northern New York, on the 26th and 27th.

Maximum temperatures.—Maine: 55° at *Surry and Portland. *New Hampshire:* 52° at *Grafton and 40° on Mount Washington. *Vermont:* 53° at *Charlotte and 54° at Burlington. *Massachusetts:* 53° at Boston and *Newburyport and 55° at Springfield. *Rhode Island:* 58° at Newport. *Connecticut:* 60° at *Mystic and New London. *New York:* 64° at *Brookhaven, 44° at Plattsburg Barracks, 58° at Buffalo, and 62° at New York City. *Pennsylvania:* 63° at *Fallsington, and 61° at Philadelphia, *Chambersburg, and Pittsburgh. *Delaware:* 62° at *Dover. *Maryland:* 63° at Baltimore, *Fallston, and *Emmittsburg. *District of Columbia:* 64° at Washington. *Virginia:* 79° at *Johnsontown, 74° at Cape Henry and *Accotink, and 55° at *Walnut Grove. *West Virginia:* 66° at Morgantown and 65° at *Helvetia. *North Carolina:* 78° at Wilmington, 68° at Cape Lookout, and 59° at *Highlands. *South Carolina:* 75° at *Aiken and Charleston. *Georgia:* 80° at *Forsyth and 76° at Savannah and Augusta. *Florida:* 86° at *Houston, 83° at Key West, 79° at Jacksonville, and 75° at Pensacola. *Alabama:* 76° at Montgomery and 74° at Mobile. *Mississippi:* 78° at Vicksburg and *Brookhaven. *Louisiana:* 83 at *Lake Charles and 78° at New Orleans. *Texas:* 83° at Eagle Pass, 80° at Brownsville, 79° at Indianola, and 75° at Denison. *Ohio:* 68° at *Ringgold, 66° at Cincinnati, and 62° at Columbus and Cleveland. *Kentucky:* 67° at Louisville. *Tennessee:* 72° at Chattanooga and 68° at *McMinnville and *Ashwood. *Arkansas:* 73° at Little Rock and 70° at *Mount Ida. *Michigan:* 59° at *Niles and Detroit, 58° at Grand Haven, *Battle Creek, and *Lansing, and 44° at Marquette. *Indiana:* 67° at *Vevay and 64° at Indianapolis and *New Harmony. *Illinois:* 66° at Cairo, 65° at *Anna, and 62° at Chicago and *Peoria. *Missouri:* 67° at *Craig, 65° at *Kansas City, *Oregon, and *Pierce City, and 63° at Saint Louis. *Kansas:* 78° at *Creswell, 70° at Dodge City, and 63° at Leavenworth. *Wisconsin:* 57° at Beloit and Milwaukee, and 44° at La Crosse. *Iowa:* 58° at *Glenwood and Keokuk, and 52° at Des Moines. *Nebraska:* 70° at *Fort Sydney, 57° at North Platte, and 54° at Omaha.

Indian Territory: 75° at Fort Sill and 69° at Fort Gibson. *Minnesota:* 40° at Saint Paul, 38° at Duluth, and 35° at Breckinridge. *Dakota:* 50° at Deadwood, 47° at *Olivet, and *Morriston, 42° at Fort Keogh, 36° at Bismarck, and 28° at Pembina. *Colorado:* 66° at Denver and *Fort Lyon, 49° at *Fort Garland, and 23° on summit of Pike's Peak. *New Mexico:* 73° at La Mesilla, 71° at *Fort Union, and 53° at Santa Fé. *Wyoming:* 57° at Cheyenne and 47° at *Fort Fred Steele. *Utah:* 52° at Salt Lake City and 48° at *Coalville. *Nevada:* 66° at *Carson City and 55° at Pioche and Winnemucca. *Arizona:* 74° at Yuma, Florence, and Tucson, and 61° at Prescott. *Idaho:* 59° at Boise City and 48° at *Fort Hall. *Montana:* 44° at Virginia City. *California:* 76° at Los Angeles, 71° at San Diego, 64° at San Francisco, and 63° at Sacramento. *Oregon:* 56° at Roseburg.

Ranges of temperature at Signal Service stations.—The monthly ranges will appear from an examination of the maxima and minima just given. The greatest daily ranges vary in New England from 27° at Thatcher's Island to 47° at Eastport; Middle Atlantic states, 24° at New York, Cape May, and Baltimore to 38° at Albany; South Atlantic states, 25° at Kittyhawk and 28° at Jacksonville to 37° at Atlanta; Eastern Gulf states, 12° at Key West and 26° at Cedar Keys to 34° at Pensacola, Mobile, and New Orleans; Western Gulf states, 29° at Little Rock and 35° at Vicksburg to 46° at Indianola; Ohio valley and Tennessee, 25° at Louisville and 29° at Morgantown to 44° at Memphis and 50° at Chattanooga; Lower Lake region, 25° at Detroit and 26° at Erie to 37° at Oswego; Upper Lake region, 21° at Grand Haven and 28° at Alpena to 35° at Duluth; Upper Mississippi valley, 30° at Keokuk and 38° at Saint Paul to 42° at Des Moines; Red River of the North valley, 36° at Breckinridge and Pembina; Missouri valley, 31° at Omaha to 40 at Bismarck and 42° at Fort Buford; Texas, 37° at Mason to 40° at Davis, 45° at Rio Grande, Concho, and Brackettsville, and 67° at Fort Elliott; Eastern Rocky Mountain slope, 24° at Dodge City and 34° at Fort Gibson to 51° at North Platte; Rocky Mountains, 35° at Socorro to 41° at Virginia City, 46° on Pike's Peak and 61° at Denver; Northern and Middle Plateau districts, 22° at Boise City to 27° at Pioche and 30° at Winnemucca; California, 14° at San Francisco to 28° at Visalia, 29° at Red Bluff and 33° at Los Angeles.

Frost was reported very generally from all States and Territories north of the thirty-fifth parallel. In Florida on the 16th, 17th, 18th, 26th, 27th and 28th; in the remaining states of the East Gulf, 1st, 6th, 7th, 12th 13th, 15th to 18th, 25th to 28th. West Gulf states, 1st, 3d, 7th, 11th to 19th, 21st, 24th to 27th; at Lake Charles, La., 25th, "intensely cold, all tender vegetation killed, a thing never known in this section before." Indian Territory, 1st, 3d, 5th, 6th, 7th to 20th, 24th, to 31st. Arizona, 10th, 16th, 18th, 23d, to 31st, very heavy. California, 2d, 3d, 4th, 6th, 7th, 8th to 12th, 14th to 18th, 21st to 31st; at Los Angeles, on the 25th, plants and vegetables in many localities entirely destroyed.

Ice formed generally throughout the northern sections of the county, as will be seen by reference to the chapter on navigation. In the Eastern Gulf states it formed on 24th, 25th, 26th and 27th; Western Gulf states, 12th, 13th, 25th, 26th and 27th; Texas and Indian Territory, 6th, 12th, 13th, 14th, 24th, 25th, 26th and 27th. California, at San Francisco, on the 24th; Los Angeles, 25th; Visalia, 23d and 25th; Red Bluff, 23d, 24th (25th 2½ inches); Sacramento, 23d, 24th and 25th; Hooker's Lake below the city, frozen over sufficiently solid for skating—first time in twenty-five years. On the 25th the water pipes in the city frozen up. Washington, 25th, shallow water ponds frozen over.

Ground frozen.—Lompoc, Cal., 24th, ½ inch, 31st; Lake Charles, La., 25th; Brookhaven, Miss., 26th and 27th; Melissa, Tex., 11th; Sacramento, Cal., 23d, 24th and 25th; Red Bluff, Cal., 24th and 25th; Visalia, Cal., 23d and 15th; Prescott, Ariz., 25th; Keokuk, Iowa, ground remained frozen throughout the month.

The following notes are of interest as indicating the excessive cold of the month, in various sections: Logan, Iowa, 19th,—20°, the coldest day at noon, in the past twenty years; Melissa, Tex., 24th, 12.15 p. m., heavy north wind, with snow and sleet, freezing as it fell; chickens were frozen fast to limbs of trees; ice formed on tanks to the depth of three inches, and the snow formed a crust so firm and hard that a horse's hoof made no impression. Coalville, Utah, 24th, —22°, coldest day in fourteen years. Humboldt Wells, Broncho, and Truckee, Cal., 26th, excessively cold, mercury frozen. Prescott, Ariz,, 25th,–18°, supposed to be the lowest temperature ever known in the Territory. Virginia City, Mont., 24th, 1,500 sheep frozen to death and several herders badly frozen; 23d to 26th, ranchmen reported a storm of wind and snow of unprecedented severity, all mails stopped and several mail coaches lost. North Platte, Dak., 11th, mail carrier frozen to death; 24th, —32°, coldest ever known here. Bismarck, Dak., 24th, —38°, lowest temperature ever recorded at the station. Breckinridge, 13th, two children and one man frozen to death. San Antonio, Tex., 25th, many cattle and sheep have died in this section from excessive cold. Boerne, Tex., 25th, 26th, most extreme cold for many years; telegraph battery frozen solid. Brackettsville, Tex.

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*Those stations marked with a star (*) have been reported by voluntary observers, or U. S. Army post surgeons.

25th, telegraph battery frozen solid. Brownsville, Tex., 25th, many sheep have perished from excessive cold. Pembina, Dak., heavy "blizzard" from the northwest, accompanied by a blinding snow-storm, blocking highways and obstructing railway communication.

PRECIPITATION.

The general distribution of the rainfall (which includes melted snow), will be found upon chart No. III, as accurately as it has been possible to illustrate the same. The data has been taken from the reports of nearly five hundred stations. Upon the left side of the chart is given a table of average precipitation for December. An examination of the same will show that there has been an excess in California, the Missouri valley, Minnesota, Eastern Gulf states, Middle Atlantic states, New England, Saint Lawrence valley, Lake region, Ohio valley, and Tennessee; greatest in the last section, where it amounted to nearly 5 inches, and least in the Eastern Gulf states. In the other districts there has been a deficiency; least in the Upper Mississippi valley, and greatest in the Western Gulf states, where over 2 inches less than the average has fallen.

Special heavy rains.—5th, *White Plains, N. Y., 5th and 6th, 4.45 inches; *Fort Barrancas, Fla., 5.43 inches in 5 hours and 20 minutes; Yreka, Cal., 3.54 inches. 6th, *Fayetteville, N. C., 3.00 inches. 10th, *McMinnville, Tenn., 10th and 11th, 2.50 inches; *Austin, Tenn., 9th and 10th, 2.62; *Fort Barrancas, Fla., 1.74 inches in 3 hours and 40 minutes; Memphis, Tenn., 9th and 10th, 3.50 inches; Helena, Ark., 9th and 10th, 3.32 inches; Paducah, Ky., 9th and 10th, 3.99 inches. 11th, Knoxville, Tenn., 2.46 inches; Chattanooga, Tenn., 10th and 11th, 2.10 inches; *Brookhaven, Miss., 10th and 11th, 2.30 inches; *Fort Barrancas, Fla., 2.33 inches. 13th, *Gainesville, Ga., 13th, and 14th, 4.40 inches; *Dover Mines, Va., 13th and 14th, 3.20 inches; *Forsyth, Ga., 13th and 14th, 3.15 inches; *Lenoir, N. C., 13th and 14th, 3.30 inches; *Franklin, N. C., 13th and 14th, 3.20 inches; *Highland, N. C., 13th and 14th, 3.85 inches; *White Plains, N. Y., 13th and 14th, 2.20 inches. 14th, Montgomery, Ala., 2.66 inches; Atlanta, Ga., 3.76 inches; Charlotte, N. C., 2.38 inches; Lynchburg, Va., 2.98 inches; Sandy Hook, N. J., 2.45 inches; *Fort Barrancas, Fla., 2.33 inches. 19th, Red Bluff, Cal., 5.04 inches; *Lompoc, Cal., 18th and 19th, 3.62 inches; *San Gorgonio, Cal., 19th and 20th, 4.24 inches. 20th, *Austin, Tenn., 2.30 inches; Los Angeles, Cal., 4.19. inches. 21st, *White Plains, N. Y., 2.00 inches. 22d, Knoxville, Tenn., 22d and 23d, 2.81 inches. 23d, *Laconia, Ind., 23d and 24th, 3.80 inches. 24th, *Vevay, Ind., 2.50 inches; *College Hill, Ohio, 24th, 25th, 2.75 inches; *McMinnville, Tenn., 24th and 25th, 3.75 inches; Morgantown, W. Va., 24th and 25th, 2.57 inches; *Austin, Tenn., 22d to 24th, 4.25 inches; Evansville, Ind., 3.00 inches. 25th, *Murphy, N. C., 24th and 25th, 3.40 inches; Paducah, Ky., from 22d to 25th, 6.69 inches. 27th, *San Gorgonio Cal., 26th to 28th, 4.20 inches. 30th, *Northport, Mich., 30th and 31st, 3.75 inches 31st, Paducah, Ky., 30th and 31st, 4.51 inches.

Largest monthly rainfalls, including melted snow.—Paducah, Ky., 20.12 inches; *Fort Barrancas, Fla., 15.46; *White Plains, N. Y., 12.60; Olympia, Washington Territory, 11.42; *Northport, Mich., 10.32; *Austin, Tenn., 10.20; Red Bluff, Cal., 9.95; *Ashwood, Tenn., 9.60; *Highlands, N. C., 9.40; *San Gorgonio, Cal., 9.39; Nashville, 9.15; *Evansville, Ind., 8.97; *Gainesville, Ga., 8.75; Memphis, 8.51; Chattanooga and *McMinnville, Tenn., 8.47; *Murphy, N. C., 8.30; Knoxville, 8.28; *Fayetteville, N. C., 8.25; *Laconia, Ind., 8.21; Sandy Hook, N. J., 8.02; Louisville, 7.93; Roseburg, Oreg., 7.86; Atlanta, 7.84; *Vevay, Ind., 7.60; Montgomery, 7.42; *Grafton, N. H., 7.40; Portland, Oreg., 7.36; *Trenton, N. J., 7.25; Cincinnati, 7.11; *Freehold, N. J., 6.77; *Saint Meinrad, Ind., 6.66; Morgantown, 6.70; Barnegat, 6.68; Cairo, 6.63; *Franklin, N. C., 660; Los Angeles and *Quebec, 6.53; Vicksburg, 6.45.

Smallest monthly rainfalls, including melted snow.—Fort Davis and Stockton, Tex., none; Socorro, N. Mex., 0.01 inch; Laredo, Tex. and *Fort Sidney, Nebr., 0.06; Uvalde, Tex., 0.09; Fort Elliott, Tex., 0.10; Dodge City and *Fort Union, N. Mex., 0.12; Pilot Point, Tex., 0.13; Cheyenne, 0.17; Concho, Tex., 0.18; *Gulf Hammock, Fla., 0.20; Castroville, Tex., 0.23; El Paso, Tex., 0.24; *Fort McPherson, Nebr., 0.26; Yuma, Ariz., 0.27; Eagle Pass, Tex., 0.29; Denver, 0.33; Coleman, Tex., 0.34; North Platte, 0.37; Boerne, Tex., 0.39; Fort Sill, 0.45; Jacksonville, 0.46; Mason and San Antonio, Tex., 0.47; Silver City, N. Mex., 0.49; Fort McKavett, Tex., and Santa Fé, 0.50; Fort Griffin, Tex., 0.51; Punta Rassa and Mayport, Fla., 0.52.

Rainy days.—The number of days on which rain or snow has fallen, varies as follows: New England, 9 to 26; Middle Atlantic states, 11 to 20; South Atlantic states, 8 to 15; Eastern Gulf states, 6 to 14; Western Gulf states, 7 to 14; Lower Lake region, 21 to 26; Upper Lake region, 15 to 24; Ohio valley and Tennessee, 14 to 23; Upper Mississippi valley, 11 to 22; Missouri valley, 8 to 16; Red River of the North valley, 8 to 11; Eastern Rocky Mountain slope, 4 to 16; Texas, 0 to 11; Rocky Mountains, 1 to 15; Middle Plateau, 9 to 20; California, 9 to 12; Oregon, 21 to 26.

Cloudy days.—The number varies in New England from 12 to 23; Middle Atlantic states, 10 to 20; South Atlantic states, 5 to 14; Eastern Gulf states, 1 to 14: Western

Gulf states, 10 to 17; Lower lake region, 18 to 29; Upper Lake region, 12 to 26; Ohio valley and Tennessee, 10 to 24; Upper Mississippi valley, 11 to 19; Missouri valley, 9 to 15; Red River of the North valley, 12 to 15; Eastern Rocky Mountain slope, 7 to 11; Texas, 2 to 12; Rocky Mountains, 1 to 14; Middle Plateau, 5 to 22; California, 8 to 12; Oregon, 21 to 27.

Hail was reported from the various States on the following days: Pennsylvania, 21st; Ohio, 19th, 24th; Missouri, 19th, 20th, 30th; Kansas, 9th, 30th; Indian Territory, 4th, 30th; Texas, 4th, 5th, 24th.

Snow fell on the following dates in the various districts: New England, 2d, 3d, 6th to 31st. Middle Atlantic states, 8th, 9th, 10th, 13th to 31st. Ohio valley, 6th, 7th, 8th, 12th to 26th, 28th to 31st. Tennessee, 25th. Lower Lake region, 6th, 8th, 9th, 11th to 31st. Upper Lake region, 1st to 4th, 6th to 9th, 11th to 31st. Upper Mississippi valley, 1st to 11th, 13th to 31st. Missouri valley, 1st to 23d, 25th, 27th, 28th, 30th. Mississippi, at Vicksburg, 25th, 26th. Louisiana, at Shreveport, 25th. Texas, northeastern quarter, 13th, 24th. Arkansas, Little Rock, 24th. Indian Territory, 20th, 24th, 30th. Rocky Mountains, 3d to 14th, 16th to 24th, 27th to 30th. Arizona, 23d, 24th, 27th, 28th, 29th. Western Plateau, 3d to 5th, 7th to 13th, 18th to 23d, 26th to 30th. California, Red Bluff, 28th. San Gorgonio, 21st, 22d, 28th, 29th. Washington Territory, 5th, 6th, 8th to 12th, 17th to 22d, 25th.

Largest monthly snowfalls.—Marquette, 56.50 inches; Mount Washington, 54.50 inches; Oswego, 44.50 inches; Duluth, 39.25 inches; Virginia City, 38.50 inches; *Northport, Mich., 37.75 inches; Alpena, 32.50 inches; *Grafton, N. H., *Newport, Vt., and Buffalo, 29.00 inches; Pike's Peak, 27.00 inches; *Rowe, Mass., 25.50 inches; *Strafford, Vt., 25.00 inches; Saint Paul, 23.00 inches; Pembina, 22.00 inches; *Cornish, Me., 21.00 inches; *Antrim, N. H., 19.50 inches; Palermo, N. Y., 19.25 inches; *Orono, Me., 19.00 inches; *Neillsville, Wis., 18.50 inches; *Little Mountain, Ohio, 18.00 inches; *Coalville, Utah, 17.75 inches; Fort Buford, Dak., 16.80 inches; *Nora Springs, Iowa, *Clinton, Mass., and Milwaukee, 16.50 inches; *Argyle, N. Y., and Winnemucca, 15.50 inches; *Newburyport, Mass., 13.75 inches; *Somerset, Mass., *Dunbarton, N. H., and Salt Lake City, 13.50 inches; *Cooperstown and *Flushing, N. Y., 13.00 inches; LaCrosse, *Manitowoc, Wis., and Bismarck, 12.50 inches.

Depth of snow on ground at end of month.—In Maine, from 4 to 12 inches; New Hampshire, 15 inches; Vermont, 2 to 18 inches; Massachusetts, trace on the coast to 18 inches in the interior; Connecticut, 2 to 3 inches; Rhode Island, 2 inches; New York, ¼ to 12 inches; Pennsylvania, ¼ to 7 inches; New Jersey; trace to 2½ inches in the interior; Ohio, ¼ along lake coast to 5 inches in the interior; Michigan, northern peninsula, 5¾ to 10 inches; southern peninsula, 2 inches at Port Huron to 24 inches at Northport; Wisconsin 2 to 6 inches; Illinois, 0.7 to 5 inches; Missouri, trace to 2 inches in northern half; Iowa, trace to 9½ inches; Minnesota, 7 to 25 inches; Dakota, 1 to 23 inches; Nebraska, ½ to 8½ inches; Kansas, 1¼ to 3 inches; Colorado, 27 inches on suummit of Pike's Peak; Montana, 1 inch at Virginia City; Utah, 3 to 8 inches; Nevada, trace to 7 inches; California, 1 inch at San Gorgonio, near Visalia, at an elevation of 3,000 feet, 20 inches, and at 11,000 feet, 108 inches.

Snow from a cloudless sky.—Milwaukee, Wis., 10th; Burlington, Vt., 19th.

Floods.—Los Angeles, Cal., 20th, mountain streams badly swollen from heavy rains, washing away roads and bridges and interrupting railroad communication for 36 hours. Phoenix, Ariz., 29th, unusually heavy rain storm, river rose 10 feet in two days, causing slight damage. Cape May, N. J., 14th, city flooded by high tides, submerging railroad tracks, extinguishing locomotives' fires, stopping trains, and causing passengers to be brought to the city in boats; 200 yards of sea wall washed away. Morgantown, West Va., 25th, the inner wall of canal-lock, near Hoard's Rock, partly carried away by the freshet.

Droughts.—San Antonio, Tex., 1st, everything suffering for want of rain; the present drought is unprecedented, its severity causing a check upon immigration. Melissa, Tex., 18th to 23d, streams mostly dried up, and also wells, cisterns, and springs.

RELATIVE HUMIDITY.

The percentages of mean relative humidity for the month range as follows: New England, 73 to 83; Middle Atlantic states, 70 to 84; South Atlantic states, 70 to 87; Eastern Gulf states, 76 to 86: Western Gulf states, 62 to 81; Ohio valley and Tennessee, 66 to 78; Lower Lake region, 72 to 82; Upper Lake region, 69 to 81; Upper Mississippi valley, 66 to 74; Missouri valley, 67 to 94; Red River of the North valley, 98 to 99; Eastern Rocky Mountain slope, 52 to 69; Texas, 20 at Stockton to 83 at Rio Grande; Western Plateau, 43 to 75; California, 68 to 84; Oregon, 78 to 86. High stations report the following averages not corrected for altitude: Pike's Peak, 70.1; Denver, 58.8; Cheyenne, 47.9; Virginia City, 62.8; Santa Fé, 49.9; Mount Washington, 86.4 per cent.

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*Those stations marked with a star (*) have been reported by voluntary observers, or U. S. Army posts urgeons.

WINDS.

The prevailing winds, at the Signal Service stations, are indicated on chart No. II by the arrows, which fly with the wind. The maximum hourly velocities, as recorded by self-registers, have been noted in descriptions of the movements of areas of low and high pressure.

Total movements of the air.—The following are the largest total movements recorded in miles at the Signal Service stations during the month: On the summit of Pike's Peak, 20,984 miles; Sandy Hook, 12,066; Thatcher's Island, 11,455; Cape May, 11,387; Indianola, 10,739; Milwaukee, 10,700; Cape Lookout, 10,414; Kittyhawk, 10,324; Sandusky, 10,012; Barnegat, 10,005; Wood's Holl, 9,930; Cape Henry, 9,710; Cheyenne, 9,502; Fort Sill, 9,144; Eastport, 8,868; Cape Hatteras, 8,843; Breckinridge, 8,728; Dodge City, 8,646. The smallest are: Deadwood, 1,740; Visalia, 1,769; La Mesilla, 2,138; Augusta, 2,194; Lynchburg, 2,362; Uvalde, Tex., 2,794; Nashville, 2,817; Baltimore, 3,005; Silver City, N. Mex., 3,080; Virginia City, 3,078; La Crosse, 3,156; Los Angeles, 3,387; Savannah, 3,500; Eagle Pass, Tex., and Salt Lake City, 3,604; Fort Buford, Dak., 3,606; Laredo, 3,644; Boise City, 3,707; San Antonio, Tex., 3,717; Springfield, Mass., 3,811; Charlotte, N. C., 3,946.

Local storms.—Winnemucca, Nev., 16th, p. m., a severe whirlwind passed from southwest to northeast, causing considerable damage, track one mile wide, and lasting fifteen minutes. Colorado Springs, Col., 28th, violent gale from the west, destroying fences, signs, and buildings; at a point 12 miles north of station a parlor car and one engine were lifted from the track and thrown down an embankment. Renick, Randolph County, Missouri, 9th, a severe tornado passed near the town at about 4 p. m., causing great havoc. The storm first appeared in the shape of a dense rolling cloud, hiding the sun and making it appear for miles as dark as night. The first warning of the tornado was signaled by a little black speck to the southeast of the town, which gradually grew larger until it seemed to cover the whole heavens, when the wind increased to hurricane violence. Many buildings were literally torn to pieces; fences and grain stacks scattered in every direction, and portions of the railroad track torn up and carried great distances. Several animals were killed outright, and many persons badly injured. The track of the storm was very narrow and the storm lasted but a few moments. Parker's station, Scott County, Missouri, 10th, a severe windstorm passed over this point between 12 and 1 o'clock, p. m., destroying several large sheds, each 100 feet in stored length, with staves, scattering the material in every direction. Two buildings were unroofed, large trees were uprooted and many fences and outbuildings entirely destroyed. Burlington, Vt., 24th, very severe wind storm, snow piled in heavy drifts, several sheds and other buildings blown down and much damage to other property.

Sand-storms.—Coleman, Tex., 4th and 9th; Fort Garland, Col., 8th; Yuma, Ariz., 24th and 25th—very violent.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily indications for December, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verifications to be 85.7 per cent. The percentages for the four elements are: Weather, 88.1; direction of the wind, 81.5; temperature, 87.7; barometer, 85.4 per cent. By geographical districts they are for New England, 89.4; Middle states, 84.7; South Atlantic states, 85.1; Eastern Gulf states, 85.9; Western Gulf states, 85.6; Lower Lake region, 87.8; Upper Lake region, 84.8; Tennessee and the Ohio valley, 83.9; Upper Mississippi valley, 86.2; Lower Missouri valley, 83.9; Northern Pacific coast region, 87.5; Central Pacific coast region, 86.6; Southern Pacific coast region, 88.3 per cent. There were 16 omissions to predict out of 3,813, or 0.42 per cent. Of the 3,797 predictions that have been made, 69, or 1.82 per cent., are considered to have entirely failed; 128, or 3.37 per cent., were one-fourth verified; 539, or 13.19 per cent., were one-half verified; 4.29, or 11.30 per cent., were three-fourths verified; 27,32, or 69.32 per cent., were fully verified, so far as can be ascertained from the tri-paily weather maps.

Cautionary signals.—270 cautionary signals were displayed during the month, of which 220, or 81.5 per cent., were justified by winds of 25 miles per hour or over at, or within a radius of 100 miles of the station. 82 off-shore signals were displayed, of which 63, or 76.8 per cent., were fully justified; 72, or 87.8 per cent., were not justified either as to direction or velocity. 43 of the off-shore were changed from cautionary. 352 signals of both kinds were displayed, of which 283, or 80.4 per cent., were fully justified. The above does not include signals ordered for 50 display stations, where the velocity is only estimated. 46 cases of winds of 25 miles and over per hour, from scattering stations, were reported, and for which signals had not been ordered. One signal was reported late.

NAVIGATION.

In the table on the right-hand side of chart No. III are given the highest and lowest readings of the Signal Service river-gauges for the month, with the dates of the same. The Savannah, at Augusta, changed but little previous to the 13th, then rose quite rapidly during the 15th, and reached its maximum of 30 feet on the 16th. During the remainder of the month it fell quite steadily. The Red continued nearly stationary during the first half of the month at a little less than 3 feet below the bench-mark (previous low-water mark), at Shreveport, then slowly rose, reaching the bench-mark night of the 18th, and its maximum height at the close of the month. In the Arkansas, at Little Rock, the oscillations have been slight and gradual, excepting a rise of nearly 5 feet on the 25th and 26th. The Tennessee, at Chattanooga, changed but little previous to 11th. During that day and the following it rose over 10 feet; on the 15th and 16th nearly 6 feet; 23d to the 26th nearly 15 feet. At Nashville, the Cumberland rose over 8 feet from the 5th to 7th; fell over 5 feet to the 9th; rose over 17 feet by the 12th, and 7 more by the 16th; fell over 21 feet up to the 22d; rose 22 feet by the 29th, when it reached its maximum. In the Ohio the changes were unimportant, excepting a slow increase of depth of water, until the 24th and 25th, when the river rapidly rose at Pittsburgh and Cincinnati; the 26th to 28th, from Louisville down. For the Missouri the changes are of little interest. At Yankton the river was frozen after the 2d; at Omaha, after the 10th; at Leavenworth, after the 12th. In the Mississippi, above Cairo, the changes were slight and gradual. The river was frozen at Saint Paul after the 7th; at La Crosse, after the 11th; at Dubuque, after the 16th; at Davenport, after the 18th; at Keokuk, after the 24th. At Cairo the river slowly rose to 30 feet by the 17th; fell to 25 feet on 23d; then rose to its maximum at close of month. At Memphis it rose to 25 feet by the 20th; fell to less than 21 feet by 25th; then rose to nearly 27 feet on the 31st. At Vicksburg it steadily rose to over 30 feet by 25th, and remained nearly stationary thence to end of month. At New Orleans there was quite a steady and slow rise.

Ice in rivers and harbors.—The following notes on the formation of ice are of interest: The *Columbia River.*—At Umatilla, Oreg., closed to navigation on the 19th. The *Missouri.*—At Plattsmouth, Nebr., ice gorged at railroad pile bridge and froze solid on the 10th; 18 to 20 inches thick on the 31st. At Leavenworth, Kans., on the 11th and 12th, floating ice; 13th, ice gorged; 14th, river frozen over. At Kansas City, Mo., floating ice from 11th to 14th, river closed on 15th. Creswell, Kans., 12th, creeks frozen over. *Platte River.*—Closed with ice, and teams crossing on the 13th. The *Mississippi.*—At Saint Paul, Minn., frozen over on the 8th. At La Crosse, Wis., closed by ice on the 12th. At Dubuque, Ia., free of ice on the 5th; gorged on the 13th; frozen over on the 17th, passengers and teams crossing. At Davenport, Ia., floating ice on 1st, 11th, 12th, 15th to 18th; last boat of season passed down on the 14th; navigation closed on the 17th; frozen over on the 19th; vehicles crossing on ice 22d. At Burlington, Ia., floating ice on the 1st, 2d, 10th, 12th to 15th; navigation closed on the 10th; nearly frozen over on the 16th; frozen over on the 18th; people crossing on the ice on the 19th; teams crossing on the 20th. At Muscatine, Ia., frozen over on the 18th; teams crossing on 22d. At Keokuk, Ia., floating ice from the 11th to the 25th, inclusive; river closed on the 25th; ice broken up on the 28th; navigation closed on the 11th. At Saint Louis, Mo., floating ice on the 16th and 17th; 18th, navigation suspended; 21st, heavy; 22d, 24th, 25th; 26th, gorged near bridge; 27th, 28th, 29th, gorged at Saint Charles; river nearly clear on 30th. At Cairo, Ill., floating ice from 18th to 31st; very heavy from 26th to 31st, causing entire obstruction of navigation. *Des Moines River.*—At Des Moines, Ia., closed by ice on the 13th. At Boonesborough, Ia., closed by ice strong enough for teams to cross on the 10th. *Rock River.*—At Rockford, Ill., frozen over solid on the 12th; Lyndon, Ill., 12th, river closed with ice above the dam; 25th, closed with ice below the dam. *Skunk River.*—Ames, Ia., river frozen over during the month. Tabor, Ia., 31st, ice in creeks 14 inches thick. *Cottonwood River.*—Creswell, Kans., 26th, river and neighboring creeks frozen over. Wellington, Kans., 31st, ice in creeks 6 inches thick. Cedar Vale, Kans., 12th to 31st, Cana creek frozen over. The *Ohio.*—At Cairo, Ill., drift wood in river from the 7th to the 17th, and from the 28th to the 31st. At Cincinnati, full of floating ice on the 27th. Miami canal closed by ice on the 26th. *Hudson River.*—At Garrison's, N. Y., navigation entirely suspended on the 31st. *Susquehanna.*—At Catawissa, Pa., closed by ice in several places on the 31st; navigation closed on north branch of Pennsylvania canal on the 17th; on the west branch on the 12th; canal frozen over on the 18th. *Connecticut.*—Springfield, Mass., 22d, river closed with ice; 29th, river in many places clear of ice; Fall River, Mass., 22d, North Watuppa Lake, frozen for first time this season. *Saint Lawrence River.*—Frozen over at Montreal on the 29th. *Newburyport, Mass.*—River and harbor entirely free from ice on 31st. *Lakes.*—Marquette, Mich., harbor frozen over from 18th to 21st. Grand Haven, Mich., harbor frozen over from 16th to 31st. Duluth, Minn., harbor frozen from 12th to 31st. Escanaba, Mich., ice in bay entire month. Port Huron, Mich., navigation closed on the 14th; Fort Gratiot, light extinguished for the season on the 19th. Alpena, Mich., last steamer of season left for Detroit on the 7th; bay full of ice on the 12th. Chicago, Ill., lake frozen along the shore on the 15th; navigation closed on the 16th; all vessels laid up on the 17th. Buffalo, N. Y., canal navigation closed on the 6th, lake navigation on the 27th; Buffalo Creek and river frozen over on 26th. Oswego, N. Y., navigation closed on the 1st; all vessels laid up for the winter on the 11th. Detroit, Mich., floating ice in river on the 16th; ice along shore on the 26th. Cleveland, Ohio, navigation closed on the 9th; ice forming along the wharves on the 16th; river frozen over, 18th; floating ice in lake in large quantities on the 26th. Toledo, Ohio, navigation practically closed on the 4th; river partly covered by ice, 13th; frozen over, 16th; navigation closed, 17th. Erie, Pa., harbor lights discontinued for the season. *Lake Champlain.*—Burlington, Vt., ice broken up in river on the 15th; on the 15th at Rouse's Point, Can., 45 vessels fast in the ice, and between Rouse's Point and Sorel 100 vessels ice-bound; lake frozen over from Crown Point to Whitehall; people and teams crossing on ice between Ticonderoga and Bridgeport on the 26th; ice bridge between Saint Alban's, Vt., and the islands in the lake firm on the 29th, and 6 inches thick in the thinnest part.

High tides.—Cape Lookout, N. C., 13th; Macon, N. C., 13th, 14th, 15th, 16th; Atlantic City, N. J., 15th, very high tides, trains delayed in crossing the meadows.

Low tides.—Indianola, 26th, 27th, 28th, 29th, 30th, 31st.

TEMPERATURE OF WATER.

The temperatures of water, as observed in rivers and harbors, with average depth at which observations were taken, are given in table on left side of chart No. II. At the following stations observations were not made on the dates indicated: on account of ice, at Alpena, from 21st to 31st, inclusive; Buffalo, 26th to 31st; Chicago, 15th to 31st; Detroit, 16th to 23d and 26th to 31st; Duluth, 13th to 31st; Escanaba, 1st to 31st; Grand Haven, 16th to 31st; Marquette, 18th to 21st; Milwaukee, on the 21st and 23d; Toledo, 16th to 31st. At Cleveland the lake was too rough for observations to be taken on the 7th, 10th, 11th, 15th, and 22d. At Savannah, 15th to 21st; at Punta Rassa, 6th to 31st, and Augusta, 14th to 25th, observations were interrupted by loss or breakage of thermometer.

ATMOSPHERIC ELECTRICITY.

Thunder-storms were reported in the various States on the following dates: Pennsylvania, 11th; New Jersey, 6th; Maryland, 6th; Virginia, 6th, 26th; North Carolina, 6th; Georgia, 11th, 15th; Florida, 5th, 11th, 15th; Alabama, 5th; Mississippi and Louisiana, 5th, 10th; Texas, 4th, 5th, 9th, 10th, 13th, 23d, 24th, 31st; Arkansas, 3d, 9th, 24th; Indian Territory, 4th; Tennessee, 6th, 22d, 23d; Ohio, 9th, 21st, 22d; Indiana, 3d, 9th, 21st, 22d; Michigan, 9th, 10th; Wisconsin, 9th; Iowa, 9th; Illinois, 9th, 10th, 21st; Missouri, 4th, 5th, 9th, 21st; Kansas, 4th, 5th, 9th, 30th.

Auroras.—Cornish, Me., 7th, 8th. Fall River, Mass., 12th. Thornville, Mich., 10th, 9 p. m., dimly defined arch with streamers. Argyle, N. Y., 17th, 9 p. m., diffuse light. Cambridge, Mass., regularly looked for at 8 p. m.; suspected, 7th, 9th; decidedly cloudy, 2d, 3d, 5th, 6th, 8th, 10th, 11th, 13th, 14th, 16th, 19th, 20th, 24th; some clouds or haze, 4th, 15th; some clouds and moonlight, 1st, 17th, 21st; moonlight, 18th, 26th, 27th; no record, 22d, 23d, 25th, 28th, 29th, 30th, 31st; aurora, if present, would have been seen on the 12th. Burlington, Vt., 7th, 11 p. m., an arch of light, of a pale green, with a few streamers above a well defined dark segment; 8th, 9 p. m., diffuse light. Wellsboro, Pa., 12th, 8.20 to 10.30 p. m.; 18th, 9 p. m., to midnight. Newport and Woodstock, Vt., 8th. Manitowoc, Wis., 7th, 11th.

Telegraphic communication interfered with by atmospheric electricity.—Bismarck, 10th, 22d, 23d; Coleman and Mason, Tex., 4th; Indianola, 5th, 12th, 18th.

OPTICAL PHENOMENA.

Solar halos were observed in the various districts on the following dates: New England, 18th to 21st, 23d to 25th, 28th to 31st. Middle Atlantic states, 1st to 3d, 16th, 18th, 20th to 25th, 27th to 31st. South Atlantic states, 3d, 4th, 8th, 11th, 19th to 22d, 24th, 27th, 29th, 30th, 31st. Eastern Gulf states, 1st, 18th, 19th, 21st, 23d, 27th, 28th. Western Gulf states, 1st, 2d, 3d, 18th to 23d, 27th. Lower Lake region, 1st, 3d, 18th, 23d, 25th, 27th. Upper Lake region, 1st, 2d, 20th, 24th, 25th, 27th, 28th, 31st. Ohio valley and Tennessee, 1st, 2d, 19th, 24th to 28th, 30th. Upper Mississippi valley, 1st, 2d, 6th, 10th, 11th, 15th, 17th, 20th, 24th, 26th to 30th. Missouri valley, 1st, 2d, 3d, 4th, 17th, 18th, 19th, 20th to 24th, 27th to 31st. Rocky Mountains, 2d, 18th, 23d, 26th, 27th, 28th. Western Plateau, 1st, 21st, 23d, 26th, 28th, 30th. California, 5th, 23d. Washington Territory, 4th.

Lunar halos were observed in the various districts on the following dates: New England, 1st, 2d, 3d, 13th, 19th, 23d to 25th, 27th, 30th; Middle Atlantic states, 3d, 13th, 26th, 27th; South Atlantic states, 3d, 19th, 21st, 25th; Eastern Gulf states, 3d, 5th, 7th, 11th, 12th, 19th, 21st, 25th; Western Gulf states, 2d, 7th, 8th, 11th; Lower Lake region, 4th, 13th, 16th, 19th, 23d, 24th, 27th; Upper Lake region, 13th, 28th, 30th; Ohio valley and Tennessee, 1st, 7th, 8th, 13th, 28th; Upper Mississippi valley, 2d, 7th, 10th, 11th, 12th, 16th, 14th, 15th, 24th, 25th, 27th, 31st; Missouri valley, 1st, 7th, 8th, 11th, 14th, 16th, 17th, 18th, 20th to 22d, 24th to 31st; Western Plateau, 17th, 21st, 26th, 27th; California, 9th, 12th, 22d, 27th; Washington Territory, 14th, 22d.

MISCELLANEOUS PHENOMENA.

Sunsets.—The characteristics of the sky at sunset, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from 131 stations show 4,042 observations to have been made, of which

32 were reported doubtful; of the remainder, 3,264, or 81.4 per cent., were followed by the expected weather.

Meteors.—Belvidere, Ill., 31st; New Corydon, Ind., 13th, 17th, 18th, 26th, 27th; Spiceland, Ind., 1st; Wabash, Ind., 15th, 11.30 p. m., a very large and brilliant meteor passed from SE. to NW., lighting up the whole heavens; Woodstock, Md., 7th, 12th, 13th, 15th, 16th; Westborough, Mass., 12th, 13th; Rowe, Mass., 7th, 9th; Ashley, Mo., 12th; Clear Creek, Nebr., 2d; Austin, Nebr., 12th; Freehold, N. J., 16th; Atco, N. J., 17th; Waterburg and North Volney, N. Y., 13th; North Platte, 13th; Castroville, Tex., 11th; Pensacola, Fla., 1st, 10th, 19th; Springfield, Ill., 10th; Madison, Wis., 16th; Chambersburg, Pa., 12th; Ashwood, Tenn., 16th; Maiden Rock, Wis., 30th; Mr. H. H. Ten Brœck reported the appearance of a remarkably brilliant meteor at 6.45 p. m. It was first observed about 37° above the western horizon, moving in a southwesterly direction. It left a trail about 5° long, equally divided into yellow, scarlet, and violet bands, lasting about 10 seconds, when, suddenly changing into a yellow cloud, it disappeared.

Earthquakes.—United States Naval Hospital, Yokohama, Japan, October 17th, 1879, 1.31 and 2.17 p. m., light shocks; 18th, 1.52 a. m., severe shock, duration, 45 seconds; 25th, 0.40 a. m., light shock; 30th, 9.44 a. m., light shock; November 15th, 9.30 a. m., two smart shocks, duration 7 seconds. Two distinct shocks moving from west to east were felt at Charlotte, N. C., and in the surrounding country within a radius of 11 miles, the one at 7 p. m. of the 12th, and the other at 2 a. m. of the 13th. The second was sufficiently distinct to rouse from sleep persons living in Charlotte, Sharon Township, Providence, and Pineville. At Los Angeles, Cal., slight shock at 8.15 p. m. of the 7th, lasting about two seconds.

Zodiacal lights.—Monticello, Ia., 8th, 11th, 13th. Cedar Vale, Kans., 11th, 12th, 13th. Yates Center, Kans., 5th, 6th, 10th, 11th, 12th, 13th. Rowe, Mass., 5th, 9th. Oregon, Mo., 13th. Clear Creek, Nebr., 12th. Atco, N. J., 1st, 2d, 12th, 13th. Cambridge, Mass. (Harvard Observatory), regularly looked for at 8 p. m.; suspected through haze on the 4th; somewhat visible 7th 9th, 12th; observations on other evenings hindered by moonlight or clouds. Lynchburg, 30th, 31st. Southington, Conn., 15th. Wytheville, Va., 1st, 3d, 4th, 6th, 7th, 8th, 12th, 16th.

Prairie and forest fires.—Creswell, Kans., 1st, 2d, 3d, 8th, 13th to 16th, 20th, 24th, 25th; Dodge City, 10th, 11th, 12th; Fort Sill, 3d, 7th, 9th, 10th, 15th, 17th; Fort Gibson, 1st, 2d, 13th, 17th, 26th; Henrietta, Tex., 3d, 9th 10th; New Orleans, 29th.

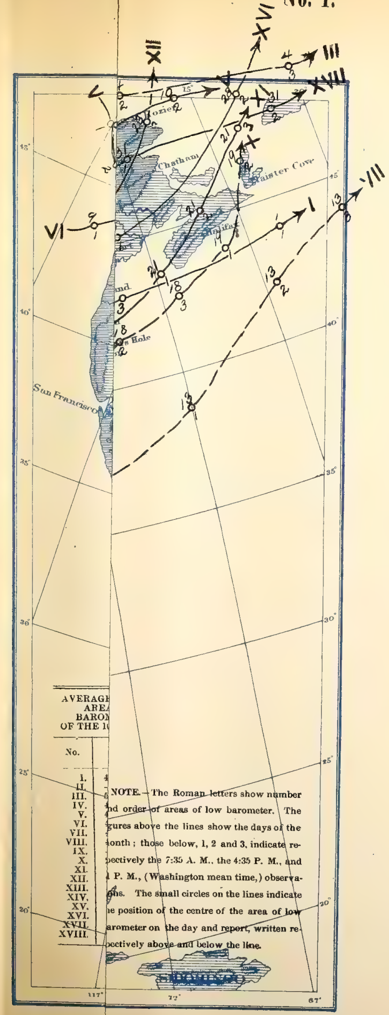
Polar bands.—New Corydon, Ind., 5th, 13th, 18th, 27th; Tabor, Ia., 27th; Yate's Center, Kans., 2d, 29th, 31st; Gardiner, Me., 8th, 13th, 19th, 28th; Clear Creek, Nebr., 2d, 20th, 27th; Freehold, N. J., 3d, 28th; Vineland, N. J., 29th; Pembina, 3d; Milwaukee, 22d; Wytheville, Va., 7th, 12th, 27th.

Mirage.—Genoa, Nebr., 10th, 12th, 13th, 22d; Pembina, 5th, 11th, 18th, 22d, 24th, 31st; Cape Lookout, N. C., 3d; Macon, N. C., 3d.

Sun spots.—The following record of observations made by Mr. D. P. Todd, assistant, has been forwarded by Prof. S. Newcomb, U. S. Navy, superintendent Nautical Almanac office, Washington, D. C.:

Date.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	
Dec., 1879.									
1st, 8 a. m. .	0	0	0	0	0	0	1	3	
3rd, 9 a. m. .	0	0	0	0	0	0	1	3	
7th, 8 a. m. .	0	0	–	–	0	0	0	0	} Faculæ.
7th, 10 a. m. .	0	0	0	0	0	0	0	0	
8th, 4 p. m. .	0	0	0	0	0	0	0	0	
9th, 9 a. m. .	1	3	0	0	0	0	1	3	Spots faint.
12th, 9 a. m. .	0	0	–	–	0	0	0	0	Faculæ.
13th, 8 a. m. .	0	0	0	0	0	0	0	0	
15th, 4 p. m. .	0	0	0	0	0	0	0	0	
16th, 8 a. m. .	1	2	0	0	0	0	1	2	
16th, 4 p. m. .	0	0	0	0	0	0	1	2	These 2 spots have had a large relative motion since morning observation.
17th, 3 p. m. .	0	0	0	0	0	0	1	2	
18th, 8 a. m. .	0	2	0	0	0	0	1	4	
20th, 8 a. m. .	0	0	–	–	0	0	0	0	
27th, 9 a. m. .	0	0	0	0	0	0	0	0	
28th, 3 p. m. .	0	0	0	0	0	0	0	0	
30th, 8 a. m. .	0	0	0	0	0	0	0	0	
30th, 2 p. m. .	0	0	0	0	0	0	0	0	

No. I.



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No.
I.
II.
III.
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VI.
VII.
VIII.
IX.
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XII.
XIII.
XIV.
XV.
XVI.
XVII.
XVIII.

NOTE.—The Roman letters show number nd order of areas of low barometer. The gures above the lines show the days of the onth; those below, 1, 2 and 3, indicate repectively the 7:35 A. M., the 4:35 P. M., and P. M., (Washington mean time,) observaons. The small circles on the lines indicate e position of the centre of the area of low arometer on the day and report, written repectively above and below the line.

32 were reported doubtful; of the remainder, 3,264, or 81.4 per cent., were followed by the expected weather.

Meteors.—Belvidere, Ill., 31st; New Corydon, Ind., 13th, 17th, 18th, 26th, 27th; Spiceland, Ind., 1st; Wabash, Ind., 15th, 11.30 p. m., a very large and brilliant meteor passed from SE. to NW., lighting up the whole heavens; Woodstock, Md., 7th, 12th, 13th, 15th, 16th; Westborough, Mass., 12th, 13th; Rowe, Mass., 7th, 9th; Ashley, Mo., 12th; Clear Creek, Nebr., 2d; Austin, Nebr., 12th; Freehold, N. J., 16th; Atco, N. J., 17th; Waterburg and North Volney, N. Y., 13th; North Platte, 13th; Castroville, Tex., 11th; Pensacola, Fla., 1st, 10th, 19th; Springfield, Ill., 10th; Madison, Wis., 16th; Chambersburg, Pa., 12th; Ashwood, Tenn., 16th; Maiden Rock, Wis., 30th; Mr. H. H. Ten Brœck reported the appearance of a remarkably brilliant meteor at 6.45 p. m. It was first observed about 37° above the western horizon, moving in a southwesterly direction. It left a trail about 5° long, equally divided into yellow, scarlet, and violet bands, lasting about 10 seconds, when, suddenly changing into a yellow cloud, it disappeared.

Earthquakes.—United States Naval Hospital, Yokohama, Japan, October 17th, 1879, 1.31 and 2.17 p. m., light shocks; 18th, 1.52 a. m., severe shock, duration, 45 seconds; 25th, 0.40 a. m., light shock; 30th, 9.44 a. m., light shock; November 15th, 9.30 a. m., two smart shocks, duration 7 seconds. Two distinct shocks moving from west to east were felt at Charlotte, N. C., and in the surrounding country within a radius of 11 miles, the one at 7 p. m. of the 12th, and the other at 2 a. m. of the 13th. The second was sufficiently distinct to rouse from sleep persons living in Charlotte, Sharon Township, Providence, and Pineville. At Los Angeles, Cal., slight shock at 8.15 p. m. of the 7th, lasting about two seconds.

Zodiacal lights.—Monticello, Ia., 8th, 11th, 13th. Cedar Vale, Kans., 11th, 12th, 13th. Yates Center, Kans., 5th, 6th, 10th, 11th, 12th, 13th. Rowe, Mass., 5th, 9th. Oregon, Mo., 13th. Clear Creek, Nebr., 12th. Atco, N. J., 1st, 2d, 12th, 13th. Cambridge, Mass. (Harvard Observatory), regularly looked for at 8 p. m.; suspected through haze on the 4th; somewhat visible 7th 9th, 12th; observations on other evenings hindered by moonlight or clouds. Lynchburg, 30th, 31st. Southington, Conn., 15th. Wytheville, Va., 1st, 3d, 4th, 6th, 7th, 8th, 12th, 16th.

Prairie and forest fires.—Creswell, Kans., 1st, 2d, 3d, 8th, 13th to 16th, 20th, 24th, 25th; Dodge City, 10th, 11th, 12th; Fort Sill, 3d, 7th, 9th, 10th, 15th, 17th; Fort Gibson, 1st, 2d, 13th, 17th, 26th; Henrietta, Tex., 3d, 9th 10th; New Orleans, 29th.

Polar bands.—New Corydon, Ind., 5th, 13th, 18th, 27th; Tabor, Ia., 27th; Yate's Center, Kans., 2d, 29th, 31st; Gardiner, Me., 8th, 13th, 19th, 28th; Clear Creek, Nebr., 2d, 20th, 27th; Freehold, N. J., 3d, 28th; Vineland, N. J., 29th; Pembina, 3d; Milwaukee, 22d; Wytheville, Va., 7th, 12th, 27th.

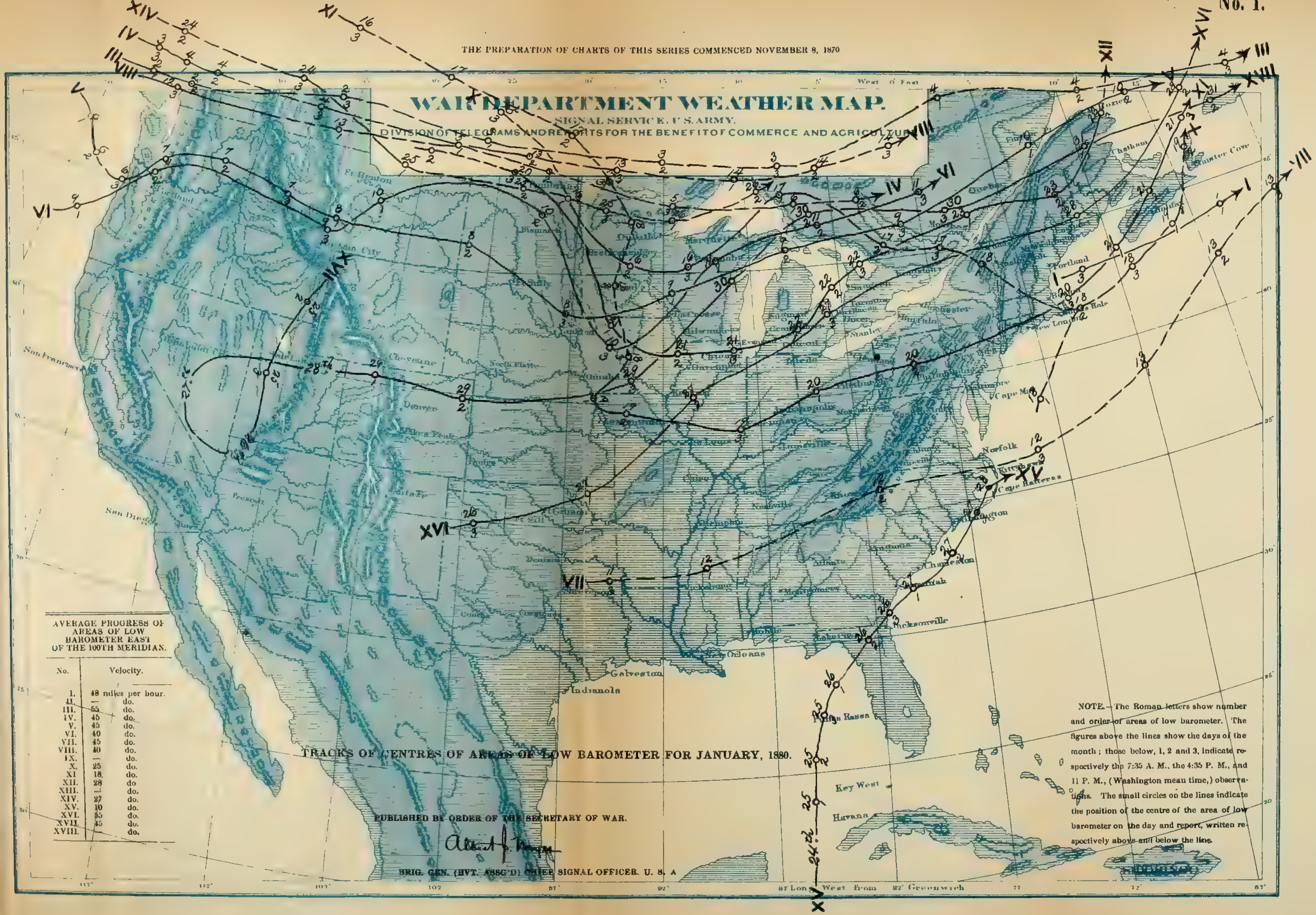
Mirage.—Genoa, Nebr., 10th, 12th, 13th, 22d; Pembina, 5th, 11th, 18th, 22d, 24th, 31st; Cape Lookout, N. C., 3d; Macon, N. C., 3d.

Sun spots.—The following record of observations made by Mr. D. P. Todd, assistant, has been forwarded by Prof. S. Newcomb, U. S. Navy, superintendent Nautical Almanac office, Washington, D. C.:

Date.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	
Dec., 1879.									
1st, 8 a. m..	0	0	0	0	0	0	1	3	
3rd, 9 a. m..	0	0	0	0	0	0	1	3	
7th, 8 a. m..	0	0	–	–	0	0	0	0	} Faculæ.
7th, 10 a. m..	0	0	0	0	0	0	0	0	
8th, 4 p. m..	0	0	0	0	0	0	0	0	
9th, 9 a. m..	1	3	0	0	0	0	1	3	Spots faint.
12th, 9 a. m..	0	0	–	–	0	0	0	0	Faculæ.
13th, 8 a. m..	0	0	0	0	0	0	0	0	
15th, 4 p. m..	0	0	0	0	0	0	0	0	
16th, 8 a. m..	1	2	0	0	0	0	1	2	
16th, 4 p. m..	0	0	0	0	0	0	1	2	These 2 spots have had a large relative motion since morning observation.
17th, 3 p. m..	0	0	0	0	0	0	1	2	
18th, 8 a. m..	0	2	0	0	0	0	1	4	
20th, 8 a. m..	0	0	–	–	0	0	0	0	
27th, 9 a. m..	0	0	0	0	0	0	0	0	
28th, 3 p. m..	0	0	0	0	0	0	0	0	
30th, 8 a. m..	0	0	0	0	0	0	0	0	
30th, 2 p. m..	0	0	0	0	0	0	0	0	

No. 1.

THE PREPARATION OF CHARTS OF THIS SERIES COMMENCED NOVEMBER 8, 1870



WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

TRACKS OF CENTRES OF AREAS OF LOW BAROMETER FOR JANUARY, 1880.

AVERAGE PROGRESS OF AREAS OF LOW BAROMETER EAST OF THE 100TH MERIDIAN.

No.	Velocity.	
I.	48	miles per hour.
II.	—	do.
III.	55	do.
IV.	45	do.
V.	45	do.
VI.	40	do.
VII.	45	do.
VIII.	40	do.
IX.	—	do.
X.	25	do.
XI	18,	do.
XII.	28	do
XIII.	—	do.
XIV.	27	do.
XV.	10	do.
XVI.	55	do.
XVII.	45	do.
XVIII.	—	do.

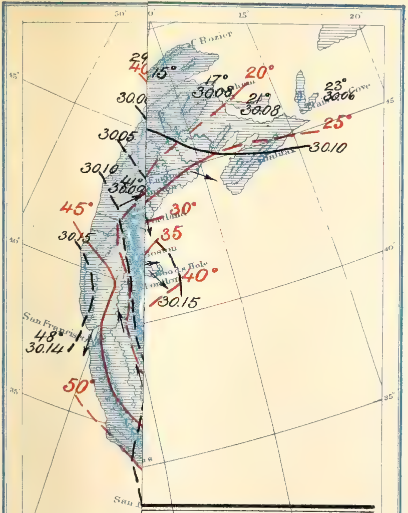
NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7:35 A. M., the 4:35 P. M., and 11 P. M., (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above and below the line.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

No. II.



TEMPERATURES FOR JANUARY, 1880.

TEMPERATURE JANU

STATIONS.		Average for January, Signal Service Observations. For several years.	Average for January, Signal Service Observations. For 1880.	Comparison of January, 1880, with the average for several years.
*Alpena				
Augusta		37°.4	37°.0	0°.4 below.
Baltimore		39 .3	42 .0	2°.7 above.
Buffalo		51 .1	47 .8	4°.3 below.
Burlington, Vt.		53 .4	52 .0	1°.4 below.
Cedar Keys		50 .5	43 .3	7°.2 below.
Charleston				
*Chicago		31 .3	41 .0	9°.7 above.
Cleveland		26 .5	38 .3	11°.8 above.
*Detroit		28 .1	28 .8	0°.7 above.
*Duluth	ope	21 .1	27 .2	6°.1 above.
Eastport	lope	27 .0	37 .5	10°.5 above.
Escanaba	t. slope	41 .0	48 .7	7°.7 above.
Galveston		13 .4	23 .7	10°.3 above.
*Grand Haven	alley	21 .3	36 .8	15°.5 above.
Jacksonville	th valley	0 .2	— .–	
Key West		19 .4	31 .6	12°.2 above.
*Marquette		23 .9	36 .7	12°.8 above.
Milwaukee	nnessee	34 .2	49 .0	14°.8 above.
Mobile		54 .7	— .–	
New London		46 .4	59 .7	13°.3 above.
New York		47 .5	58 .0	10°.5 above.
Norfolk		61 .3	66 .7	5°.4 above.
Portland, Maine	es	45 .9	59 .2	13°.3 above.
Punta Rassa	ntes	32 .8	42 .0	9°.2 above.
*Sandusky		22 .7	31 .4	8°.7 above.
San Francisco	y	13 .3	23 .3	10°.0 above.
Savannah	stations	15 .8	[illegible] .7	6°.9 above.
*Toledo		5 .0	18 .2	13°.2 above.
Wilmington		3 .4	6 .4	[illegible] above.
Wood's Holl				

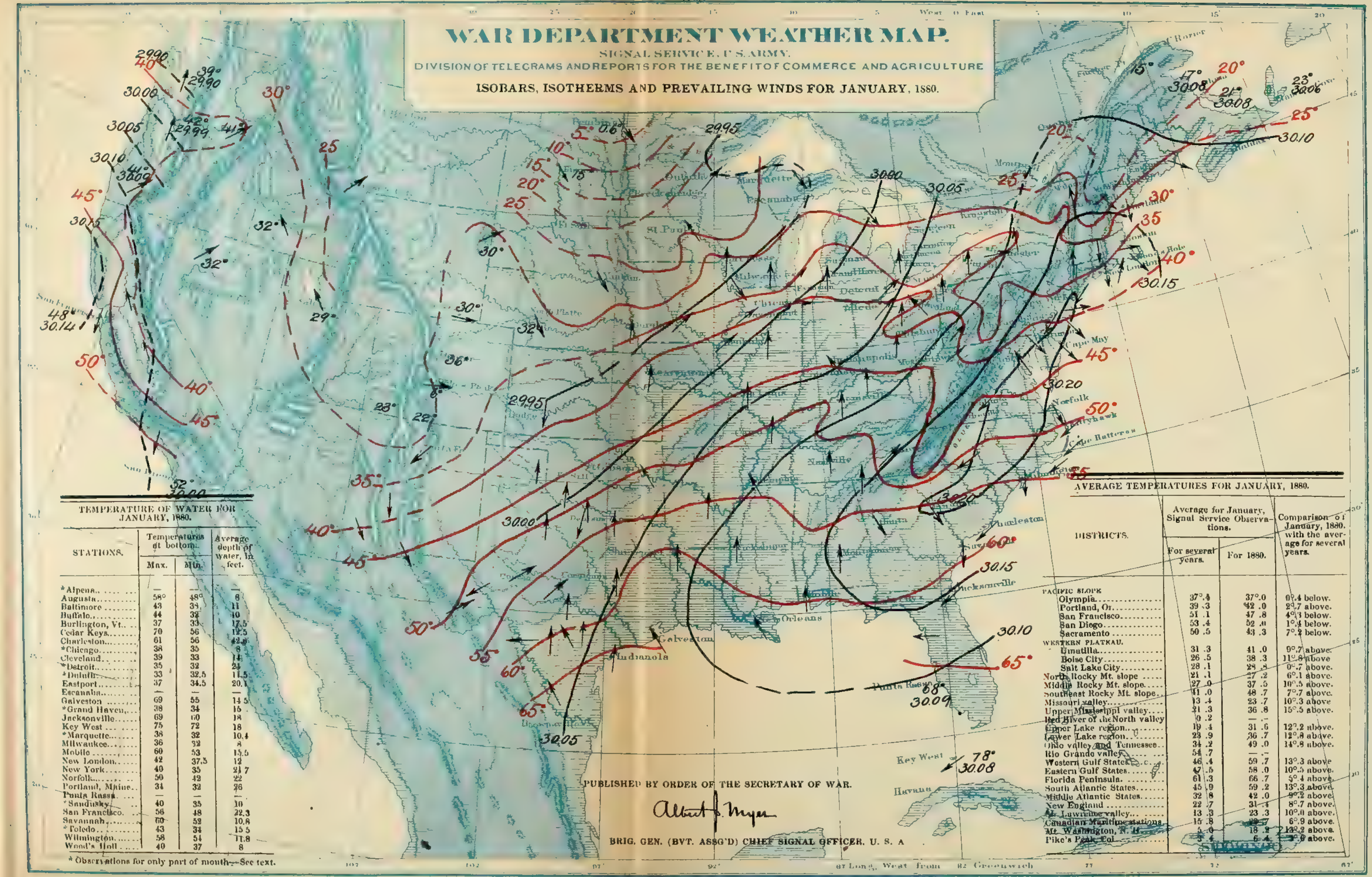
* Observations for

No. 11.

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY.
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE

ISOBARS, ISOTHERMS AND PREVAILING WINDS FOR JANUARY, 1880.



TEMPERATURE OF WATER FOR JANUARY, 1880.

STATIONS.	Temperature at bottom.		Average depth of water, in feet.
	Max.	Min.	
*Alpena	—	—	—
Augusta	58°	48°	6
Baltimore	43	34	11
Buffalo	44	32	10
Burlington, Vt.	37	33	17.5
Cedar Keys	70	56	12.5
Charleston	61	56	12.8
*Chicago	38	35	8
Cleveland	39	33	14
*Detroit	35	32	24
*Duluth	33	32.5	11.5
Eastport	37	34.5	20.1
Escanaba	—	—	—
Galveston	69	55	14.5
*Grand Haven	38	34	16
Jacksonville	69	60	18
Key West	75	72	18
*Marquette	38	32	10.4
Milwaukee	36	32	8
Mobile	60	53	15.5
New London	42	37.5	12
New York	40	35	21.7
Norfolk	50	42	22
Portland, Maine	34	32	36
Punta Rassa	—	—	—
*Sandusky	40	35	10
San Francisco	56	48	22.3
Savannah	60	52	10.8
*Toledo	43	34	15.5
Wilmington	58	54	11.8
Wood's Holl	40	37	8

* Observations for only part of month.—See text.

AVERAGE TEMPERATURES FOR JANUARY, 1880.

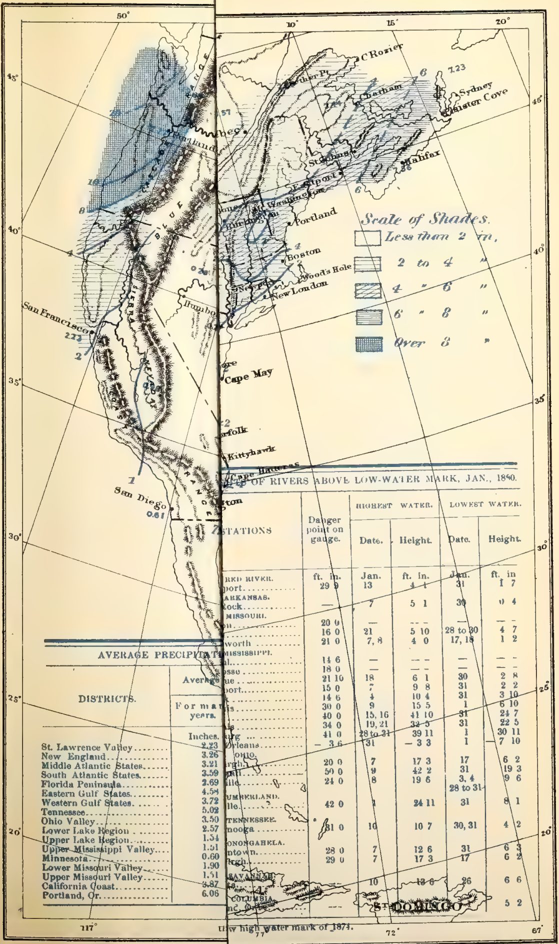
DISTRICTS.	Average for January, Signal Service Observations.		Comparison of January, 1880, with the average for several years.
	For several years.	For 1880.	
PACIFIC SLOPE			
Olympia	37°.4	37°.0	0°.4 below.
Portland, Or.	39 .3	42 .0	2°.7 above.
San Francisco	51 .1	47 .8	4°.3 below.
San Diego	53 .4	52 .0	1°.4 below.
Sacramento	50 .5	43 .3	7°.2 below.
WESTERN PLATEAU.			
Umatilla	31 .3	41 .0	9°.7 above.
Boise City	26 .5	38 .3	11°.8 above
Salt Lake City	28 .1	28 .8	0°.7 above.
North Rocky Mt. slope	21 .1	27 .2	6°.1 above.
Middle Rocky Mt. slope	27 .0	37 .5	10°.5 above.
Southeast Rocky Mt. slope	41 .0	48 .7	7°.7 above.
Missouri valley	13 .4	23 .7	10°.3 above
Upper Mississippi valley	21 .3	36 .8	15°.5 above.
Red River of the North valley	0 .2	— .–	
Upper Lake region	19 .4	31 .6	12°.2 above.
Lower Lake region	23 .9	36 .7	12°.8 above.
Ohio valley and Tennessee	34 .2	49 .0	14°.8 above.
Rio Grande valley	54 .7	— .–	
Western Gulf States	46 .4	59 .7	13°.3 above
Eastern Gulf States	47 .5	58 .0	10°.5 above.
Florida Peninsula	61 .3	66 .7	5°.4 above.
South Atlantic States	45 .9	59 .2	13°.3 above.
Middle Atlantic States	32 .8	42 .0	9°.2 above.
New England	22 .7	31 .4	8°.7 above.
St. Lawrence valley	13 .3	23 .3	10°.0 above.
Canadian Maritime stations	15 .8	[illegible] .7	6°.9 above.
Mt. Washington, N. H.	5 .0	18 .2	13°.2 above.
Pike's Peak, Col.	3 .4	6 .4	3°.0 above.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASS'G'D) CHIEF SIGNAL OFFICER, U. S. A.

No. III.



AVERAGE PRECIPITAT

DISTRICTS.	Average For ma years.
	Inches.
St. Lawrence Valley	2.23
New England	3.26
Middle Atlantic States	3.21
South Atlantic States	3.59
Florida Peninsula	2.69
Eastern Gulf States	4.58
Western Gulf States	3.72
Tennessee	5.02
Ohio Valley	3.50
Lower Lake Region	2.57
Upper Lake Region	1.54
Upper Mississippi Valley	1.51
Minnesota	0.60
Lower Missouri Valley	1.90
Upper Missouri Valley	1.51
California Coast	3.87
Portland, Or.	6.06

OF RIVERS ABOVE LOW-WATER MARK, JAN., 1880.

STATIONS	Danger point on gauge.	HIGHEST WATER.		LOWEST WATER.	
		Date.	Height.	Date.	Height.
RED RIVER.	ft. in.	Jan.	ft. in.	Jan.	ft. in
port	29 9	13	4 1	31	1 7
ARKANSAS.					
Rock	—	7	5 1	30	0 4
MISSOURI.					
n	20 0	—	— —	—	— —
	16 0	21	5 10	28 to 30	4 7
worth	21 0	7, 8	4 0	17, 18	1 2
MISSISSIPPI.					
l	14 6	—	— —	—	— —
osso	18 0	—	— —	—	— —
ue	21 10	18	6 1	30	2 8
port	15 0	7	9 8	31	2 2
	14 6	4	10 4	31	3 10
is	30 0	9	15 5	1	6 10
	40 0	15, 16	41 10	31	24 7
s	34 0	19, 21	32 5	31	22 5
urg	41 0	28 to 31	39 11	1	30 11
Orleans	— 3 6	31	— 3 3	1	— 7 10
OHIO.					
rgh	20 0	7	17 3	17	6 2
ati	50 0	9	42 2	31	19 3
ille	24 0	8	19 6	3, 4 28 to 31	9 6
UMBERLAND.					
lle	42 0	1	24 11	31	8 1
TENNESSEE.					
nooga	31 0	10	10 7	30, 31	4 2
ONONGAHELA.					
ntown	28 0	7	12 6	31	6 3
rgh	29 0	7	17 3	17	6 2
SAVANNAH.					
a	— —	10	13 6	26	6 6
COLUMBIA.					
nd, Or	---				5 2

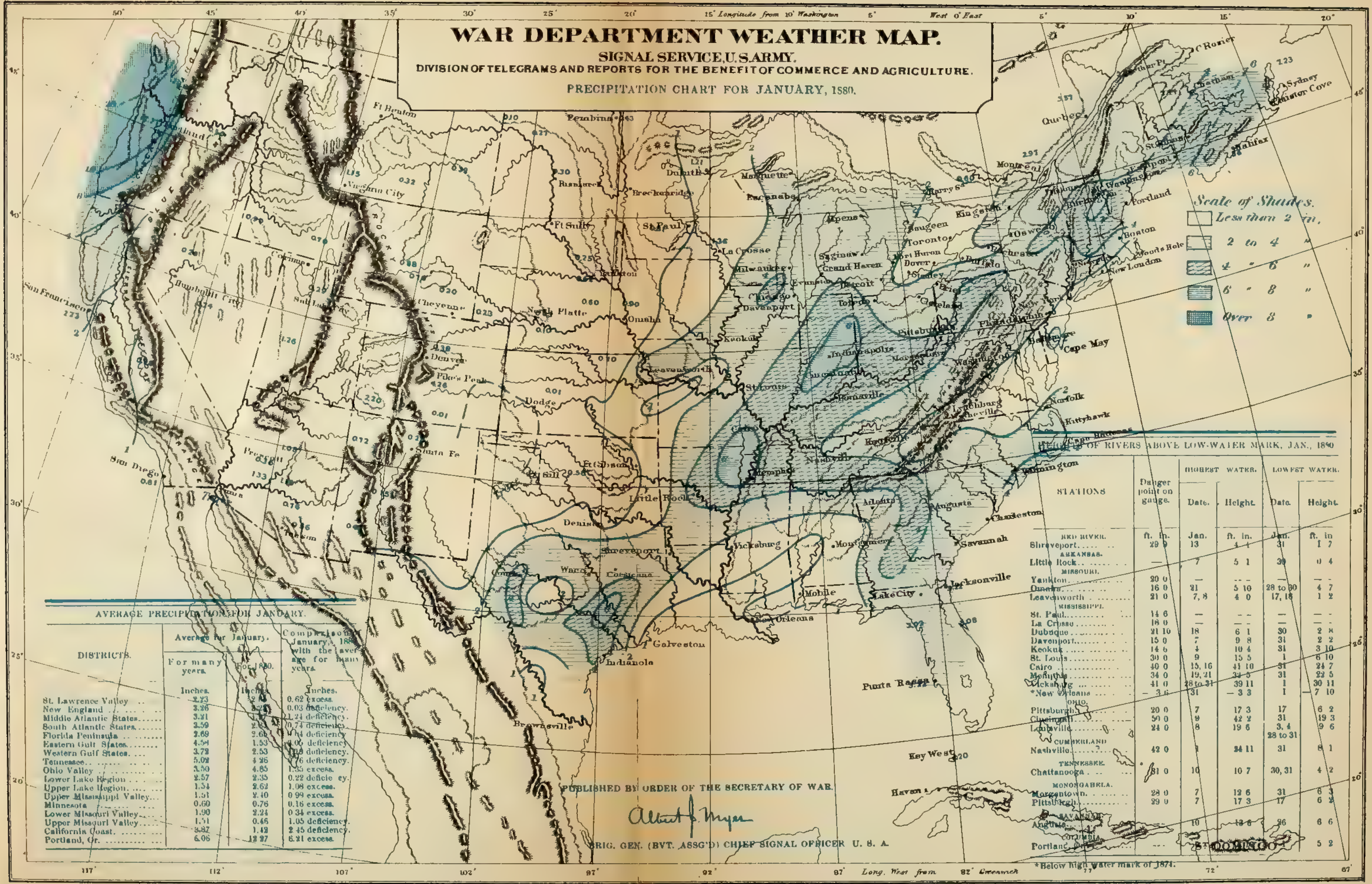
w high water mark of 1874.

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

PRECIPITATION CHART FOR JANUARY, 1880.



Scale of Shades.

- ☐ *Less than 2 in.*
- ☐ *2 to 4 "*
- ▨ *4 " 6 "*
- ▨ *6 " 8 "*
- ▩ *Over 8 "*

AVERAGE PRECIPITATION FOR JANUARY.

DISTRICTS.	Average for January.		Comparison of January, 1880, with the average for many years.
	For many years.	For 1880.	
	Inches.	Inches.	Inches.
St. Lawrence Valley	2.23	[illegible]	0.62 excess.
New England	3.26	[illegible]	0.03 deficiency.
Middle Atlantic States	3.31	[illegible]	1.24 deficiency.
South Atlantic States	3.59	[illegible]	0.74 deficiency.
Florida Peninsula	2.69	2.6[illegible]	[illegible] deficiency.
Eastern Gulf States	4.54	1.53	[illegible] deficiency.
Western Gulf States	3.72	2.53	[illegible] deficiency.
Tennessee	5.02	4.26	[illegible] deficiency.
Ohio Valley	3.50	4.85	1.35 excess.
Lower Lake Region	2.57	2.35	0.22 deficiency.
Upper Lake Region	1.54	2.62	1.08 excess.
Upper Mississippi Valley	1.51	2.40	0.99 excess.
Minnesota	0.60	0.76	0.16 excess.
Lower Missouri Valley	1.90	2.24	0.34 excess.
Upper Missouri Valley	1.51	0.46	1.05 deficiency.
California Coast	3.87	1.42	2.45 deficiency.
Portland, Or.	6.06	12.27	6.21 excess.

HEIGHTS OF RIVERS ABOVE LOW-WATER MARK, JAN., 1880

STATIONS	Danger point on gauge.	HIGHEST WATER.		LOWEST WATER.	
		Date.	Height.	Date.	Height.
	ft. in.	Jan.	ft. in.	Jan.	ft. in
RED RIVER.					
Shreveport	29 0	13	4 4	31	1 7
ARKANSAS.					
Little Rock	—	7	5 1	30	0 4
MISSOURI.					
Yankton	20 0	—	— —	—	— —
Omaha	16 0	21	5 10	28 to 30	4 7
Leavenworth	21 0	7, 8	4 0	17, 18	1 2
MISSISSIPPI.					
St. Paul	14 6	—	— —	—	— —
La Crosse	18 0	—	— —	—	— —
Dubuque	21 10	18	6 1	30	2 8
Davenport	15 0	7	9 8	31	2 2
Keokuk	14 6	4	10 4	31	3 10
St. Louis	30 0	9	15 5	1	6 10
Cairo	40 0	15, 16	41 10	31	24 7
Memphis	34 0	19, 21	34 5	31	22 5
Vicksburg	41 0	28 to 31	39 11	1	30 11
*New Orleans	— 3 6	31	— 3 3	1	— 7 10
OHIO.					
Pittsburgh	20 0	7	17 3	17	6 2
Cincinnati	50 0	9	42 2	31	19 3
Louisville	24 0	8	19 6	3, 4 28 to 31	9 6
CUMBERLAND					
Nashville	42 0	1	24 11	31	8 1
TENNESSEE.					
Chattanooga	31 0	10	10 7	30, 31	4 2
MONONGAHELA.					
Morgantown	28 0	7	12 6	31	6 3
Pittsburgh	29 0	7	17 3	17	6 2
SAVANNAH.					
Augusta	— —	10	13 6	26	6 6
COLUMBIA.					
Portland, Or.	— —	[illegible]	[illegible]	[illegible]	5 2

*Below high water mark of 1874.

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Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER U. S. A.

Mr. William Dawson, at Spiceland, Ind., reports, "on the 5th 2 small spots 6′ from west edge; considerable faculæ in SE. quadrant; air poor. 9th, 3 small spots near center, much cloud. 16th, 3 small spots 5′ from east edge, air bad. 22d, one moderate-sized spot 6′ from west edge, air bad. 26th, no spots; too cloudy to observe well. 31st, 4 spots in one group about 7′ north of center." Mr. H. D. Gowey, at North Lewisburg, Ohio, reports, "observed two large sun spots on the 18th, at 9.15 a.m., Lewisburg mean time."

Mr. F. Hess, at Fort Dodge, Iowa, reports, "during the first week of the month, when a group of three or more spots should have been visible, the sun could not be observed on account of the cloudiness. 17th and 18th, 10 a.m., one large double spot with penumbra, and one small one in SE. quadrant. 19th, 11 a.m., one large and one small spot within a common penumbra, and two small ones in SE. quadrant. 20th, 11 a.m., only one spot; indistinctly visible, on account of haze, in SW. quadrant. 22d, 9 a.m., one large spot in SW. quadrant. The sun was examined on all other clear days of the month, but no spots noticed."

Mr. David Trowbridge, at Waterburg, N. Y., reports, "sun observed on 7th, 9th, 12th, 13th, 16th, 26th, 27th, and 28th, no spots. On the 18th, 3 p.m., a small spot about ⅓ diameter of the disk from the west margin; 18th, one group of two well-defined spots about ⅓ diameter from east margin of disk; 19th, the two spots still visible; 21st, only one spot visible."

Professor Hinrichs, at Iowa City, Iowa, "sun spots were seen on the 1st."

At Fort Whipple, Va., observations were continued throughout the month, but no spots reported.

Precipitation received after issue of November review.—Washington Territory: Neah Bay, 8.78 inches; Fort Canby, 5.60; Bainbridge Island, 4.40; Walla Walla, 1.83; Fort Townsend, 1.50; Fort Colville, 1.03 inches. *Oregon:* Fort Stevens, 8.68; Albany, 5.80; Fort Klamath, 5.78; Eola, 4.00; Fort Harney, 3.34; Umatilla, 0.61 inches. *Idaho Territory:* Fort Lapwai, 2.36 inches. *Montana:* Fort Ellis, 0.30; Blackfeet Agency, 0.21. Forts Benton and Shaw, 0.06; Fort Logan, trace. *Dakota:* Fort Totten, 0.20; Fort Meade, 0.04; Fort Sully, 0.03; Forts Hale and Sisseton, trace. *Michigan:* Fort Brady, 2.12 inches. *Iowa:* Clarinda, 3.68 inches. *Wyoming:* Fort Fetterman, 0.26 inch. *Colorado:* State Agricultural College, Fort Collins, 1.50 inches. *Nevada:* Pioche, 0.08 inch. *California:* Fort Gaston, 11.24; Oakwood Ranche, 3.61; Oakland, 2.98; Poway, 2.75; Campo, 3.00; Fort Bidwell, 1.75 inches. *Arizona:* Fort Apache, 2.12; Burkes, 1.22; Florence, 0.79; Wickenburg, 0.00 inches. *New Mexico:* Fort Wingate, 0.51 inch. *Kansas:* Independence, 2.15 inches. *Texas:* Fort Bliss, 0.01; Fort Ringgold, 0.00 inches. *Florida:* Biscayne, 1.00; Okahumpka, 0.00 inches.

Mean temperature for Umatilla, Oreg., for November is 37°.6 or 4°.2 below the average for several years; maximum 61° and minimum 15°; prevailing wind direction, SE.

Published by order of the Secretary of War.

ALBERT J. MYER,
Brigadier General (Brevet Assigned), Chief Signal Officer, U. S. A.

PAPER 39.

MONTHLY WEATHER REVIEW, JANUARY, 1880.

INTRODUCTION.

In preparing this REVIEW the following data, received up to February 14th, have been used, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 136 Signal Service stations and 16 Canadian stations, as telegraphed to this office; 157 monthly journals and 150 monthly means from the former and 12 monthly means from the latter; reports from 27 sunset stations; 234 monthly registers from voluntary observers; 43 monthly registers from United States Army post surgeons; marine records; international simultaneous observations; monthly reports from voluntary observers in and the local Weather Service of Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

The general distribution of atmospheric pressure for the month, as reduced to sea-level, is shown by the isobaric lines upon Chart No. II. When compared with the January averages for the past eight years, the distribution of pressure for the present January is found to be very abnormal. From Lake Ontario to Virginia and thence northeastward to Maine it has been in excess, gradually increasing northeastwards to 0.13 inch on the east coast of New England; it is also slightly in excess (0.04) at Santa Fé and San Francisco. At all other stations there has been a deficiency; it averages about 0.04 on the South Atlantic coast and Lake Erie; 0.08 along the Gulf coast; 0.11 from Arkansas to the Lower Ohio valley and Lakes Michigan and Superior and in the Lower Missouri and Upper Mississippi valleys, 0.18; the largest deficiency, 0.21, occurs at La Crosse. At Virginia City, Montana, the deficiency is 0.13, and at Portland, Oregon, 0.11.

Local barometric ranges.—The total range of the reduced barometric readings have averaged about as follows: New England, 1.14 inches at Wood's Holl to 1.38 inches at Burlington; Middle states, 1.21 inches at New York to 0.93 inches at Norfolk; South Atlantic and Gulf states, 0.80 inch at Wilmington, 0.54 inch at Key West, 0.63 inch at New Orleans, 0.69 inch at Indianola, 0.97 inch at Shreveport; Mississippi and Ohio valleys and Lake region, from 0.99 inch at Memphis to 1.11 inches at Pittsburgh, 1.39 inches at Alpena, and 1.33 inches at Duluth; Eastern slope, 1.42 inches at Bismarck and 1.33 inches at Dodge City; Rocky Mountain stations, 0.67 inch at Santa Fé to 1.19 inches at Virginia City; Plateau districts, 1.00 inch at Salt Lake and Winnemucca, and 1.28 inches at Boise City; California, 0.61 inch at Los Angeles to 0.92 inch at Red Bluff.

Areas of high barometer.—Thirteen high areas have appeared within the limits of the United States during the month. Nine of them appeared to develop over the extreme Northwest or Manitoba; one over the Mississippi valley, while the other three first appeared upon the Pacific coast. The latter are specially interesting on account of the low temperatures accompanying them.

No. I is a continuation of high area No. XI of the December review; at 7 a. m. (Washington mean time) it was central over the Upper Ohio Valley, while the pressure was above the normal from the Southwest to Lake Michigan and thence to the Atlantic coast; north to east winds prevailed, with light rains in Texas, and foggy weather thence to Missouri and North Carolina; northwards, clear, frosty weather, followed by rising temperature during the day, and at night, in the Ohio valley, light rains, as low area No. II progressed eastward over Canada. On the 2d the barometer continued above the normal over the Southern States, with clear weather; while easterly to southerly winds and light rain continued from Texas to the Ohio valley.

No. II followed in rear of low area No. II. At 11 p. m. of the 1st the pressure had reached the normal in Dakota, and by 7 a. m. of the 2d the highest pressures were over Minnesota; during the day the pressure increased as the area moved eastward over the Lake region and Canada, while it fell rapidly over the Northwest in advance of low area No. III. 3d, moved eastward, and at 11 p. m. was central over Nova Scotia; during the day the pressure increased over the South Atlantic states. 4th, the pressure over Canadian maritime provinces fell rapidly in advance of the low area before referred to, and the maximum pressure was transferred to the South Atlantic coast; clear or fair weather in the Southern states, but continued rains from the Southwest to the Lower Lakes in the barometric trough left by low area No. III, and which separated the present high area from the following.

No. III appeared over the Northwest during the night of the 3d, accompanied by clear, cool weather; on the 4th moved rapidly eastward in rear of low area No. III to the Lake region, and on the 5th thence to New England and Lower Canada. On the 6th it moved southeastward over Nova Scotia and Cape Breton; on the morning of which day the thermometer at Sydney, C. B., fell to —6°.

No. IV appeared over the Northwest during the night of the 5th, and on the 6th and 7th moved rapidly eastward over Canada and New England to the Gulf of Saint Lawrence, where the pressure remained high until the 9th, on the night of which day it fell rapidly in advance of low area No. V.

No. V appeared over the Northwest during the 9th in rear of low No. V, and at 11 p. m. was central in the Mississippi valley. 10th, moved northeastward with increasing pressure, and on the 11th was over Nova Scotia.

No. VI appeared on the Pacific coast on the 10th in rear of low area No. VI. 11th, extended eastward over the Plateau districts, producing the minimum temperature of the month (27°) at Visalia, Cal. 12th, at 7 a. m. the highest pressure was at Salt Lake City (0.34 inch above the normal), with minimum temperature of the month (2°) at that station. 13th, moved to the Eastern slope and merged with high area No. VII. On this day the minimum temperature of the month occurred at Fort Gibson, 26°, and Henrietta, 27°. Cautionary signals for a "norther," ordered at Indianola and Galveston, were justified at former station by a north wind of 35 miles.

No. VII appeared over the Northwest during the 11th in rear of low No. VI, and on the 12th, 13th, and 14th moved slowly southeastward over the eastern half of the United States as an extensive area. On the two latter days it produced the minimum temperatures of the month in the Ohio valley and Atlantic states.

No. VIII appeared over the Northwest during the 14th in rear of low No. VIII, and during the 15th moved eastward to the Atlantic states, where it remained until the 17th, when it disappeared to the eastward.

No. IX.—The pressure, which had continued comparatively high on the Pacific coast since the passage of high No. VI, rose decidedly during the 14th over Oregon, and continued high over this region until the 16th, when this area was transferred to the Plateau districts, but with diminishing pressure. During the 17th it was apparently transferred to the Southwest, and on the 18th covered the Gulf states.

No. X appeared over Manitoba on the night of the 18th, and during the 19th extended eastward over Canada as low area No. XI began its eastward movement. On the 20th it was apparently northward of the Saint Lawrence valley.

No. XI slowly developed over the Mississippi valley during the 23d as low area No. XII moved over Canada and Maine. 24th, it covered the country east of the Mississippi, and on the 25th was transferred to the Atlantic states. 26th and 27th, it moved northeastward over New England and Nova Scotia.

No. XII appeared over Manitoba on the 27th, while low areas Nos. XVII and XVI covered, respectively, the Plateau districts and Mississippi Valley. 28th, it extended south and eastward in rear of low area No. XVI, and on the 29th moved eastward to the Atlantic states, where it remained until the evening of the 30th, when it gave way in advance of low area No. XVII.

No. XIII appeared over Oregon and Washington Territory on the 29th as low area No. XVII moved eastward over the Rocky Mountains, increasing in pressure, but extending southeastward to the Mississippi valley; it however remained central on the Pacific coast to the end of the month. Cautionary off-shore signals ordered for a "norther" on the coast of Texas were justified by Indianola N. 42, and Galveston N. 26.

Areas of low barometer.—During the month eighteen areas of low barometer appeared within the limits of observation, nine of which (Nos. II, III, IV, V, VI, VIII, IX, XI, and XIV) first appeared on the Pacific coast. Four (Nos. VII, X, XVI, and XVII) were formed as secondary areas in the depressions left by areas Nos. VI, IX, and XIV. Three (Nos. XII, XIII, and XVIII) first appeared over, or to the north of Montana, while one (No. XV) first appeared over the eastern portion of the Gulf of Mexico.

No. I is a continuation of low area No. XX of the December REVIEW; its center passed eastward to the south of Nova Scotia early on the morning of the 18th, accompanied by northerly winds and heavy snow along the coast of Nova Scotia and Cape Breton.

No. II is a continuation of No. XXI, December REVIEW, and was central at 7 a. m. (Washington mean time) of the 1st to the north of Montana, in which Territory brisk to high south to west winds prevailed; during the day it moved rapidly eastward over Canada, accompanied by high westerly winds at the most northerly stations (Pembina, W. 41; Marquette, SW. 34; Escanaba, SW. 32; Saugeen, SW. 33); light rain fell in the Ohio valley and Lower Lake region. 2d, it passed eastward with its center to the north of the valley and Gulf of Saint Lawrence; at Father Point the wind reached a velocity of NW. 43, at 11 p. m.; light rain fell at Chatham and Sydney. Cautionary signals, ordered on the morning of the 1st at Milwaukee and Grand Haven, at midnight of the 1st from Cape May to Sandy Hook, on the morning of the 2d from New York to Eastport, were justified, except at Eastport, Me., by the following velocities: Milwaukee, S. 28; Cape May, SW. 29; Newport, SW. 28; Thatcher's Island, SW. 36. They were ordered late for the New England coast.

No. III appeared on the Pacific coast during the 2d. At New Westminster, B. C., from 1 to 5 a. m. (local time), a heavy SE. gale prevailed with fierce gusts of wind and rain; wind continued from the SW. throughout the day; at 8 p. m. snow squalls began, and by 9 a. m. of the 3d the ground was covered with frozen snow to a depth of 1½ inch. Fresh southerly winds and rain throughout the day at Olympia and Portland, Oreg., and occasional light rains thence southward to San Francisco. At night the winds increased to brisk, with light snow at stations in Northern Idaho and Western Montana. 3d, moved rapidly eastward over British America, apparently unattended by precipitation near its center, but preceded in the Upper Mississippi valley and Lake region by foggy and rainy weather, and in Ontario by sleet and snow. 4th, it moved northeastward to Labrador, and was followed over the Northwest and Lake region by high area No. III. Cautionary signals, ordered on the morning of the 3d at Milwaukee and Grand Haven, and at noon of the 3d from Cape May to Sandy Hook, were not justified.

No. IV appeared on the Pacific coast on the 3d, with its center, like that of the preceding area, to the north of our stations. At New Westminster the barometer at 9 and 11.56 a. m. read 29.75 and 29.76, respectively, after which it fell, and at 9 p. m. read 29.60 with heavy rain. "At 11 p. m., a tremendous heavy gale set in from SE., with heavy rain and fierce gusts, which continued, with intervals of dead calm, until 8 a. m. of the 4th. The average velocity of the wind was over 35 miles an hour, but as there were calms and lulls it is estimated that some of the gusts attained a velocity of 60 miles." The observer also states "that there is no doubt this is the heaviest gale we have had here for four years; * * * the rain came down in sheets * * * in fact it was more like a November gale in England than any I have seen since I came here (1863)." The rain continued until 8 a. m. of the 4th, at which hour, however, only 0.98 inch was measured, and was followed by flurries of snow; the pressure remained low, the barometer reading 29.42 and 29.43 at 4 and 12 a. m., respectively, after which it rose, and by noon of the 5th had regained 29.75. Southerly winds and rain prevailed in Washington Territory and Oregon, changing to snow at Olympia. During the night of the 4th and morning of the 5th, high southerly winds and gales, with light drifting snow, prevailed in Western Montana, and during the afternoon of the latter date the depression passed rapidly eastward over Manitoba, preceded by rising temperature, fog and light rain, in the Upper Lake region; thunder and lightning was reported at 11 p. m. at Marquette, and heavy rains fell in the Lower Mississippi valley. On the 6th it probably moved northeastwards to Labrador, as high area No. III passed to the south of Nova Scotia, and high area No. IV advanced to the Lake region. Cautionary signals were not ordered in advance of this area.

No. V appeared off the Pacific coast during the evening of the 5th; on the morning of the 6th its center was probably over the ocean, some distance to the west of Olympia, and moving southwards. The winds at Victoria, New Westminster, and Olympia, which on the 5th were southerly or easterly, changed on the 6th to NE. and N., with heavy snow. After a temporary rise of pressure, during the morning of the 6th, at Portland and Olympia, the barometer fell rapidly, and at 4 a. m. of the 7th had reached the lowest (29.13, or 0.82 inch below the normal) at Olympia. This was probably near the storm-vortex, as the air was calm at the station; at Portland and Umatilla, brisk to high SW. winds prevailed; while to the northward NE. winds prevailed, with very heavy snow. At Port Townsend the snow was 3 feet deep; Seattle, 4 feet; Victoria, 29 inches, and in surrounding country 4 feet; Yale, 10 feet; and at New Westminster, 2 feet. Hundreds of barns were demolished by the weight of snow, and communication much interrupted. 7th and 8th, the storm moved rapidly eastward, pursuing a course about 5° south of the two preceding areas, and attended by brisk to high winds and occasional light snow. 9th, at 7 a. m. (Washington time), it was central in the Upper Mississippi valley, and during the day passed over Lakes Michigan and Huron as quite a severe storm; at 11 p. m. it was central near Parry Sound. 10th, it moved down the Saint Lawrence valley, accompanied by high winds, and at 3 p. m. was central over the Gulf. Cautionary signals, ordered at Milwaukee and Grand Haven, and along the Atlantic coast from Cape Hatteras to New York, on the morning of the 9th, and from Wood's Holl to Eastport, during the afternoon of the 9th, were justified at the lake stations and along the New England coast. The following maximum velocities were recorded: Portland, Oreg., S. 33; Umatilla, SW. 38; Boise City, SE. 28; Cheyenne, W. 36; Omaha, NW. 39; Milwaukee, W. 42; Eastport, NE. 29.

No. VI appeared on the coast of Oregon early on the morning of the 9th. This was the last, and by far the most severe, of a series of five storms (Nos. II, III, IV, V, VI) which appeared in rapid succession on the Pacific coast, and subsequently moved eastward across the continent, from December 31 to January 11. It was encountered early on the morning of the 9th off the coast of Oregon, by steamers *Oregon* and *Victoria* of the Pacific Mail Steamship Company. The following is an extract from the log of the Oregon: "Left Astoria for San Francisco on the morning of the 8th, barometer 30.00 and falling; midnight barometer falling rapidly, wind S., strong gale, squally, sea heavy swell; 9th, 4 a. m., SSE. strong gale; 6 a. m., off the Umpqua river, SE. hurricane, tremendous sea, barometer 28.20, no change to 10 a. m., when shipped very heavy sea, sweeping away portion of bulwarks—barometer began rising, wind SE.; noon, wind veered to SW. light; 2 p. m. to midnight, SW. squalls with rain, sleet, and snow; midnight, wind veered to NW." The steamer *Victoria*, which was 45 or 50 miles distant to the northwest of the Oregon, experienced NW. winds, while the *Oregon* had SE. winds, the barometer reading the same on both vessels. The *J. G. Wall* lost bulwarks and rails, &c., in very heavy southerly gale on the 8th (probably 9th), while off Umpqua. Schooner *Emma Utter* was blown on the rocks above Empire City, early on the morning of the 9th. At Empire City a heavy southerly gale prevailed, during which buildings were blown down, wharves washed away, and several lighters sunk; the gale was the most severe ever experienced at Coos Bay. In Clatsop county, at the mouth of the Cumberland river, the storm, during Thursday night (Friday night), was exceedingly severe; the tide rising 6 inches higher than before noted; "on Friday the wind suddenly changed to west, and, as the trees were heavily laden with snow, struck the forest with terrible effect; loss estimated at thousands of dollars." At Westport, Clatsop county, at 2 p. m. of the 9th, "a storm of snow and wind set in, and continued for two hours with great fury, uprooting trees, &c.; in the neighborhood much damage was done to bridges, buildings, &c." In Washington county a number of barns and houses were blown down, and great destruction done to fences and trees—various roads leading from Portland were completely blocked by fallen timber; the damage in northern part of the county is estimated at $20,000. In the Willamette valley much damage was done to timber, &c.; at Salem buildings were damaged during "a severe wind and rain storm, which was followed by a heavy fall of snow." During the day it passed rapidly eastward over Oregon, Washington Territory, and Idaho, to Western Montana, doing much damage throughout the Cumberland valley. The lowest barometer reading occurred at Roseburg, between 8 and 12 a. m.; Portland, at 1.20 p. m., at which station an observation was made every 15 minutes from 10 a. m. to 4 p. m., the pressure remaining below 29.00 inches from 10 a. m. to 3 p. m.; Olympia, at 2 p. m.; New Westminster, B. C., 3 p. m.; at Umatilla the pressure, at 2 p. m., was falling, and the lowest probably occurred about 6 p. m.; Boise City, Idaho, and Virginia City, Montana, at 9 p. m. At Roseburg the wind continued throughout from S. and SW., and at 4 p. m. the rain changed to snow. At Portland the wind was SE. fresh from 3.57 to 11.30 a. m., when it suddenly increased to a velocity of 40 miles and veered to S.; at 11.45 it increased to 45 miles, and at 1.45 p. m. to 50 miles, though it is estimated that there were occasional gusts of 70 miles; the maximum registered velocity was 53 miles per hour from 1.50 p. m to 2.05 p. m., this being the highest on record at the station and "without a parallel within the recollection of the early settlers of this state"; at 2.45 p. m. it veered to W., and at 5.30 backed to SW. Many buildings were demolished in the city, the total loss being estimated at about sixty thousand dollars; one person was killed; "the trees on the hills in the vicinity of Portland fell toward the NW. during the early part of the storm, and to the NE. and E. during the latter part." At Olympia the wind was S. from 3.56 a. m. to 7 a. m., when it backed to NE. with heavy snow. At noon and 2 p. m. it was N., still snowing, but at 7.56 p. m. had backed to SW., with clear weather. At La Centre, Clark county, a school building was crushed by a falling tree, and two children killed. At Vancouver the barracks were damaged to the amount of $2,000. Steamer *Idaho* left Cascade at noon for Portland, but about 1.30 p. m. met the "terrible" storm and had to return; vessels were driven ashore at Cascade and Grate's Point; at Dallas a heavy wind prevailed, but no damage was done. An observer at Goldendale, Klikitat county, to the east of the Cascade range, says "the storm from the Willamette, Umpqua, and Rogue valleys, came over the Cascade mountains and down upon us with great fury. The snow had disappeared on the evening of the 8th, but on the morning of the 9th came again from the NE. until noon, when it ceased and a warm breeze set in from the S., which continued to 3 p. m., when a SW. gale commenced and lasted until late in the evening." At Umatilla a velocity of 80 miles was registered; during the morning a light wind blew from the E., and at noon backed to SE., after which it increased rapidly, and at 2 p. m. was SW. 60 miles; at 8 p. m., it was W. 32; many buildings were blown down. In Columbia county, at Dayton, the wind, which was SE. at noon, commenced to blow from the SW. about 1 p. m., and continued steady until 6 p. m., when it increased to a hurricane, which lasted until 7; at 8 p. m. the barometer began to rise and the wind fell somewhat, but continued to blow with considerable force from the west throughout the night; buildings were damaged, and in the vicinity a house was literally blown to pieces; at Waitsburg, "wind S., buildings were turned over"; at Pomeroy, church blown down, buildings damaged, and on the mountains in the vicinity forest trees were blown down; at Pataha City "the storm of Friday night was the severest ever known, damaging barns, &c." At Lewistown, Idaho, at 8.20 p. m., the wind attained a velocity of W. 35 miles. At Boise City the wind was SE. from 4.24 a. m. to 2 p. m.; SW. at 8.24 p. m., and W. at 9 p. m. At Virginia City, from the reports at present to hand, the wind continued in the SW. from noon of the 9th to noon of the 10th, after which it veered to W. At this station it attained a velocity of 25 miles at 4.40 a. m., of the 10th. So far we have considered only the reports from places near the centre of the storm, but reports from British Columbia, California, and Nevada show its influence to have extended to these regions. To the north the precipitation occurred as snow, and some very heavy falls are reported. At Victoria, V. I., snow commenced with a NE. wind at 4 p. m. of the 8th and continued to 3 p. m. of the 9th. At 4.17 p. m. the wind had changed to SW. and was blowing with a velocity of 50 miles per hour. At San Juan this is reported as "the most severe season ever experienced, and on Friday the barometer fell lower than ever before noted, during which day a severe snow storm prevailed on the Sound, with a wind of 40 miles." At New Westminster, B. C., the barometer began to fall at 4 a. m., and continued falling rapidly until 3 p. m., when it reached 28.68 inches, the lowest reading ever recorded at the station. At 2 p. m. the wind, which had been NE. since the 6th, "began to shift to all quarters (light airs); 3.30 p. m., commenced snowing; 4 p. m., heavy gust of wind from the W., blowing the snow from the tops of the trees in clouds; on the hill tops the snow could be seen moving in dense white clouds to the SSE. of us, the clouds appeared to be revolving in a circle from the west to the south of station." The mail steamer from Victoria to New Westminster experienced northerly gales and tremendous snow storm in the Gulf of Georgia on the 9th. In California a shock of earthquake occurred about 5.45 a. m., and reports from Hollister, Gonzales, and Santa Cruz will be found under the appropriate heading. Heavy SE. gales prevailed throughout the day, with rain, changing to SW. in the evening. At Shasta trees were torn up; at Red Bluff the wind attained a velocity of SE. 60 miles, about noon, and snow fell to the depth of about 12 inches on the surrounding mountains; at Modesta, in the San Joaquin valley, a SE. hard wind was blowing, and the weather "cold and bleak."

A severe storm of snow and wind set in on the Sierra Nevada range during the day (9th) and continued all night (9th–10th) with unabated fury, blockading the main line of the Central Pacific Railroad. Between Cisco and Emigrant Gap about 1,000 feet of snow sheds were swept away by snow slides from the mountain slopes, and at 11 a. m. of the 10th, 800 feet of sheds were blown down between Cisco and Cascade. In northern Nevada the storm was severely felt and did considerable damage in the southern part of Humboldt county. At Winnemucca the wind reached a velocity of SW. 56 during the evening of the 9th. The accompanying table gives in 13 columns, 1st, the stations in Oregon, Washington Territory, British Columbia, Idaho, and Western Montana; 2d, height of barometer cistern above sea-level; 3d and 4th, time and height of highest reading preceding storm; 5th and 6th, time and height of lowest reading during storm; 7th, 8th, and 9th, total fall, duration of fall, and fall per hour; 10th to 13th, times of commencement of gale and highest velocity, and direction of wind and miles per hour registered during the highest velocity.

	Altitude of barometer cistern above sea level.	Barometer reduced to 32°							Gale.			
		Began falling—		Lowest reading—		Total fall.	Time of falling.	Fall per hour.	Began—	Highest velocity.		
		Time.	Height.	Time.	Height.					Time.	Direction.	Miles per hour.
	Feet.		*Inches.*		*Inches.*	*Inches.*	*Hours.*	*Inches.*				
*Steamer Oregon	....	8th, a. m.	30.00?	9th, 6 a. m. to 10 a. m.	28.20	1.80	24	0.075	8th, midnight.	9th, 6 a. m. to 10 a. m.	SE.	Hurricane.
Roseburg	537.0	8th, 9 p. m.	29.35	9th, 7.55 and 11.55 a. m.	28.61	0.74	12	0.062	....	9th, noon	SW.	26
Portland	66.5	8th, 9 p. m.	29.72	9th, 1.20 p. m.	28.51	1.21	16½	0.073	9th, 11.30 a. m.	9th, 1.50 p. m. to 2.05 p. m.	S.	53†
Olympia	36.0	8th, 9 p. m.	29.62	9th, 2 p. m.	28.48	1.14	17	0.067	....	....	....	....
N. Westminster	33.0	9th, 4 a. m.	29.58	9th, 3 p. m.	28.68	0.90	11	0.082	9th, 4 p. m.	9th, 4 p. m.	W.	Heavy gust.
Umatilla	461.0	8th, 9 p. m.	29.49	9th, 2 p. m.	28.46	1.03	17	0.061	9th, 1 p. m.	9th, 6 to 7 p. m.	SW.	80
Boise City	2,877.0	8th, 9 p. m.	27.06	9th, 9 p. m.	26.44	0.58	24	0.024	....	9th, 2 p. m.?	SE.	32
Virginia City	5,480.0?	9th, 8.40 a. m.	23.91	9th, 9 p. m.	23.33	0.58	12½	0.046	....	10th, 4.40 a. m.	SW.	25

*From Astoria to off the Umpqua. †Gusts of 70 miles.

10th, it moved eastward over Montana and Dakota to Minnesota, attended by high winds and occasional snow; and on the 11th, northeastward over the Lake region into Canada as quite a severe storm. Cautionary signals, ordered on the afternoon of the 10th at Milwaukee and Grand Haven, were justified by NW. 39 miles at the former, and S. 30 miles at the latter place. Sandusky reported SW. 36, and Saugeen SE. 44.

No. VII.—As low area No. VI moved northeastward over the Lake region on the 11th, a barometric trough stretched southwestward to Texas, in the southern extremity of which the present area formed. On the morning of the 12th it was over northern Mississippi; barometer at Vicksburg, 30.16 or 0.06 below normal. During the day the lowest pressure was transferred to Virginia, and during the evening passed off the coast as high area No. VII advanced from the Northwest. Northerly winds, with heavy rain or snow, prevailed throughout the day from Arkansas to Tennessee and the Ohio valley, and extended by evening to the Middle states and New England. 13th, passed to the south of Nova Scotia, and at 11 p. m. was near Cape Breton. Rain on the North Carolina coast, and snow thence to Maine, was followed by clearing and clear weather. Heavy snow fell in Nova Scotia and Cape Breton. Cautionary signals, ordered from Cape Hatteras to Cape Henry on the afternoon of the 12th, and the morning of the 13th from Wood's Holl to Eastport, were fully justified by the following velocities: Cape Hatteras, NE. 40; Kittyhawk, NE. 60; Cape Henry, NW. 60; Wood's Holl, NE. 28; Thatcher's Island, NE. 61, and Eastport, NE. 29.

No. VIII appeared on coast of British Columbia during the evening of the 12th; a SE. wind, with heavy snow and rain, prevailing at Victoria, V. I. At New Westminster, B. C., snow began to fall early in the morning and continued until 4 p. m., when there were 12½ inches on the ground; it then commenced to rain, and continued throughout the night, with strong SE. wind, in gusts; at 9 p. m. the barometer had fallen to 29.36; rain or snow prevailed in Washington Territory and Oregon, and by 9 p. m. southerly winds (increasing to a gale at Fort Shaw) and light snow were reported from western Montana. 13th, in the morning "the weather was bright and clear from the West at New Westminster, B. C., after 3 inches more snow during the night." During the day the area moved rapidly eastward to Manitoba. Gales prevailed from Wyoming (Fort Fetterman, W. 40 to 59 miles; Cheyenne, W. 42) to Iowa and Minnesota (Saint Paul, SE. 52, much damage to buildings); the only precipitation reported was very light rain or snow near the head-waters of the Missouri, at 4 a. m., and light snow (immeasurable) at Escanaba at 11 p. m. 14th, passed into Canada. Light snow fell at Parry Sound. Cautionary signals, ordered at 11 p. m. for Milwaukee and Grand Haven, were justified: Milwaukee, SW. 26.

No. IX.—At 9 p. m. of the 13th it commenced snowing at New Westminster, and at 3 a. m. of the 14th a hard rain set in; at night a heavy SE. gale set in, with hard rain, and at 9 p. m. the pressure had fallen to 29.69. 15th, the wind veered to SSW., heavy rain, followed by clear weather and rising barometer. At 4 a. m. the center of the present low area was north of Montana, in which state the wind was SW. brisk to high; at 3 p. m. it was central in the Red River of the North valley, with light snow, and at 11 p. m. had moved to the north of Lake Superior. The path of center, being too far north, is not shown on Chart No. I.

No. X followed rapidly in rear of the preceding area, unattended by precipitation, and at 11 p. m. was central over Wisconsin, by which time, however, light rain or snow had commenced at Escanaba and Marquette. 17th, moved eastward over Ontario, and light rains or snows fell in the Lake region, Saint Lawrence, and Ohio valleys, and Tennessee, and, by night, rains in the interior of the East Gulf and South Atlantic states. 18th, passed off the Atlantic coast, with light rains along the coast.

No. XI.—At New Westminster, B. C., 16th, "heavy rain, wind from all quarters, followed by warm, fresh breeze, from S.; river open; at night SE. gale in gusts;" falling barometer, reaching 29.68 at 9 p. m. 17th, at 4 a. m. storm and gale in western Montana; area moved rapidly eastward during the day to Manitoba, unattended, so far as our reports show, by precipitation, except light snow at Fort Garry and Duluth. 18th, moved southward to Iowa, with clear weather from the center southeastward and partly cloudy weather on the north and west sides of depression. 19th, remained almost stationary during the morning, with decreasing pressure, in the Lower Missouri valley; in the mean time the surrounding barometric gradient increased, and a strong northeasterly current set in from the Upper Lake region towards Missouri, having, at 3 p. m., an average temperature of 40°; (Milwaukee, 37°; La Crosse, 42°; and Davenport, 40°), while the opposing southerly winds had a temperature of 52° at Springfield and 66° at Cairo, Ill.; at this hour rain was falling from Saint Louis and Indianapolis on the south side to Chicago and Davenport on the north. By 11 p. m. the area had moved eastward and was central between Saint Louis and Indianapolis; rain having extended eastward to western Pennsylvania. 20th and 21st, it moved east northeastward, and at 3 p. m of the latter date was central over Nova Scotia. It was accompanied by heavy snow in the Lower Lake region, northern New York, and New England, and increasing in energy as it moved eastward, developed into quite a severe storm as it approached the coast of New England. South of the center of path, as shown on Chart I, warm southwesterly winds and clear or fair weather continued, except a light thunder storm in the Middle states, the maximum temperatures of the month (68°) occurring at Lynchburg and Fort Whipple, Va. During the night of the 20th and early morning of the 21st it was central between Capes Cod and Sable as a very severe storm. Cautionary signals, ordered at Milwaukee and Grand Haven on the afternoon and along the Atlantic coast from Macon, N. C., to New York at midnight of the 19th, and thence to Eastport at midnight of the 20th, were justified, though late, for the coast of Maine. The following maximum velocities were registered: Milwaukee, NE., 26; Cape Hatteras, SW., 36; Cape May, W., 37; Sandy Hook, NW., 42; Newport, W., 30; Thatcher's Island, E., 32; Portland, NE., 29, and Eastport, NE., 50.

No. XII appeared to the north of Montana on the 20th; gales were reported in western part of state, and light snow fell at Virginia City, Fort Buford, and Pembina. During the night the depression was transferred rapidly southward to the Lower Missouri valley, with very light rain at Yankton and La Crosse. 21st, at 3 p. m., warm southerly winds prevailed, with light rains from the East Gulf states to southern Wisconsin, and light snow northwards, while to the west of the Mississippi the wind had generally changed to NW. During the evening a somewhat heavy thunder storm moved from the Central Mississippi valley over Kentucky and Tennessee. 22d, moved northeastward to Ontario, with light rain, turning to snow in the Lake region; light thunder storms in the South Atlantic states, and rain or snow in the Middle states and New England. 23d, moved northeastward, followed by clear weather in New England. Cautionary signals, ordered on the afternoon at Milwaukee and Grand Haven and at midnight of the 21st along the Atlantic coast from Macon to Sandy Hook and on the morning and afternoon of the 22d thence to Eastport, were justified, except at Macon and Cape Lookout. Maximum velocities: Milwaukee, NW. 30; Grand Haven, SE. 28; Cape Henry, NW. 32; Cape May, NW. 40; Sandy Hook, E. 36; Thatcher's Island, SE. 30, and Eastport, SE. 36. As the pressure increased during the morning of the 22d over the southwest a severe "norther" set in on the coast of Texas, for which cautionary off-shore signals had been ordered on the afternoon of the 21st. They were justified by Indianola N. 40, and Galveston N. 32.

No. XIII was to the north of Montana on the afternoon of the 22d. Its track was too far north to appear on the chart.

No. XIV appeared on the Pacific coast on the 24th, but reports north of Portland, Oreg., are not yet at hand. At that station, after four days of comparatively high pressure, the barometer fell, and by noon reached 29.68, or 0.35 below the normal, wind S.; during the evening and night the barometer rose and the wind veered to NW., and at 9 p. m. the pressure was lowest at Boise City (29.81, or 0.38 below the normal). At this time the wind had increased to a gale in Western Montana, and easterly winds, with threatening weather, were prevailing at Humboldt and Battleford, British America. 25th, lowest pressures from Montana to Manitoba; the barometer at Virginia City rising from 29.10, or 0.57 below normal, to 29.37, or 0.29 below normal, and falling at Pembina from 29.52, or 0.56 below, to 29.23, or 0.83 below; light snows or rains fell along the Pacific coast, over the Western Plateau, and at Virginia City, Fort Custer, Deadwood, and Bismarck. The pressure remained low over the Plateau districts, and the low area arising therefrom will be described as area No. XVII. 26th, moved to the northward of Lake Superior. Cautionary signals were ordered at Milwaukee and Grand Haven, and justified by S. 28 and S. 26, respectively.

No. XV appeared over the Eastern Gulf on the 25th, and moved slowly northward during the day. 26th, moved northeastward over Florida, preceded by NE. winds and rainy weather in the East Gulf and South Atlantic states. 27th, moved slowly northeast off the South Atlantic coast. 28th, disappeared or merged into the area of low pressure over the Lake region (No. XVI). Cautionary signals, ordered on the 25th on the North Carolina coast, along the Gulf and Atlantic coasts from Port Eads to Wilmington on the morning of the 26th, and from Cape May to New York at midnight, were generally justified by winds attending either this area or area No. XVI; maximum velocities: Cedar Keys, S. 25; Savannah, NE. 32; Macon, NE. 35; Lookout, NE. 39.

No. XVI developed in the Southwest during the 26th as low area No. XIV moved into Canada. 27th, moved rapidly northeastward to the Lake region, unattended by precipitation or high winds. 28th, passed rapidly to the Gulf of Saint Lawrence.

No. XVII is the secondary depression that was left by area No. XIV over the Plateau districts and remained there until the 28th. From the 26th to the 28th stormy weather, with heavy snows, prevailed in California and the Southern Plateau district, of which interesting particulars will be found under the head of "*snow.*" On the 29th, it moved eastward in rear of high area No. XII, and, preceded by easterly winds, rain, or snow, to the Lake region. 30th, moved over the Lake region with increasing energy, and on the 31st reached the Gulf of Saint Lawrence. Cautionary signals, ordered up on the afternoon of the 29th at Milwaukee and Grand Haven and along the Atlantic coast from Macon to Sandy Hook, and on the morning of the 30th thence to

Eastport, were justified. Maximum velocities: Milwaukee, W. 43; Cape Lookout, NE. 39; Cape May, S. 36; Sandy Hook, SW. 48; Boston, W. 45; and Eastport, S. 32. At Boston the anemometer cups were blown away and the wind estimated at 60 miles.

No. XVIII passed eastward from Montana to Lake Superior on the 31st, accompanied by light snow.

INTERNATIONAL METEOROLOGY.

Three international charts, Nos. IV, V, and VI, accompany the present REVIEW. No. IV indicates the probable course of the principal areas of low pressure over the North Atlantic Ocean and neighboring waters and continents during the month of December, 1879; it is based upon observations made on board about 180 vessels, and which have been collected from various sources or received directly at this office up to February 5, 1880. Nos. V and VI are charts for the month of June, 1878, and are based upon the international simultaneous observations, as described in the REVIEW for July, 1879, supplemented by such other observations as have been considered specially applicable and trustworthy.

On Chart No. IV the tracks of eight of the most prominent areas of low pressure, which during a portion of their existence were located over the North Atlantic Ocean, are traced. In the following *résumé* only that part of the ocean lying between the parallels of 35° and 55° will be referred to, unless specially noted. The month opened with areas of low pressure over Europe, near the Azores, and to the north of Newfoundland. The first has already been noticed as area No. XIV, Chart IV, in the December REVIEW; the second is a continuation of area No. XV, Chart IV of the same REVIEW, while the third was probably a continuation of low area No. XVIII of the November REVIEW. An extensive area of high pressure (over 30.40 inches or 772.1^{mm}), covered the ocean from 20° to 40° W. and north of 45° N. The low area near the Azores, from which islands reports are not yet received, was probably central about 34° N. 28° W., moving eastward. Steamer *Borussia* sailed from Corunna on November 26, and had SE. winds which freshened to a gale on November 30; on December 1 the wind suddenly chopped to NNW. with heavy cross sea, during which she sprang a leak, and foundered on the 2d, 350 miles to the southwest of Fayal, having on board about 225 persons. Steamer *Colombo* in 32° N. and 29° to 39° W. had a continuation of westerly gales from the 1st to the 5th. North of Azores northerly winds prevailed between 10° and 20° W., easterly thence to 40° W., southerly to 50° W., and northwesterly thence to the coast of the United States, where a second area of high pressure existed. 2d and 3d, the low area south of the Azores moved to the Bay of Biscay, accompanied by very heavy seas, and producing severe easterly gales and heavy snows over the British Isles; the high area north of the Azores and the low area north of Newfoundland disappeared, while the high area on the American coast moved northeastward, and on the morning of the 4th extended from the banks of Newfoundland to 35° W.; on the 3d heavy easterly gales and high seas prevailed near the Bermudas. 5th and 6th, the low area moved rapidly eastward from the Bay of Biscay to the Black Sea, producing a slight rise of temperature to the south and east of its center; with this exception, the cold period, which set in over Western Europe during the first week of December, continued almost uninterrupted throughout the entire month. During the 5th, low area No. II, Chart I, December REVIEW, passed eastward over Newfoundland, and on the 6th was central about 55° N. 35° W., moving northeastward. 7th, low areas over mid-ocean and Canada; high areas over the East Atlantic and the Banks of Newfoundland; southerly to westerly gales in 55° N. 20° W.; northerly in 40° W., and southerly south of Nova Scotia. 8th, high area over the East Atlantic, extending over Europe, with very low temperatures; low area approached the coast of Norway, inducing a temporary rise in temperature over Northern Europe; southeast "hurricane" in 35° N. 23° W., and southeasterly winds thence northward to 50° N. along the western margin of high area; low area over Newfoundland. 9th, center of high area was transferred to Western Europe, over which region extremely low temperatures were recorded. At Paris at 8 a. m. the thermometer registered —23.9° C. or —11° Fahr. Some hours earlier a temperature of —28° C. or —18.4° Fahr. was recorded on the surface of the snow. These are probably the lowest temperature readings ever recorded in this vicinity; during the winters of 1788-'9, 1794-'5, and 1871-'2, —21.5°, —23.5°, and —21.3°, respectively, were recorded, these being the lowest readings since 1700. In the British Isles the mean temperature for the week ending December 8th of seven stations in the midland counties, when compared with the mean of the same week during thirteen previous years, shows a deficit of 19° Fahr.; minimum readings ranging from —11° Fahr. (—23.9° C.) to —2° (—18.9° C.) were registered at various places from the 2d to the 7th. On the 9th a low area existed in the vicinity of the Azores; ship *Peruvian* was dismasted in a southeast hurricane and abandoned in about 43° N. 27° W.; high area over the Western Atlantic. 10th and 11th, low area over mid-ocean, attended by southerly gales from 15° to 25° W. and northerly gales about 40° W.; high area over Western Atlantic. 12th, southerly winds and rising temperature from British Isles to 30° W., northerly gales in 45° W.; a low area passed eastward north of Newfoundland. 13th, southerly winds and rain over the Eastern Atlantic; high area over Western Atlantic. 14th and 15th, high area moved eastward over the Western Atlantic, followed during the latter day by low area No. VIII, Chart I, December REVIEW. 16th to 20th, low area moved east-northeastward from Newfoundland; southerly winds prevailed from the British Isles to 30° W., but thence westward westerly gales and high seas, accompanied from 17th to 20th by snow or hail squalls. 21st, the low area moved northeastward off the Irish and Scotch coasts; steamer *Hibernian* at noon in 54° N. 18° W. had a west by north wind, force 7, barometer 59.68. From this day to the end of the month low pressures generally prevailed to the north of the fifty-fifth parallel, and during this period at least three distinct low areas can be traced from Newfoundland eastward. Severe westerly gales continued to prevail almost without intermission across the Atlantic from Ireland to Newfoundland, and extremely cold weather, with severe snow and "hail" squalls, were experienced from 25° W. to the Banks of Newfoundland, while a decided rise in temperature took place over Northwestern Europe. On the morning of the 21st a low area passed rapidly eastward over Newfoundland, which was encountered by the *Hibernian* on the 22d in 54° N. 23° W., lowest barometer 29.63, or 752.6, wind WSW., force 9. On the evening of the 23d another low area passed over Newfoundland, which was encountered by the *Hibernian* on the 25th in 52° N. 33° W., and by the *Leipsig* in 50° N. 20° W., between 6 and 9 p. m. During the 27th it passed to the northward of the British Isles accompanied by very severe gales thence to the coast of Norway. On the 25th another low area passed eastward over Newfoundland; was experienced by the *Hibernian* on the 26th in 51° N. 37° W., lowest barometer 28.85, or 732.7, violent WSW. gale (force 12), with terrific squalls and high seas; by the *Leipsig* from 8 to 11 p. m. in about 49½° N. 23° W., barometer 29.60, or 751.8, remaining low all night and morning of the 27th; and by the *Rossend Castle* in 57° N. 19° W. On the 28th it passed rapidly eastward over the British Isles accompanied by hurricane winds; at 7 p. m. the "Tay bridge disaster" occurred. 9th, high pressures prevailed over the Atlantic, with continued cold westerly gales and very high seas; low area with high temperatures over Northern Europe, while the high area over that continent moved southward to the Mediterranean accompanied by low temperatures. During the latter part of the day the pressure gave way over the Western Atlantic, and another low area covered Newfoundland on the 30th, which by the 31st had moved eastward to 35° W.

TEMPERATURE OF THE AIR.

The general distribution of the temperature of the air is shown by isothermal lines or figures upon Chart No. II. On the right side of the same chart is a table giving the average temperature, by districts, of January for several years and for the present month. As might be expected from the abnormal distribution of pressure and consequent preponderance of southerly winds, it is found that the temperature for all districts, except those on the Pacific coast and thence to Utah, is abnormally high. For New England and the Middle states it is about 9° above normal, and for the Florida peninsula about 5°, but for all other districts east of the Rocky Mountains the excess ranges from 10° to 15.5°; the combined means of Cheyenne and Virginia City give an excess of 6°. In the valley of the Snake and Columbia rivers the excess is nearly 12° at Boise City, 10° at Umatilla, and 3° at Portland, Oreg. In California, and especially in the Sacramento valley, the temperature has been decidedly low.

Maximum temperatures.—Maine: 54° at *Surry, 52° at Portland, and 48° at Eastport. *New Hampshire:* 54° at *Contoocookville and 40° on Mount Washington. *Vermont:* 48° at *Charlotte and *Lunenburg and 46° at Burlington. *Massachusetts:* 60° at Thatcher's Island, *Somerset, and *Fall River, and 56° at Springfield. *Rhode Island:* 61° at Newport. *Connecticut:* 65° at *Mystic and New London and 59° at *Southington. *New York:* 66° at *Brookhaven, 64° at New York City, 57° at Buffalo, 53° at Oswego, 46° at Albany, and 43° at *Plattsburg Barracks. *Pennsylvania:* 67° at Pittsburgh, 63° at Philadelphia, 60° at *Catawissa, and 51° at *Dyberry. *Delaware:* 64° at *Dover. *Maryland:* 68° at *Emmittsburg, 65° at Baltimore, and 64° at *Cumberland. *District of Columbia:* 66° at Washington. *Virginia:* 75° at *Snowville, 73° at *Wytheville, and 66° at Norfolk. *West Virginia:* 70° at Morgantown and 64° at *Helvetia. *North Carolina:* 80° at *Statesville, 70° at *Weldon and Charlotte, and 67° at Cape Lookout. *South Carolina:* 77° at Charleston and 73° at *Aiken. *Georgia:* 87° at *Forsyth, 75° at Savannah, and 71° at Atlanta. *Florida:* 86° at *Gulf Hammock, 77° at Jacksonville, 80° at Punta Rassa, 83° at Key West, and 73° at Pensacola. *Alabama:* 74° at *Green Springs and Mobile and 75° at Montgomery. *Mississippi:* 74° at *Fayette and 77° at *Brookhaven and Vicksburg. *Louisiana:* 82° at *Okaloosa and *Lake Charles and 75° at New Orleans. *Texas:* 92° at Decatur, 86° at Rio Grande, 81° at Fort Elliott, 79° at Corsicana, and 75° at Galveston and Mason. *Ohio:* 67° at Cincinnati and *Ruggles, 64° at Columbus, and 62° at Toledo. *Kentucky:* 70° at Louisville and 69° at Bowling Green. *Tennessee:* 78° at Austin and 72° at Ashwood, McMinnville, Nashville, and Knoxville. *Arkansas:* 78° at Little Rock and 76° at *Mount

Ida. *Michigan:* 63° at *Thornville, 62° at *Lansing and *Kalamazoo, 57° at Grand Haven and Detroit, 52° at Alpena, and 50° at Northport. *Indiana:* 74° at *Laconia, 67° at *New Harmony, and 66° at Indianapolis. *Illinois:* 74° at *Anna, 70° at Cairo, 64° at Springfield, and 61° at Chicago. *Missouri:* 72° at Saint Louis, 67° at *Ashley and *Kansas City, and 62° at *Corning. *Kansas:* 76° at *Fort Wallace, 74° at *Independence, 64° at Leavenworth, and 61° at *Manhattan. *Wisconsin:* 58° at Madison, 53° at La Crosse, 44° at *Bloomfield, and 42° at *Ashland. *Iowa:* 68° at *Vail, 63° at Des Moines and Keokuk, 62° at *Glenwood, and 55° at Dubuque. *Nebraska:* 76° at *Austin, 70° at North Platte, and 62° at Omaha. *Indian Territory:* 75° at Fort Sill and 72° at Fort Gibson. *Minnesota:* 48° at Saint Paul and 40° at Duluth. *Dakota:* 70° at Morriston, 67° at Yankton, 55° at Deadwood, 49° at Bismarck, and 40° at Pembina. *Colorado:* 70° at *Fort Lyon, 63° at Denver, 51° at *Hermosa, and 24° on Pike's Peak. *New Mexico:* 73° at La Mesilla, 67° at Socorro, and 55° at Santa Fé. *Wyoming:* 63° at Cheyenne and 47° at Fort Fred Steele. *Utah:* 47° at *Coalville and 45° at Salt Lake City. *Nevada:* 54° at Winnemucca. *Arizona:* 78° at Tucson, 76° at Yuma, and 61° at Prescott. *Idaho:* 64° at Fort Hall and 57° at Boise City. *Montana:* 47° at Virginia City. *California:* 76° at Los Angeles, 71° at Red Bluff, 70° at Visalia and *Salinas City, 61° at Sacramento, and 60° at San Francisco. *Oregon:* 63° at Umatilla, 57° at Portland, and 56° at Roseburg.

Minimum temperatures.—Maine: —15° at *Orono and 0° at Eastport. *New Hampshire:* —12° on Mount Washington and —10° at *Dunbarton. *Vermont:* —12° at *Newport and 0° at Burlington. *Massachusetts:* —10° at *Billerica and 8° at Boston and Springfield. *Rhode Island:* 15° at Newport. *Connecticut:* 0.7° at *Southington and 10° at New Haven. *New York:* —6° at *Madison Barracks, —2° at Sidney Plains and *Plattsburg Barracks, 1° at Albany, 16° at Buffalo, and 17° at New York City. *Pennsylvania:* —3° at *Dyberry, 3° at *Catawissa, 19° at Philadelphia, and 20° at Pittsburgh. *Delaware:* 20° at *Dover. *Maryland:* 3° at *Woodstock, 12° at *Cumberland, and 17° at Baltimore. *District of Columbia:* 14° at Washington. *Virginia:* 13° at *Mount Solon, 23° at Lynchburg, 29° at *Walnut Grove, and 31° at Cape Henry and Norfolk. *West Virginia:* 12° at Morgantown and 18° at *Helvetia. *North Carolina:* 15° at *Highlands, 25° at *Fayetteville and Wilmington, 26° at *Weldon, and 34° at Cape Lookout. *South Carolina:* 27° at *Aiken and 33° at Charleston. *Georgia:* 30° at Atlanta and *Gainesville and 34° at Savannah and *Forsyth. *Florida:* 36° at *Gulf Hammock, 40° at Pensacola and *Houston, 45° at Jacksonville, and 65° at Key West. *Alabama:* 30° at *Green Springs and 39° at Mobile. *Mississippi:* 32° at *Brookhaven and *Fayette and 35° at Vicksburg. *Louisiana:* 28° at *Okaloosa, 33° at Shreveport, and 42° at New Orleans. *Texas:* 5° at Fort Elliott, 21° at Pilot Point, 28° at Mason, 32° at Denison, 38° at Rio Grande, and 47° at Galveston. *Ohio:* 6° at *Westerville and *Urbana, 15° at Columbus, 18° at Cleveland, and 25° at Cincinnati. *Kentucky:* 28° at Louisville and *Bowling Green. *Tennessee:* 25° at Knoxville and *McMinnville, 26° at *Ashwood, and 29° at Nashville and Chattanooga. *Arkansas:* 20° at *Mount Ida and 32° at Little Rock. *Michigan:* —2° at Marquette, 5° at Alpena, 9° at *Lansing and *Kalamazoo, 12° at Grand Haven, 13° at Northport, 16° at Port Huron, and 19° at Detroit. *Indiana:* 15° at *Spiceland, 18° at *Fort Wayne, 20° at Indianapolis, and 26° at *New Harmony. *Illinois:* 10° at *Riley, *Belvidere, and *Sterling, 20° at Chicago, and 30° at Cairo. *Missouri:* 14° at *Corning, 18° at *Kansas City, and 23° at Saint Louis. *Kansas:* —3° at *Fort Wallace, 15° at *Holton, Manhattan, *Cedar Vale, and *Yates Center, and 20° at Leavenworth. *Wisconsin:* —12° at *Ashland and *Neillsville, —6° at *La Crosse, and 6° at Madison. *Iowa:* —6° at *Cresco, —3° at *Fort Dodge, 6° at *Glenwood, 10° at Des Moines and Dubuque, and 21° at Keokuk. *Nebraska:* —19° at *Fort Sidney, —2° at *Genoa and North Platte, and 5° at Omaha. *Indian Territory:* 23° at Fort Sill and 26° at Fort Gibson. *Minnesota:* —19° at Duluth and —12° at Saint Paul. *Dakota:* —35° at Fort Buford, —32° at Pembina, —21° at Bismarck, —7° at Deadwood, —5° at *Morriston, and —2° at Yankton. *Colorado:* —17° at *Fort Garland, —15° on Pike's Peak, —7° at *Fort Lyon, and —6° at Denver and *Hermosa. *New Mexico:* —2° at Santa Fé, 7° at Silver City, and 20° at La Mesilla. *Wyoming:* —25° at *Fort Fred Steele and —11° at Cheyenne. *Utah:* —16° at *Coalville and 2° at Salt Lake City. *Nevada:* 0° at Winnemucca. *Arizona:* —17° at Prescott, 8° at Fort Verde, and 30° at Yuma. *Idaho:* —11° at *Fort Hall and 13° at Boise City. *Montana:* —18° at Virginia City. *California:* 25° at Sacramento and *Salinas City, 26° at Red Bluff, 27° at Visalia and *Princeton, 30° at Los Angeles, and 37° at San Francisco. *Oregon:* 18° at Umatilla, 25° at Roseburg, and 26° at Portland.

Ranges of temperature at Signal Service stations.—The monthly ranges will appear from an examination of the maxima and minima just given. The greatest daily ranges vary in New England from 25° at Wood's Holl to 36° at Eastport and 40° at New London and Boston; Middle Atlantic states, 20° at Barnegat to 27° at Washington, Baltimore, and Sandy Hook, and 36° at Albany; South Atlantic states, 22° at Savannah to 36°

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* Those marked with * are reported by voluntary observers or United States Army post surgeons.

at Jacksonville, and 31° at Wilmington and Augusta; Eastern Gulf states, 13° at Key West and 18° at New Orleans and Cedar Keys to 31° at Montgomery; Western Gulf states, 16° at Galveston to 31° at Vicksburg and 32° at Corsicana; Ohio valley and Tennessee, 22° at Columbus to 25° at Memphis, 30° at Knoxville, 33° at Pittsburgh, and 36° at Morgantown; Lower Lake region, 23° at Detroit to 31° at Oswego and 34° at Rochester; Upper Lake region, 24° at Grand Haven to 29° at Madison, 33° at Alpena, 38° at Marquette, and 48° at Duluth; Upper Mississippi valley, 28° at Dubuque to 31° at Saint Louis, 37° at Saint Paul, and 40° at La Crosse; Missouri valley, 35° at Leavenworth to 39° at Yankton, 52° at Bismarck, and 62° at Pembina; Texas, 31° at San Antonio and Denison to 40° at Rio Grande, 50° at Uvalde, 51° at Fort Elliott, and 55° at Decatur; Eastern Rocky Mountain slope, 32° at Fort Gibson and Fort Sill to 36° at Deadwood and 44° at Dodge City and North Platte; Rocky Mountains, 25° on Pike's Peak to 32° at Virginia City, 34° at Cheyenne, and 42° at Denver; Northern and Middle Plateau districts, 23° at Boise City to 25° at Salt Lake City and 33° at Winnemucca; California, 15° at San Francisco to 22° at Sacramento, 31° at Los Angeles, 33° at Red Bluff, and 36° at Visalia.

Frost was reported very generally from all States and Territories north of the thirty-fifth parallel. In Florida on the 19th, but causing no injury to vegetation; Gulf states, 14th, 19th, 21st to 27th; interior of Texas, 13th, 14th, 22d, 23d, 24th, 25th, 26th, 31st; New Mexico, 1st, 5th, 11th, 12th, 13th, 20th, 22d, 23d, 26th, 27th, 30th, 31st; Arizona, 2d, 3d, 4th, 5th, 6th, 9th, 12th, 13th to 20th, 22d to 31st; California, 1st, 2d, 7th, 9th, 11th, 12th, 13th, 14th, 15th, 16th, 19th, 20th, 21st, 26th to 31st; at Salinas, Cal., frost was reported as frequent and severe; at Los Angeles on the 31st it injured tender vegetation, but fruit trees not seriously.

Ice formed generally throughout the northern sections of the country as will be seen by reference to the chapter on navigation. In the South Atlantic states on the 13th, 14th, 25th, 26th; Mississippi, 14th, 23d, 24th, 25th, 26th, 27th; California, 10th, 11th, 12th, 13th, 28th, 29th, 30th, 31st.

Ground frozen.—Litchfield, Pa., 30th, ground frozen to a depth of 4 inches; Bloomfield, Wis., frozen only at intervals throughout the month; Fall River, Mass., frost in ground during first half of month.

PRECIPITATION.

The general distribution of the rainfall, including melted snow, is illustrated upon chart No. III, as accurately as possible from about 500 reports. In the left-hand corner is a table of average rainfalls, by districts. This table shows the rainfall for the present January to have been below the average in the Atlantic and Gulf states, Tennessee (eastern part), Lower Lake region, Upper Missouri valley, and California; the largest deficiencies occurring in the East Gulf states and California. In the other districts, namely, the Upper Lake region, the Ohio, Upper Mississippi, and Lower Missouri valleys, and on the coast of Oregon there is an excess, which is most marked in the last named section.

Special heavy rains.—1st and 2d, Eugene City, Oreg., 4.20 inches; 1st to 3d, Brackettville, Tex., 5.00 inches; 2d, Louisville, Ill., 2.00 inches in five hours; Concho, Tex., 3.60 inches; 2d and 3d, Lyndon, Ill., 2.62 inches; 3d, Riley, Ill., 2.97 inches; Austin, Tex., 2.00 inches; Castroville, Tex., 2.08 inches; San Antonio, Tex., 2.20 inches; Boerne, Tex., 2.53 inches; 3d and 4th, Marengo, Ill., 3.02 inches; New Ulm, Tex., 4.75 inches; Indianola, 4.08 inches; 4th, Fort Wayne, Ind., 3.00 inches; 5th, Memphis, 2.92 inches; 5th and 6th, New Corydon, Ind., 2.49 inches; Saint Meinrad, Ind., 3.35 inches; Portland, Oreg., 3.34 inches; 5th to 7th, Eugene City, Oreg., 4.55 inches; 8th and 9th, Princeton, Cal., 2.80 inches; 20th to 22d, Wellsborough, Pa., 4.50 inches; White Plains, N. Y., 3.10 inches; 22d, Auburn, N. H., 3.04 inches; 25th and 26th, Quitman, Ga., 3.90 inches; Thomasville, Ga., 3.67 inches; 26th, Wilmington, N. C., 2.55 inches; 26th and 27th, Smithville, N. C., 3.63 inches; 27th, Wellsborough, Pa., 2.40 inches; 27th and 28th, Auburn, N. H., 6.00 inches; White Plains, N. Y., 2.70 inches; 29th, Pike's Peak, 27th to 29th, 3.64 inches.

Largest monthly rainfalls, including melted snow.—Olympia, Wash., 19.69 inches; Auburn, N. H., 14.16; Portland, Oreg., 12.27; Roseburg, Oreg., 9.37; Wellsborough, Pa., 8.71; College Hill, Ohio, 8.28; New Corydon, Ind., 7.84; Memphis, 6.87; Summit, Cal., 6.60; New Ulm, Tex., 6.44; Saint Meinrad, Ind., 6.40; Brackettsville, Tex., 6.39; Spiceland, Ind., 6.00; Morgantown, 5.77; Jacksonburg, Ohio, 5.75; Princeton, Cal., Vevay, and Fort Wayne, Ind., and North Lewisburg, Ohio, 5.50; Quitman, Ga., 5.40; Portland, Me., 5.36; Urbana, Ohio, 5.35; Bellefontaine, Ohio, 5.33; Weir's Bridge, N. H., 5.23; Smithville, N. C., 5.05; Cape Lookout, N. C., 5.01.

Smallest monthly rainfalls, including melted snow.—Fort Halleck, Nev., none; Fort Elliott, Tex., Fort Lyon, Colo., Yuma, Ariz., Fort McDermitt, Nev., Fort Abraham Lincoln, Dak., and Dodge City, Kans., trace; Fort Wallace, Kans., 0.01 inch; North Platte, 0.03; Fort McPherson, Nebr., and Fort Buford, Dak., 0.10; Fort Fetterman, Wyo., and Corning, Mo., 0.13; Stockton and Pilot Point, Tex., and La Mesilla, N.

Mex., 0.14; Socorro, N. Mex., 0.15; Cheyenne, 0.20; Camp Sheridan, Nebr., and Fort Hale, Dak., 0.22; Sidney, Nebr., 0.24; Morriston, Dak., 0.25; Pembina, Dak., and Winnemucca, Nev., 0.26; Fort Stevenson, Dak., 0.27; Santa Fé, 0.28; Burkes, Ariz., and Salt Lake City, 0.29; Bismarck and Fort Gibson, 0.30; Prescott, Ariz., 0.35; Denver, 0.38; Olivet, Dak., 0.39; Fort Garland, Colo., and Wellington, Kans., 0.46; Silver City, N. M., 0.47; Fort Douglass, 0.52; Holton, Kans., 0.53; Manhattan, Kans., and Umatilla, Oreg., 0.56; Fort Sill, Ind. T., and Creswell, Kans., 0.58; Deadwood, 0.59; Genoa, Nebr., 0.60.

Rainy days.—The number of days on which rain or snow has fallen varies as follows: New England, 9 to 21; Middle Atlantic states, 11 to 20; South Atlantic states, 6 to 19; Eastern Gulf states, 5 to 12; Western Gulf states, 7 to 12; Lower Lake region, 13 to 20; Upper Lake region, 12 to 21; Ohio valley and Tennessee, 11 to 17; Upper Mississippi valley, 10 to 15; Missouri valley, 1 to 9; Red River of the North valley, 5 to 7; Eastern Rocky Mountain slope, 2 to 13; Texas, 2 to 11; Rocky Mountains, 1 to 8; Middle Plateau, 6 to 10; California, 5 to 9; Oregon, 12 to 23.

Cloudy days.—The number varies in New England from 9 to 16; Middle Atlantic states, 5 to 14; South Atlantic states, 8 to 17; Eastern Gulf states, 3 to 20; Western Gulf states, 5 to 14; Lower Lake region, 8 to 17; Upper Lake region, 8 to 17; Ohio valley and Tennessee, 8 to 15; Upper Mississippi valley, 9 to 14; Missouri valley, 7 to 12; Red River of the North valley, 6 to 9; Eastern Rocky Mountain slope, 4 to 10; Texas, 0 to 16; Rocky Mountains, 0 to 6; Middle Plateau, 6 to 19; California, 1 to 10.

Hail was reported in the various states on the following days: New Hampshire, 3d, 6th; Massachusetts, 12th; Connecticut, 25th; New Jersey, 13th, 31st; Pennsylvania, 6th, 12th, 20th; Maryland, 20th; Ohio, 23d; Indiana, 11th, 24th; Illinois, 29th; Tennessee, 21st, 22d; Mississippi, 22d; Louisiana, 22d; Texas, 31st; Missouri, 29th; Kansas and Nebraska, 29th; Iowa, 9th, 19th, 24th, 29th.

Snow fell on the following dates in the various districts: New England, 1st, 3d, 4th, 6th, 7th, 8th, 9th, 11th, 12th, 13th, 15th to 31st; Middle Atlantic states, 3d, 6th, 10th, 11th, 12th, 13th, 14th, 15th, 20th, 22d, 23d, 27th, 30th, 31st; North Carolina, 13th; Tennessee, 12th; Lower Lake region, 1st, 11th, 12th, 13th, 15th, 20th, 21st, 22d, 23d, 24th, 29th, 31st; Ohio valley, 5th, 12th, 13th, 15th, 20th, 22d, 23d, 25th; Upper Lake region, 8th, 9th, 10th, 11th, 13th, 14th, 15th, 17th, 19th, 20th, 21st, 22d, 23d, 26th to 31st; Upper Mississippi valley, 9th, 10th, 11th, 13th, 19th to 31st; Missouri valley, 6th, 8th, 10th, 11th, 19th to 23d, 24th to 31st; Rocky Mountains, 8th, 9th, 10th, 12th, 13th, 14th, 15th, 19th, 21st, 22d, 23d, 25th, 26th, 27th, 28th, 29th; Middle Plateau district, 8th, 9th, 10th, 14th, 15th, 19th, 22d, 23d, 25th, 27th, 28th, 29th. In Arizona on the 28th a very heavy snow storm, accompanied with high winds. California, 9th, 25th, 26th, 27th, 28th; on the 26th snow fell to the depth of 2 inches at several places, and in relation to which the following notes are of interest: Shasta, snowing all day, very cold; Watsonville, rain and snow in morning, more snow fell than at any time for last 15 years; Calistoga, snow 1 inch deep in morning, heaviest fall for past 6 years; Davisville, began snowing at daylight, ½ inch fell in 3 hours; Santa Rosa, began snowing at midnight, first time snow has remained on ground for past 6 years; Napa, 7 a. m., temperature 34°, 2 inches of snow in valley and on surrounding hills, much heavier on mountains at head of valley, heaviest snow for past 6 years; Ukiah, 4 a. m. to noon, severe storm, 2 inches of snow here, at Low Gap 5 inches, and at Little Lake 4 inches; Salinas, 7 a. m., rain turned to heavy snow, which fell for 2 hours, first snow on record in Salinas valley; Gonzales, 7 a. m., light snow, the last snow occurred about 10 years ago; Santa Paula, snow lower on mountains than for past 9 years; on the 27th at Los Angeles the snow-fall was the heaviest ever known in that section; first snow for past 14 years. At Grass Valley, 8 p. m., the snow was 6 inches deep and falling fast; at Georgetown, 8. p. m., 12 inches deep; at Rio Vista, 1 inch, and at Dixon, at 6 p. m., it was snowing hard. On the 28th, at Visalia, first snow for the past 11 years; at Banta, San Joaquin County, 28th, snow covered the hills and valleys. Campo, 28th, clear sky again after the most severe snow storm for many years, snow 3 feet all over the high mountains. Washington Territory, 2d, 3d, 5th, 8th, 9th, 10th, 11th, 12th, 25th.

Largest monthly snow-falls.—Summit, Cal., 66 inches; Pike's Peak, 42.60 inches; Truckee, Cal., 29.50 inches; Mount Washington, 25.60 inches; Grafton, N. H., 22.75 inches; Hermosa, Colo., 22 inches; Escanaba, 20.60 inches; Cornish, Me., and Strafford, Vt., 19 inches; Woodstock, Vt., Neillsville, Wis., Tehachapi, Cal., 18.50 inches; Dunbarton and Antrim, N. H., 17 inches; Embarrass, Wis., 16.50 inches; Northport, Mich., 16.10 inches; Auburn, N. H., 14.50 inches; Gardner, Me., 14 inches; Orono, Me., Contoocookville, N. H., Lunenburg, Vt., and Keene, Cal., 13 inches; Newport, Vt., 12.50 inches; Duluth, 9 inches; Catawissa, Pa., 8.10 inches.

Snow from a cloudless sky.—Bismarck, Dak., 29th.

The *depth of snow on ground at end of month* was reported as follows: In Maine, from 3 to 10 inches; New Hampshire, 2 to 10 inches on the low-lands and 12 to 36 inches on the summit of Mount Washington; Vermont, 1 to 12 inches; New York, trace to ½ inch in the interior; Lower Lake region, trace to ¾ inch; West Virginia, trace; Michigan, ⅛ to ½ inch in the interior; Upper Lake region ½ inch at Alpena to 20 inches at

Duluth; Wisconsin, trace to 8½ inches; Minnesota, 1½ to 6 inches; Iowa, ½ to 2½ inches; Nebraska, trace to 1½ inches; Dakota, ½ to 2½ inches; Wyoming Territory, 2 inches; Colorado, 3 to 24 inches on the low-lands and 6 to 45 inches on the summit of Pike's Peak; New Mexico, 1 inch; Nevada, trace to 3 inches.

Floods.—New Orleans, La., 30th, high water damaged the levee both above and below the city.

RELATIVE HUMIDITY.

The percentages of mean relative humidity for the month range as follows: New England, 70 to 84; Middle Atlantic states, 72 to 85; South Atlantic states, 71 to 88; Eastern Gulf states, 72 to 81; Western Gulf states, 67 to 81; Lower Lake region, 70 to 80; Upper Lake region, 66 to 80; Ohio valley and Tennessee, 60 to 74; Upper Mississippi valley, 60 to 74; Missouri valley, 62 to 83; Red River of the North valley, 92 to 95; Eastern Rocky Mountain slope, 49 to 63; Texas, 22 at Stockton to 75 at Brackettville and Laredo; Western Plateau, 40 at Yuma to 65 at Boise City; California, 65 to 80; Oregon, 69 to 82. *High stations* report the following averages not corrected for altitude: Mount Washington, 86.5 per cent.; Pike's Peak, 52.4; Denver, 39.8; Cheyenne, 38.7; Virginia City, 53.3; Santa Fé, 44.6.

WINDS.

The *prevailing direction of the winds* for the month is shown by arrows flying with the wind, on chart No. II. In general they agree with what might be expected from the distribution of pressure, being *northerly* along the Atlantic coast and in the extreme northwest; *southerly* from the Gulf coast to the Lakes, over the Plateau districts, in the Sacramento valley, Oregon, and Washington Territory; at San Diego and San Francisco the prevailing wind was northerly. The *maximum velocities*, as recorded by self-registers, have been noted in the description of high and low areas. The *maximum* on the summit of Pike's Peak, SW. 95 miles, occurred on the 8th, and on the summit of Mount Washington, NW. 138 miles, on the 10th, both of them during the passage of low area No. V.

Total movements of the air.—The following are the *largest* total movements recorded in miles at the Signal Service stations during the month: On the summit of Pike's Peak, 21,238 miles; Cheyenne, 11,789; Cape Lookout, N. C., 11,181; Thatcher's Island, Mass., 11,081; Portsmouth, N. C., 10,734; Kittyhawk, N. C., 10,574; Milwaukee, 10,330; Sandusky, 10,142; Sandy Hook, 9,911; Cape Hatteras, 9,587; Cape May, 9,425; Key West, 9,110; Barnegat, N. J., 8,987; Burlington, Vt., 8,867; Eastport, 8,798; Cape Henry, 8, 788; North Platte, 8,769. The *smallest* are La Mesilla, N. M., 1,541 miles; Nashville, Tenn., 1,692; Visalia, Cal., 1,871; Lynchburg, Va., 1,958; Uvalde, Tex., 2,263; Augusta, Ga., 2,380; Socorro, N. Mex., 3,031; El Paso, Tex., 3,119; Davis, 3,137; Los Angeles, Cal., 3,214; Silver City, N. Mex., 3,231; Montgomery, 3,254; San Antonio, 3,274; Salt Lake City, 3,516; La Crosse, 3,520.

Sand storms.—Burkes, Ariz., 26th, 27th.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily indications for January, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verifications to be 84.4 per cent. The percentages for the four elements are: weather, 86.9; direction of the wind, 83.2; temperature, 84.5; barometer, 82.7 per cent. By geographical districts they are: for New England, 85.8; Middle states, 85.8; South Atlantic states, 84.4; Eastern Gulf states, 80.7; Western Gulf states, 80.7; Lower Lake region, 84.3; Upper Lake region, 87.8; Tennessee and the Ohio valley, 84.9; Upper Mississippi valley, 84.9; Lower Missouri valley, 82.7; Northern Pacific region, 84.7; Central Pacific coast region, 90.3; Southern Pacific coast region, 96.0. There were 10 omissions to predict out of 3,813, or 0.26 per cent. Of the 3,803 predictions that have been made, 156, or 4.10 per cent., are considered to have entirely failed; 129, or 3.39 per cent., were one-fourth verified; 471, or 12.39 per cent., were one-half verified; 421, or 11.07 per cent., were three-fourths verified; 2,626, or 69.05 per cent., were fully verified, so far as can be ascertained from the tri-daily weather maps.

Cautionary signals.—160 cautionary signals were displayed during the month, of which 119, or 74.4 per cent., were justified by winds of 25 miles per hour or over at or within a radius of 100 miles of the station. 46 off-shore signals were displayed, of which 40, or 87.0 per cent., were fully justified; 42, or 91.3 per cent., were justified as to direction; 41 or 89.1 per cent., were justified as to velocity; and 3, or 6.4 per cent. were not justified either as to direction or velocity. 29 of the off-shore were changed from cautionary. 206 signals of both kinds were displayed, of which 159, or 77.2 per cent., were fully justified. The above does not include signals ordered for 50 display stations, where the velocity is only estimated. 48 cases of winds of 25 miles and over per hour, from scattering stations, were reported, and for which signals had not been ordered. Eight signals were reported late.

NAVIGATION.

In the table on the right-hand side of Chart No. III are given the highest and lowest readings of the Signal Service river-gauges for the month, with the dates of the same. The *Missouri* remained frozen over at and above Omaha throughout the entire month. At Omaha, on the 21st, the ice melted in the immediate vicinity of the gauge, and observations on height of river were resumed; the water slowly fell from the above date to the end of the mouth; at Leavenworth the observations were resumed on the 7th, and the river remained low throughout the month. The *Mississippi* remained closed at and above Le Claire; observations were resumed at Dubuque on the 18th, at Davenport on the 7th, and at Keokuk on the 3rd; at Dubuque and Davenport the river continued to fall to end of month; at Keokuk it rose to 10 feet on the 4th, fell to 6 feet on the 8th, rose to 8 feet on the 10th, after which it fell to end of month; at Saint Louis it rose from 1st to 10th, and then fell to end; at Cairo it fell from 37 feet 4 inches (within 3 feet of danger line) on the 2d to 33 feet 7 inches on the 8th, rose to 42 feet 11 inches (3 feet above danger line) on the 16th, and then fell to 24 feet 7 inches by end; at Memphis rose from 27 feet 7 inches on 1st to 32 feet 5 inches (within 19 inches of danger line) on the 19th, then fell to end; at Vicksburg it rose from 30 feet 11 inches on the 1st to 40 feet 11 inches (danger line 41 feet) at end of month; at New Orleans it rose from the 1st to the end of month, when it was within 9 inches of the danger line. The *Tennessee*, at Chattanooga, fell from the 1st to 6th, rose to 11th, and fell to end of month. The *Cumberland*, at Nashville, fell from 1st to 6th, rose to 9th to 16 feet 6 inches, it then remained almost stationary to the 15th, after which a general fall set in which continued to end. The *Ohio*, at Pittsburgh, fell from 15 feet on the 18th to 11 feet 7 inches on the 5th, rose to 17 feet 3 inches on 7th, fell to 6 feet 2 inches on the 16th, rose to 9 feet 3 inches on 22d, and fell to end of month; at Cincinnati it rose from 24 feet on 2d to 42 feet 2 inches (8 feet below danger line) on 9th, and fell to 19 feet 3 inches at end; at Louisville it fell from 14 feet 6 inches on 1st to 9 feet 6 inches on 4th, rose to 19 feet 6 inches (5 feet from danger line) on the 8th, and fell to end of month. The *Savannah* oscilated between 6 and 7 feet from 1st to 8th, rose to 13 feet 6 inches on the 10th, fell to 6 feet 8 inches on 21st, rose to 12 feet on 28th, and fell to end.

Ice in rivers and harbors.—The following notes on the formation of ice are of interest: *Columbia River.*—Portland, Oreg., 3d, navigation between this city and the cascades reopened; river nearly clear of ice. *Fraser.*—New Westminster, river open on the 16th. *Missouri.*—Yankton, Dak., and Omaha, Nebr., river frozen over throughout the month. Plattsmouth, Nebr., 8th, ice in river very rotten, but held in place by the pile bridge and lack of a rise; 19th, ice breaking up and moving slowly; 20th to 28th, small ice gorges forming at several places, but finally freezing over the second time on the 29th. Saint Joseph, Mo., 8th, ice breaking up; 10th, river clear of ice. Leavenworth, Kans., 5th, ice melting rapidly; 6th, breaking up; 7th, ice gorged, carrying away river gauge and causing other damage; 8th, 9th, river full of floating ice; 10th, river clear; 29th, 30th, 31st, floating ice in river. Kansas, City, Mo., 5th, ice breaking up; 6th, 7th, 8th, ice running out of river; 9th, river clear of ice; 11th, floating ice. Brunswick, Mo., 5th, drift-wood in river, destroying river gauge. Boonville, Mo., 4th, ice breaking up, gorges forming. *Platte River.*—Clear Creek, Nebr., 1st, 8th, 19th, floating ice in river; 28th, river frozen over hard. Plattsmouth, Nebr., 12th, ice melting rapidly, dangerous for travel. *Mississippi.*—La Crosse, 18th, ice on river becoming soft and unsafe for travel, but throughout the month the river remained closed. Dubuque, Iowa, 12th, ice breaking up; 15th, frozen over; people crossing on the ice; 16th, open in several places; 18th, all travel across river ceased; 19th, ice breaking up; 21st, floating ice; 26th, river nearly clear of ice; 27th, ferry-boats making trips; 31st, river full of floating ice. Le Claire, Iowa, 31st, river entirely frozen over. Davenport, Iowa, 4th, ice breaking up; 5th, 6th, 7th, 8th, gorged, causing considerable damage to wharves; 9th, floating ice; steamer arrived from Le Claire; floating ice also on the 12th, 13th, 14th, 15th, 23d, 24th, 28th to 31st. Muscatine, Iowa, 9th, ice breaking up; 18th, river clear. Burlington, Iowa, 6th, ice breaking up; all travel across the river ceased; large ice floes floating down the river; 8th, river clear; 10th to 16th, floating ice; 18th, river clear; 31st, large quantities of floating ice. Fort Madison, Iowa, 30th, first boat passed down the river; river clear of ice. Keokuk, Iowa, 2d, ice breaking up; 3d, moving out slowly; 4th, ice gorged in places, river rising rapidly; 5th, heavy floating ice, gorged in places; river clear along the Illinois side, but closed on the Iowa side; considerable damage done to bridge piers; 6th, Iowa side and main channel clear; navigation opened; river falling rapidly; 8th, steamer arrived from Montrose; 9th and 10th, heavy floating ice; 11th to 13th, small quantities of floating ice; 14th, heavy floating ice; 15th, heavy floating ice; steamer *Arkansas* left for Saint Louis; 16th, first boat arrived from Saint Louis; small quantities of floating ice; 17th to 24th and 29th, floating ice; 31st, heavy floating ice. Saint Louis, 1st, 2d, 3d, 4th, small quantities of floating ice in river; navigation resumed; 5th, river clear of ice; 8th, drift-wood in river. Cairo, Ill., 1st to 3d, floating ice in river.

Iowa.—Des Moines, Iowa, 9th, ice breaking up and floating out rapidly. *Rock River.*—Rockford, Ill., 6th, floating ice in river; 7th, river clear of ice; 29th, floating ice. Lyndon, Ill., 5th, ice passed out of river, causing serious inundations wherever gorges were formed. *Kishwaukee.*—Belvidere, Ill., 4th, river rising rapidly, mill-dam destroyed by floating ice. *Ohio River.*—Wellsburg, W. Va., no ice in the river at this point this winter. *Lake Superior.*—Duluth, 14th, ice in harbor breaking up and drifting away; 21st, large quantities of floating ice in bay; 22d, ice forming in lake rapidly. *Lake Michigan.*—Chicago, 3rd, ice breaking up in river and along lake front. *Grand Traverse Bay.*—Northport, Mich., bay free of ice throughout the month. *Detroit River.*—Detroit, 1st to 3d, ice forming along shore; 9th to 14th, floating i. e; 15th, clear of ice. *Lake Erie.*—Toledo, 4th and 5th, ice breaking up and running out; 7th, free of ice; 10th, navigation opened between this port and Detroit; 15th, tug Carrington left for Port Sarnia. Cleveland, 21st, scow arrived loaded with stone; first boat since close of navigation. Sandusky, 3d, ice breaking up; 5th, large masses moving out; 9th, first steamer arrived. Buffalo, 1st, creek and harbor free of ice. *Hudson River.*—Albany, 28th, river entirely free of ice, rose 11 feet in past 36 hours, causing considerable damage to property. *Watuppa Lake.*—Fall River, Mass., lake clear of ice throughout the month. *Lake Champlain.*—Burlington, Vt., 1st, 22d to 25th, 28th, 31st, floating ice in lake. *Merrimac River.*—Newburyport, Mass., river and harbor free of ice throughout the month, except on the 1st, 14th, 27th, 28th, 30th, when small quantities of floating ice appeared.

High tides.—Cape Lookout, N. C., 14th, 15th, 26th; Fort Macon, N. C., 11th, 12th, 13th to 16th; Portsmouth, N. C., 14th.

Low tides.—Indianola, Tex., 1st, 2d, 10th, 11th, and 12th.

TEMPERATURE OF WATER.

The *temperatures of water*, as observed in rivers and harbors, with average depth at which observations were taken, are given in the table on left side of Chart No. II. At the following stations observations were not made on the dates indicated, on account of ice, at Alpena and Escanaba during entire month; Chicago, 1st, 2d, and 3d; Detroit, 1st, 2d, 3d, 10th, 11th, 12th; Duluth, 1st to 13th inclusive, 22d to end of month; Grand Haven, 1st, 2d, and 3d; Marquette, 28th to 31st; Sandusky and Toledo 1st to 6th.

ATMOSPHERIC ELECTRICITY.

Thunder-storms were reported in the various States and Territories on the following dates: Pennsylvania, 20th 21st; New Jersey, Maryland, Virginia, and West Virginia, 20th; North Carolina, 9th, 22d; Georgia, 8th, 21st, 26th, 27th; Florida, 25th; Alabama, 17th, 21st; Mississippi, 21st, 22d; Louisiana, 5th, 21st; Texas, 1st, 2d, 3d, 4th, 24th, 29th, 30th, 31st; Arkansas, 7th; Indian Territory, 29th; Tennessee, 6th, 21st, 22d; at Nashville the thunder-storm of the 21st was very severe, the heavy peals of thunder and vivid flashes of lightning, 10.10 p. m., being a marked feature of the storm; Kentucky, 7th, 8th, 21st; Ohio, 8th, 21st, 22d; Illinois, 7th, 8th, 21st; Indiana, 7th, 8th, 12th, 17th, 21st; Missouri, 19th, 21st, 29th; Iowa and Nebraska, 29th; Kansas, 22d, 29th.

Auroras.—Harvard College Observatory, Cambridge, Mass., looked for every clear evening, but none seen. Guttenburg, Iowa, 28th, 9 p. m., diffuse light, no streamers; Independence, Iowa, 16th; Gardiner, Me., 28th; Austin, Nebr., 4th; Starkey, N. Y., 11th, 20th, 24th; Milton, Pa., 11th, 7 p. m., arch extended from northeast to southwest disappeared at 8.40 p. m.; Coalville, Utah, 30th; Tucson, Ariz., 8th; Eastport, 7th, 11.40 p. m., 8th, 3 a. m.; Newport, R. I., 4th, 11.30 p. m.; Burlington, Vt., 7th.

Telegraphic communication interfered with by atmospheric electricity.—Mason, Tex., 2d, 3d; Davis, Tex., 1st, 2d; Cape Hatteras, N. C., 22d.

OPTICAL PHENOMENA.

Solar halos were observed in the various districts on the following dates: New England, 16th, 17th, 18th, 22d, 24th, 25th, 26th, 28th, 29th; Middle Atlantic states, 2d, 3d, 5th, 16th, 17th, 18th, 19th to 30th; South Atlantic states, 1st, 3d, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 22d, 23d, 24th, 25th, 27th, 28th; Eastern Gulf states, 19th, 20th, 21st, 22d, 23d, 24th, 25th, 28th; Western Gulf states, 15th, 16th, 17th, 18th, 19th, 21st, 22d, 23d, 24th, 26th, 28th, 29th; Lower Lake region, 17th, 19th, 21st, 24th, 25th, 27th, 28th, 29th, 31st; Upper Lake region, 5th, 16th, 17th, 24th, 25th, 26th, 27th, 28th, 29th; Ohio valley and Tennessee, 1st, 2d, 14th, 15th, 16th, 19th, 20th, 21st, 23d to 29th; Upper Mississippi valley, 1st, 15th to 29th; Missouri valley, 2d, 4th, 14th to 20th, 24th to 31st; Eastern Rocky Mountain slope, 1st, 2d, 14th, 17th, 18th, 23d, 25th, 27th, 28th; Rocky Mountains, 15th, 20th, 21st, 23d, 24th, 29th; Western Plateau, 17th, 18th, 21st, 23d, 24th, 26th, 27th; California, 2d, 4th, 19th, 22d, 24th, 25th, 26th.

Lunar halos were observed in the various districts on the following dates: New England, 5th, 13th, 15th, 17th, 25th, 26th, 27th, 30th; Middle Atlantic states, 5th, 15th, 16th, 17th, 21st, 23d, 25th, 26th, 30th; South Atlantic states, 20th, 21st, 23d; Eastern Gulf states, 5th, 16th, 19th, 20th, 22d, 23d; Western Gulf states, 9th, 19th, 29th; Lower Lake region, 6th, 8th, 9th, 10th, 11th, 19th, 20th, 25th; Upper Lake region, 13th, 16th, 18th, 24th, 26th, 28th; Ohio valley, 1st, 14th, 24th, 25th, 26th, 28th, 29th; Upper Mississippi valley, 10th, 11th, 14th, 15th, 17th, 19th, 23d, 24th, 25th, 26th, 28th, 30th, 31st; Missouri valley, 5th, 11th, 16th, 19th, 20th, 23d, 24th, 25th, 26th, 27th, 28th; Rocky Mountains, 7th, 15th, 18th, 27th, 28th, 29th; California, 9th, 11th, 24th, 29th.

Mirage.—Olivet, Dak., 30th; Genoa, Nebr., 17th, 18th, 22d, 23d, 24th, 30th, 31st; Pembina, Dak., 20th, 23d, 24th.

MISCELLANEOUS PHENOMENA.

Sunsets.—The characteristics of the sky at sunset, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from 137 stations show 4,183 observations to have been made, of which 35 were reported doubtful; of the remainder, 3,486, or 84.0 per cent., were followed by the expected weather.

Meteors.—Wabash, Ind., 19th, between 5 and 6 a. m., "a large meteor passed over the city, making the whole heavens a brilliant glow of light. It was apparently some 3 feet in diameter and left behind it a long fiery train of different colored sparks." Southington, Conn., 2d; Lyndon, Ill., 12th, 15th; New Corydon, Ind., 10th, 12th, 13th, 15th, 19th, 24th; Monticello, Iowa, 6th; Yates Center, Kans., 5th, 7th Woodstock, Md., 3d, 10th, 16th, 24th, 29th, 31st; Rowe, Mass., 1st, 2d, 15th; Fall River; Mass., 31st; Fayette, Miss., 3d, 10th; Ashley, Miss., 17th; Clear Creek, Nebr., 3d, 31st; Genoa, Nebr., 7th; Grafton, N. H., 21st; Freehold, N. J., 17th, 31st; Waterburg, N. Y., 2d, 10th, 13th; Starkey, N. Y., 16th; Jacksonburg, Ohio, 18th; Los Angelles, Cal., 8th; Dodge City, 9th; Davis, Tex., 8th; Mobile, Ala., 30th; Pensacola, Fla., 10th; Milwaukee, Wis., 6th.

Earthquakes.—Key West, 22d, 11.10 p. m., "severe shock passed over the island, lasting one minute; a rocking motion, from southwest to northeast, was felt by many persons in the upper stories of buildings along a path not more than 100 yards wide; vessels in the harbor did not feel the shock, and no noise accompanied it." Havana, Cuba, 22d, 11.04 p. m., "light shock of ten seconds' duration, three oscillations from southeast to northeast; 23d, 3.45 p. m., another light shock of less duration; 26th, at about 5 a. m., still another shock was experienced by many persons; in the western portion of the island shocks have been generally felt for several days, accompanied with continued subterraneous thunder or roaring; the boroughs of San Cristobal and Candelaria are in ruins, and several persons killed, wounded, and contused; on the night of the 29th four light shocks were felt at San Cristobal. On the Isle of Pines, 22d, shock at 11 p. m.; 23d, at 4 a. m. and 9 p. m.; 26th, at 4.30 p. m. and 1 p. m." San Salvador, C. A., 22d, "violent shocks were felt in the interior: much damage is reported from Libertas; the earth at this place seemed literally to be dancing; persons were thrown to the ground and many buildings suffered; the lake of Ilopango was in motion like a boiling cauldron, emitting dense sulphurous vapors; industries of all kinds suspended." In California, on the 9th, "at Hollister, San Benito County, about 6 a. m., heaviest earthquake shock ever felt here; vibrations from NE. to SW. continued over twenty seconds; Gonzales, Monterey County, 5.45 a. m., quite a perceptible shock felt; Santa Cruz, Santa Cruz County, 5.45 a. m., shock from N. to S., lasting from fifteen to twenty seconds." Yokohama, Japan, December 3d, 1879, 7.09 a. m., severe shocks; duration, 20 seconds; at 9.45 a. m. light shock; 7th, 5.10 a. m., light shock; 11 a. m., light shock.

Polar bands.—New Corydon, Ind., 1st, 13th, 15th, 17th, 24th, 26th, 27th, 31st; Guttenburg, Iowa, 28th; Glenwood, Iowa, 4th, 11th, 19th; Yates Center, Kans., 11th; Gardiner, Me., 15th, 28th; Thornville, Mich., 4th, 24th; Clear Creek, Nebr., 4th, 5th, 8th, 10th, 11th, 14th, 15th, 16th, 18th, 19th, 20th, 23d, 25th; Auburn, N. H., 15th, 26th; Vineland, N. J., 21st, 26th; Wytheville, Va., 24th, 25th, 26th, 28th; Toledo,, 24th; Barnegate, N. J., 28th; Atlantic City, N. J., 28th.

Prairie and forest fires.—Morriston, Dak., 18th; Fort Dodge, Kans., 13th to 19th; Glenwood, Iowa, 16th; Creswell, Kans, 5th, 8th, 9th, 11th, 14th, 15th, 18th to 22d, 25th, 27th, 28th, 30th; Independence, Kans., 9th to 29th; Wellington, Kans., 23d; Lake Charles, La., 24th; North Platte, 10th; Deadwood, Dak., 8th; Fort Gibson, Ind. T., 9th, 11th, 12th, 14th, 16th; Henrietta, Tex., 11th, 16th, 17th.

Sun spots.—The following record of observations made by Mr. D. P. Todd, Assistant, N. A. O., has been forwarded by Prof. S. Newcomb, U. S. Navy, superintendent Nautical Almanac Office, Washington, D. C.:

Date.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	
Jan., 1880.									
1st, 12 m....	1	2	0	0	0	0	1	2	Spots small.
1st, 3 p. m..	0	0	0	0	0	0	1	2	
4th, 1 p. m..	3	22	0	0	3	22	4	24	Faculæ; many of the spots small. The new spots probably reappeared by solar rotation.
8th, 2 p. m..	0	0	2	8	0	0	2	16	
10th, 8 a. m..	0	0	0	0	0	0	2	24	A few of the spots very large.
10th, 3 p. m..	1	2	0	0	0	0	3	26*	
13th, 9 a. m..	0	0	0	0	0	0	3	26*	
14th, 9 a. m..	1	4	0	0	0	0	4	30*	Faculæ.
14th, 4 p. m..	0	0	1	4	0	0	3	26*	
15th, 3 p. m..	1	4	1	10	1	4	3	20*	Faculæ.
18th, 10 a. m..	0	0	1	10	0	0	2	10	Faculæ.
18th, 4 p. m..	0	0	0	0	0	0	2	10	
19th, 9 a. m..	0	0	0	3	0	0	2	7	
21st, 9 a. m..	0	0	1	5	0	0	1	2	Faculæ.
23d, 9 a. m..	0	0	1	2	0	0	0	0	
24th, 2 p. m..	0	0	0	0	0	0	0	0	Faculæ.
25th, 5 p. m..	0	0	0	0	0	0	0	0	
26th, 9 a. m..	1	3	0	0	0	0	1	3	Several groups of faculæ.
28th, 9 a. m..	1	1	0	0	0	0	2	4	Faculæ.
28th, 5 p. m..	0	0	0	0	0	0	2	4	
29th, 9 a. m..	0	0	0	0	0	0	0	0	Faculæ.
31st, 4 p. m..	2	9	0	0	?	?	2	9	Spots quite large—probably reappeared by solar rotation.

*Approximated.

NOTES AND EXTRACTS.

Generation of cyclones.—In an elaborate report upon the Madras cyclone of May, 1877, Mr. J. Eliot gives the following general conclusions relating to cyclone generation in the Bay of Bengal:

1. Cyclonic disturbances of small intensity are of frequent occurrence during the prevalence of the southwest monsoon or rainy season. Cyclones, or revolving storms of great extent and intensity, occur only at the two transitional periods, viz, at the April transitional period preceding the southwest monsoon, and the October transition period succeeding the southwest monsoon and ushering in the northeast monsoon.

2. Cyclone occurrence is most probable during the October transition period.

3. The most intense and extensive cyclones occur during the October transition period.

4. The most powerful cyclones in the bay tend to occur at or about the minimum sun-spot period.

5. Cyclones formed at the commencement of the April transition period, or near the end of the October transition period, are usually generated in the south of the bay, and proceed towards the Coromandel coast.

6. Cyclones generated during the latter part of the April transition period, or the greater part of the October transition period (*i. e.*, to the end of October), usually take their origin in the center of the bay to the west or northwest of the Andamans, and advance towards the coast of Ganjam, Orissa, or Bengal.

7. There is a strong antecedent probability, derived from past experience, of the occurrence of at least one intense cyclone at each minimum sun-spot period.

8. The invariable antecedents of powerful cyclones at the two transition periods are, approximate uniformity of pressure over and around the coast of the Bay of Bengal, light and variable winds or calms over a considerable portion of the bay, and

little or no rainfall over the coast region as well as in the bay; the weather is hence sultry, the sea smooth. The amount of aqueous vapour accumulates, and finally gives rise to peculiar sky effects.[*] The immediate antecedent is heavy rainfall, concentrated over a portion of the bay, accompanied by strong indraft, most marked from the Indian Ocean at the entrance of the bay. This indraft from the Indian Ocean gives rise to strong winds and heavy rain at the stations on the south and west coasts of Ceylon.

9. The direction of progression of the cyclonic vortex when it is fully developed varies according to the antecedent meteorological conditions of the bay from west to northeast.

10. Cyclones at sea (*i. e.*, cyclonic vortexes) advance in approximately straight lines over the sea area.

11. The part of the coast struck by the cyclonic vortex is previously indicated, as a rule (but not invariably), by a more rapid fall of the barometer than at the neighbouring coast stations.

12. The path of a cyclonic vortex at the two transitional periods appears to coincide closely, if not exactly, with the line of least atmospheric motion immediately previous to the origin and development of the cyclone.

13. The intense motion of a cyclonic vortex is confined almost entirely to the lower atmospheric strata. The plane of saturation is very probably at no great height. In no case has any cyclone of the Bay of Bengal crossed a mountain range. Deflection or destruction is the fate of a cyclonic vortex approaching the hills of the coast regions of the bay. The only case on record of a cyclone crossing the peninsula of India is that of the 22d October, 1842, which passed by the Palghat Gap, and was traced to 60° E. longitude in the Arabian Sea.

14. In the discussion of cyclones the antecedent favorable conditions and the source of the energy must be carefully distinguished. The invariable and necessary antecedents are—

(1) Approximate uniformity of pressure over the bay.
(2) Light and variable winds over the central area of the bay.
(3) No general rainfall for some time previously over the bay and in India.

The source of the energy is vapour condensation and rain precipitation, or, as stated in the Backergunge Cyclone Report, the primary cause of cyclone formation is "the production and ascent of a large quantity of vapour which is condensed with the liberation of its latent heat over the place of its production instead of being carried away to some distant region."

15. The air motion in cyclones is one of indraft and therefore the wind direction at any point is not at right angles to the direction of the center. The stream lines or the lines of air motion are spiral curves. The relation between the wind direction and the direction of the center is probably not invariable, but depends upon the intensity of the storm or the baric gradient. The law laid down by Mr. Willson in the Report on the Midnapore cyclone is probably the nearest approximation. It is "with the face of the wind, the direction of the center is from ten to eleven points to the right-hand side."

Published by order of the Secretary of War.

ALBERT J. MYER,
Brigadier General (*Brevet Assigned*), *Chief Signal Officer, U. S. A.*

PAPER 40.

MONTHLY WEATHER REVIEW, FEBRUARY, 1880.

INTRODUCTION.

In preparing the Review the following data, received up to March 14th, have been used, viz: The regular tri-daily weather charts, containing the data of simultaneous observations taken at 138 Signal Service stations and 13 Canadian stations, as telegraphed to this office; 142 monthly journals and 146 monthly means from the former, and 12 monthly means from the latter; reports from 27 sunset stations; 238 monthly registers from voluntary observers; 38 monthly registers from United States Army post surgeons; marine records; international simultaneous observations; monthly reports from voluntary observers in, and the local weather service of, Missouri; reliable newspaper extracts; special reports.

Since July 31st, 1878, the following stations of the first class have been opened on the

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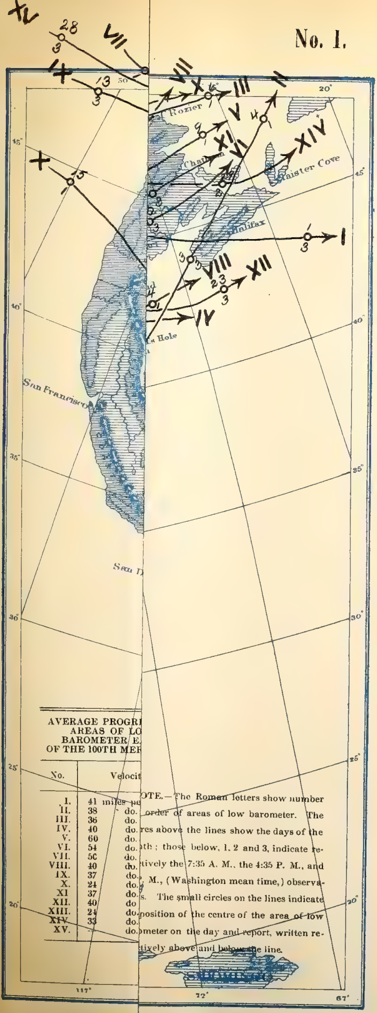
[*] The most complete account of these will be found in a small poetical description of the cyclones of the Bay of Bengal, published by J. R. Elson, Esq., master pilot, Calcutta

No. 1.



AVERAGE PROGR
AREAS OF LO
BAROMETER E
OF THE 100TH MER

No.	Velocit
I.	41 miles pe
II.	38 do.
III.	36 do.
IV.	40 do.
V.	60 do.
VI.	54 do.
VII.	50 do.
VIII.	40 do.
IX.	37 do.
X.	24 do.
XI	37 do.
XII.	40 do
XIII.	24 do.
~~XIV~~	33 do.
XV.	- do.

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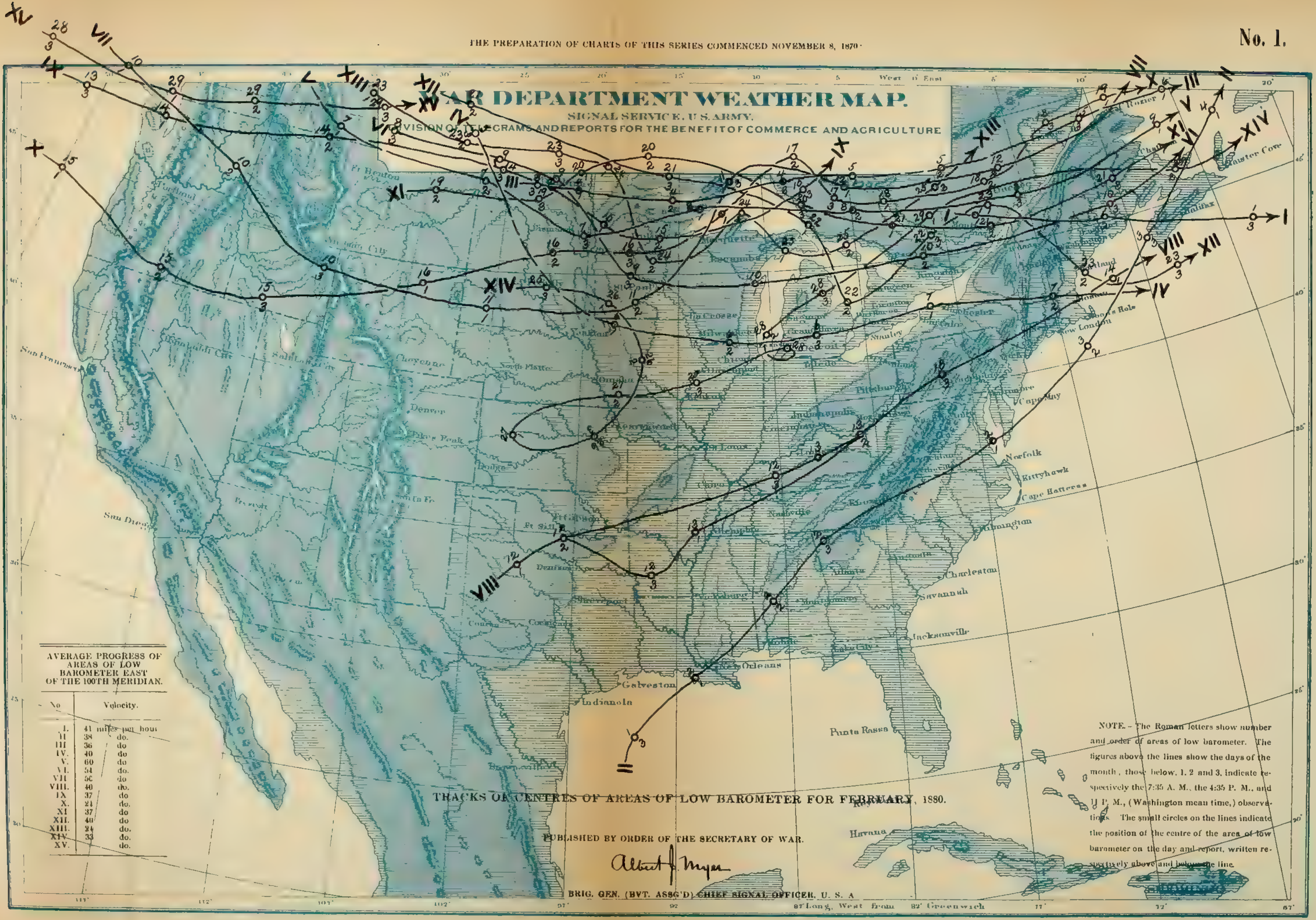
No. 1.

THE PREPARATION OF CHARTS OF THIS SERIES COMMENCED NOVEMBER 8, 1870.



WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE

AVERAGE PROGRESS OF AREAS OF LOW BAROMETER EAST OF THE 100TH MERIDIAN.

No	Velocity.
I.	41 miles per hour
II	38 do.
III	36 do
IV.	40 do
V.	60 do
VI.	54 do.
VII	56 do
VIII.	40 do.
IX	37 do
X.	24 do.
XI	37 do
XII.	40 do
XIII.	24 do.
XIV.	33 do.
XV.	do.

TRACKS OF CENTRES OF AREAS OF LOW BAROMETER FOR FEBRUARY, 1880.

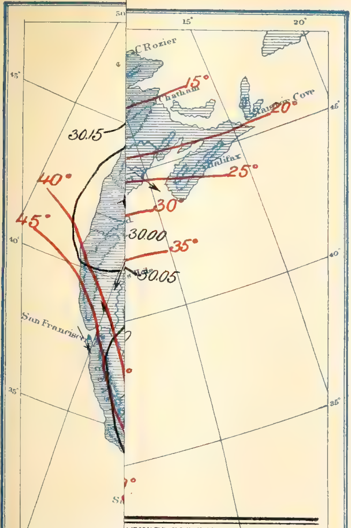
PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASS'G'D) CHIEF SIGNAL OFFICER, U. S. A.

NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month, those below, 1, 2 and 3, indicate respectively the 7:35 A. M., the 4:35 P. M., and 11 P. M., (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above and below the line.

No. 11.



TEMPERAT ATURES FOR FEBRUARY, 1880.

FE

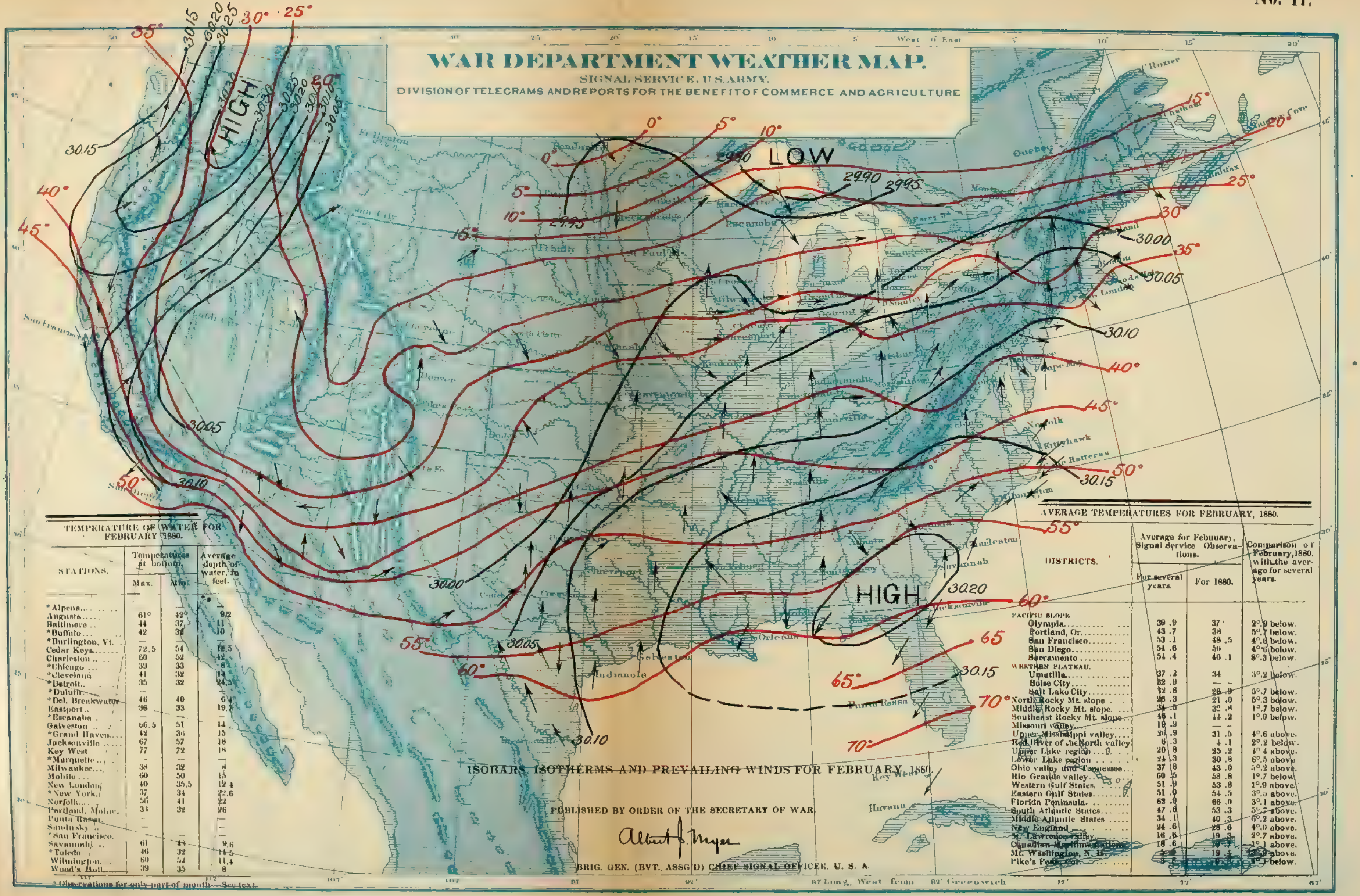
STATIONS.	Average for Febuuary, Signal Service Observations.		Comparison of February, 1880, with the average for several years.
	For several years.	For 1880.	
*Alpena			
Augusta			
Baltimore	39 .9	37°	2°.9 below.
*Buffalo	43 .7	38	5°.7 below.
*Burlington, Vt.	53 .1	48 .5	4°.6 below.
Cedar Keys	54 .6	50	4°.6 below.
Charleston	54 .4	46 .1	8°.3 below.
*Chicago			
*Cleveland	37 .2	34	3°.2 below.
*Detroit	32 .9	— –	
*Duluth	32 .6	26 .9	5°.7 below.
*Del. Breakwater	26 .3	21 .0	5°.3 below.
Eastport	34 .5	32 .8	1°.7 below.
*Escanaba	46 .1	44 .2	1°.9 below.
Galveston	19 .9	— –	
*Grand Haven	26 .9	31 .5	4°.6 above.
Jacksonville	6 .3	4 .1	2°.2 below.
Key West	20 .8	25 .2	4°.4 above.
*Marquette	24 .3	30 .8	6°.5 above
Milwaukee	37 .8	43 .0	5°.2 above.
Mobile	60 .5	58 .8	1°.7 below
New London	51 .9	53 .8	1°.9 above.
*New York	51 .0	54 .5	3°.5 above.
Norfolk	62 .9	66 .0	3°.1 above.
Portland, Maine	47 .6	53 .3	5°.7 above.
Punta Rassa	34 .1	40 .3	6°.2 above.
Sandusky	24 .6	28 .6	4°.0 above.
*San Francisco	16 .6	19 .3	2°.7 above.
Savannah	18 .6	19 .7	1°.1 above.
*Toledo	5 .5	19 .4	13°.9 above.
Wilmington	3 .8	[illegible]	4°.1 below.
Wood's Holl			

* Observations fo

No. 11.

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY.
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE



ISOBARS, ISOTHERMS AND PREVAILING WINDS FOR FEBRUARY, 1880.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT., ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

TEMPERATURE OF WATER FOR FEBRUARY, 1880.

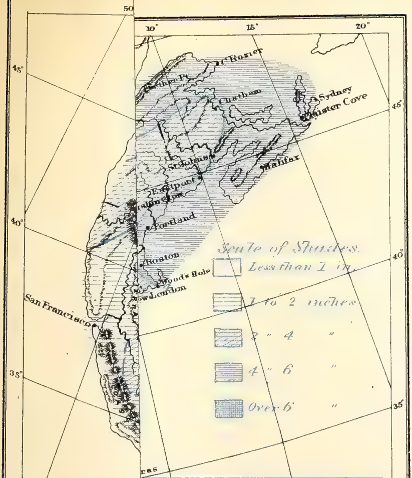
STATIONS.	Temperatures at bottom.		Average depth of water, in feet.
	Max.	Min.	
*Alpena	—	—	—
Augusta	61°	42°	9.2
Baltimore	44	37	11
*Buffalo	42	32	10
*Burlington, Vt.	—	—	—
Cedar Keys	72.5	54	12.5
Charleston	60	52	42
*Chicago	39	33	8
*Cleveland	41	32	14
*Detroit	35	32	24.5
*Duluth	—		—
*Del. Breakwater	46	40	6.4
Eastport	36	33	19.7
*Escanaba	—	—	—
Galveston	66.5	51	44
*Grand Haven	42	36	15
Jacksonville	67	57	18
Key West	77	72	18
*Marquette	—	—	—
Milwaukee	38	32	8
Mobile	60	50	15
New London	40	35.5	12.4
*New York	37	34	22.6
Norfolk	56	41	22
Portland, Maine	34	32	26
Punta Rassa	—		—
Sandusky	—		—
*San Francisco		—	—
Savannah	61	44	9.6
*Toledo	46	32	14.5
Wilmington	60	52	11.4
Wood's Holl	39	35	8

*Observations for only part of month.—See text.

AVERAGE TEMPERATURES FOR FEBRUARY, 1880.

DISTRICTS.	Average for Febuuary, Signal Service Observations.		Comparison of February, 1880, with the average for several years.
	For several years.	For 1880.	
PACIFIC SLOPE			
Olympia	39.9	37	2°.9 below.
Portland, Or.	43.7	38	5°.7 below.
San Francisco	53.1	48.5	4°.6 below.
San Diego	54.6	50	4°.6 below.
Sacramento	54.4	46.1	8°.3 below.
WESTERN PLATEAU.			
Umatilla	37.2	34	3°.2 below.
Boise City	32.9	—	
Salt Lake City	32.6	26.9	5°.7 below.
North Rocky Mt. slope	26.3	21.0	5°.3 below.
Middle Rocky Mt. slope	34.5	32.8	1°.7 below.
Southeast Rocky Mt. slope	46.1	44.2	1°.9 below.
Missouri valley	19.9	—	
Upper Mississippi valley	26.9	31.5	4°.6 above.
Red River of the North valley	6.3	4.1	2°.2 below.
Upper Lake region	20.8	25.2	4°.4 above.
Lower Lake region	24.3	30.8	6°.5 above
Ohio valley and Tennessee	37.8	43.0	5°.2 above.
Rio Grande valley	60.5	58.8	1°.7 below
Western Gulf States	51.9	53.8	1°.9 above.
Eastern Gulf States	51.0	54.5	3°.5 above.
Florida Peninsula	62.9	66.0	3°.1 above.
South Atlantic States	47.6	53.3	5°.7 above.
Middle Atlantic States	34.1	40.3	6°.2 above.
New England	24.6	28.6	4°.0 above.
St. Lawrence valley	16.6	19.3	2°.7 above.
Canadian Maritime Provinces	18.6	[illegible]	1°.1 above.
Mt. Washington, N. H.	[illegible]	19.4	[illegible] above.
Pike's Peak, Col.	[illegible]	[illegible]	[illegible] below.

No. III.



VERS ABOVE LOW-WATER MARK, FEB., 1880.

	Danger point on gauge	Highest water.		Lowest water.	
		Date.	Height.	Date.	Height.
	ft. in.	Jan	ft. in.	Jan.	ft. in
..	29 9	29	5 3	1	2 0
...	—	16 17	10 0	8, 9	0 1
...	20 0	—	— —	—	— —
...	16 0	5, 6	8 0	22, 23	5 0
...	21 0	28	6 9	11	2 9
....	14 6	—	—	—	— —
...	18 0	—	— —	—	— —
....	21 10	17	6 6	2	2 11
...	15 0	18	4 6	1	1 10
....	14 6	28	5 10	9	2 4
...	30 0	20, 21	11 7	10 to 12	8 4
...	40 0	24	43 5	11	19 1
...	34 0	29	33 4	12	14 6
...	41 0	1	40 0	17	27 8
...	3 6	2	—. 2 8	19	— 6 1
...	20 0	14	21 7	10	3 8
...	50 0	17	53 3	10, 11	14 2
...	24 0	18, 19	30 6	12	7 4
...	42 0	19, 20	44 2	1, 2	8 0
...	31 0	16, 17	26 10	1	4 3
...	28 0	14	20 6	2	6 6
...	29 0	14	21 7	10	3 8
...		3	18 8	26, 27, 28	6 6
...	---	—	—	—	— —

ark of 1874. † Above low water mark of 1878.

AVERAGE

DISTRICTS.

St. Lawrence Valley....
New England........
Middle Atlantic States...
South Atlantic States...
Florida Peninsula......
Eastern Gulf States......
Western Gulf States....
Tennessee..............
Ohio Valley.............
Lower Lake Region......
Upper Lake Region......
Upper Mississippi Valley.
Minnesota..............
Lower Missouri Valley....
Upper Missouri Valley ..
California Coast........
Portland, Or............

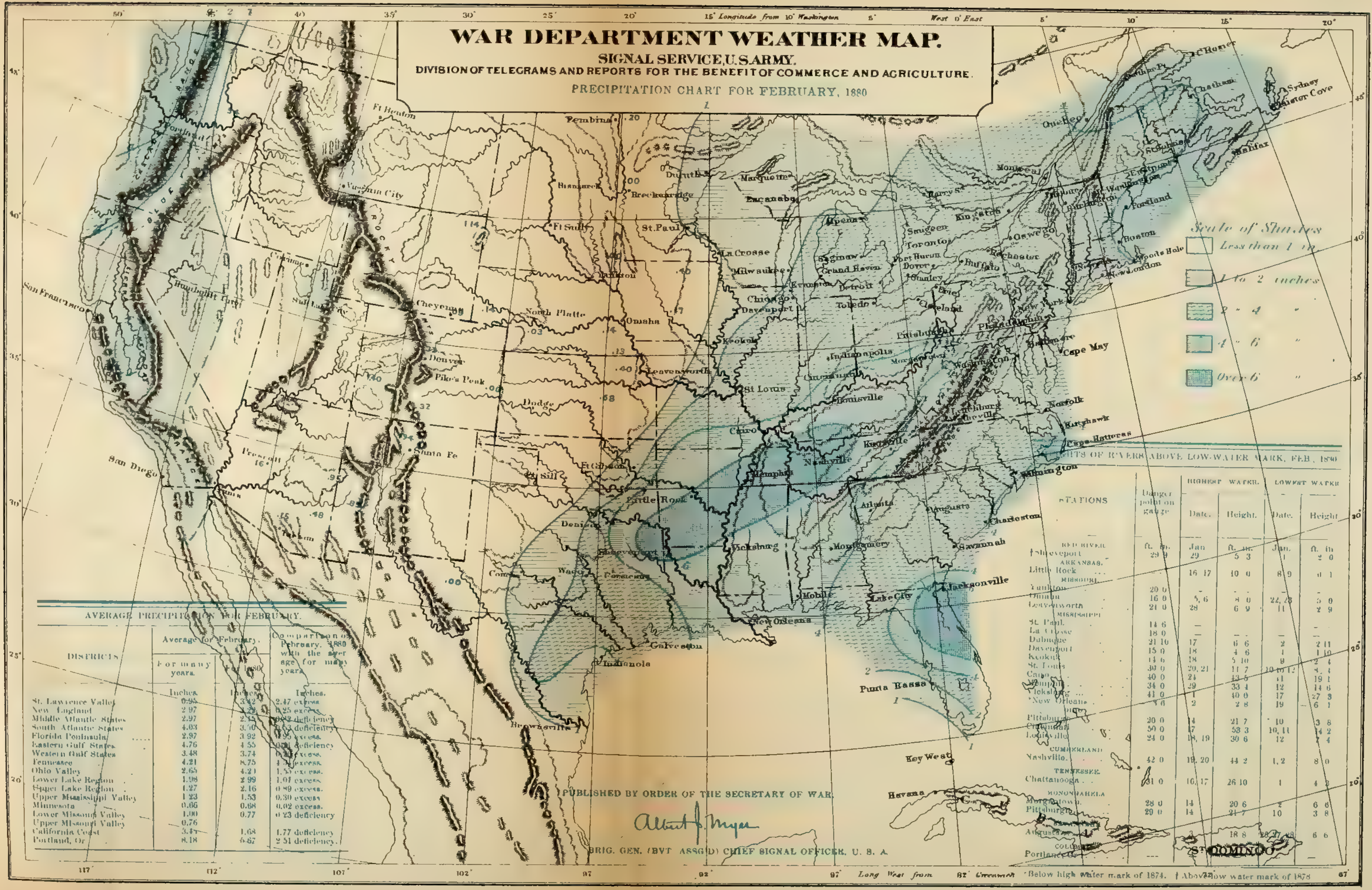
No. III.

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

PRECIPITATION CHART FOR FEBRUARY, 1880



AVERAGE PRECIPITATION FOR FEBRUARY.

DISTRICTS	Average for February. For many years.	Average for February. For 1880.	Comparison of February, 1880 with the average for many years.
	Inches.	Inches.	Inches.
St. Lawrence Valley	0.95	3.42	2.47 excess.
New England	2.97	3.22	0.25 excess.
Middle Atlantic States	2.97	2.15	0.82 deficiency
South Atlantic States	4.03	3.50	0.53 deficiency
Florida Peninsula	2.97	3.92	0.95 excess.
Eastern Gulf States	4.76	4.55	0.21 deficiency
Western Gulf States	3.48	3.74	0.26 excess.
Tennessee	4.21	8.75	4.54 excess.
Ohio Valley	2.65	4.21	1.55 excess.
Lower Lake Region	1.98	2.99	1.01 excess.
Upper Lake Region	1.27	2.16	0.89 excess.
Upper Mississippi Valley	1.23	1.53	0.30 excess.
Minnesota	0.66	0.68	0.02 excess.
Lower Missouri Valley	1.00	0.77	0.23 deficiency
Upper Missouri Valley	0.76		
California Coast	3.45	1.68	1.77 deficiency
Portland, Or	8.18	6.67	2.51 deficiency.

HEIGHTS OF RIVERS ABOVE LOW-WATER MARK, FEB., 1880.

STATIONS	Danger point on gauge	Highest water. Date.	Highest water. Height.	Lowest water. Date.	Lowest water. Height.
RED RIVER.	ft. in.	Jan.	ft. in.	Jan.	ft. in.
†Shreveport	29 9	29	5 3	1	2 0
ARKANSAS.					
Little Rock	—	16 17	10 0	8 9	0 1
MISSOURI.					
Yankton	20 0	—	—	—	—
Omaha	16 0	5, 6	8 0	22, 23	5 0
Leavenworth	21 0	28	6 9	11	2 9
MISSISSIPPI.					
St. Paul	14 6	—			—
La Crosse	18 0	—	—	—	—
Dubuque	21 10	17	6 6	2	2 11
Davenport	15 0	18	4 6	1	1 10
Keokuk	14 6	18	5 10	9	2 4
St. Louis	30 0	20, 21	11 7	10 to 12	4 4
Cairo	40 0	24	43 5	11	19 1
Memphis	34 0	29	33 4	12	14 6
Vicksburg	41 0	1	40 0	17	27 3
*New Orleans	3 6	2	2 8	19	—6 1
OHIO.					
Pittsburg	20 0	14	21 7	10	3 8
Cincinnati	50 0	17	53 3	10, 11	14 2
Louisville	24 0	18, 19	30 6	12	7 4
CUMBERLAND.					
Nashville	42 0	19, 20	44 2	1, 2	8 0
TENNESSEE.					
Chattanooga	31 0	16, 17	26 10	1	4 3
MONONGAHELA.					
Morgantown	28 0	14	20 6	2	6 6
Pittsburg	29 0	14	21 7	10	3 8
SAVANNAH.					
Augusta		3	18 8	26, 27, 28	6 6
COLUMBIA.					
Portland, Or.	---				—

*Below high water mark of 1874. † Above low water mark of 1878

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

dates named: Des Moines, Iowa, August 1st, 1878; Unalashka, Alaska August 18th, 1878; Stevenson, Dak., September 19th, 1878; Madison, Wis., September 29th, 1878; Charlotte, N. C., October 6th, 1878; Buford, Dak., October 23d, 1878; Deadwood, Dak., November 1st, 1878; Keogh, Mont., November 18th, 1878; Custer, Mont., December 5th, 1878; Chattanooga, Tenn., January 8th, 1879; Little Rock, Ark., July 1st, 1878; Springfield, Ill., July 1st, 1879; Pensacola, Fla., October 27th, 1879; Cedar Keys, Fla., November 5th, 1879; Yates, Dak., November 10th, 1879; Helena, Mont., November 10th, 1879; Lewiston, Idaho, November 23th, 1879; Dayton, Wash., December 1st, 1879; Elliott, Tex., December 1st, 1878; Assiniboine, Mont., December 13th, 1879; Missoula, Mont., December 16th, 1879; Breakwater, Del., January 29th, 1880. The station at Tybee Island, Ga., was closed February 15th, 1879, and that at Saint Mark's, Fla., on October 30th, 1879.

BAROMETRIC PRESSURE.

The mean barometric pressure for the month is shown on chart No. II. Compared with the preceding month, the area of 30.20 which extended over the southern portion of the Middle states and northern portion of the South Atlantic states has moved to the southern portion of Georgia, and the line of 30.10 has moved westward over Texas and southward from New England to the central portion of the Middle states. The pressure has changed slightly in the southern portion of the Lake region, while the area of mean low barometer has moved eastward to the northern portion of Lake Superior. In the Northwest the pressure is generally one-tenth of an inch below the average for the month, while at the Rocky Mountain stations it remains near the normal. The most decided change in the distribution of pressure has occurred on the Pacific coast; the high area which was apparently west of the coast during January having moved northeast over Oregon, replacing the low area of 29.90 by a general increase of pressure on the entire coast. Compared with the same month in previous years, the pressure continues above the normal in the Southern, Middle, and New England states, and it is slightly below the normal in the Ohio valley and thence northward and northwestward.

Local barometric ranges.—These have been least in Florida, southern California, New Mexico, Colorado, Wyoming, and western Texas. They have been greatest over the Middle Atlantic states, Upper Lake region, the Upper Mississippi valley, and the Northwest. By districts they are as follows: New England states, 1.22 to 1.60 inch; Middle Atlantic states, 1.26 to 1.72 inch; South Atlantic states, 0.80 to 1.31 inch; Eastern Gulf states, 0.38 to 1.05 inch; Western Gulf states, 0.86 to 1.13 inch; Ohio valley and Tennessee, 1.04 to 1.40 inch; Lower Lake region, 1.23 to 1.36 inch; Upper Lake region, 1.37 to 1.95 inch; Upper Mississippi valley, 1.30 to 1.80 inch; Red River of the North valley, 1.56 to 1.70 inch; Lower Missouri valley, 1.33 to 1.54 inch; Upper Missouri valley, 0.73 to 1.02 inch; Middle Eastern Rocky Mountain slope, 1.04 to 1.22 inch; Texas, 0.67 to 1.19 inch; Rocky Mountain stations, 0.64 to 0.95 inch; Middle Plateau, 0.86 to 1.10 inch; California, 0.51 to 0.83 inch; Oregon, 1.16 to 1.22 inch; Washington Territory, 1.27 inch.

Areas of high barometer.—These areas have moved more directly to the east than usual, and in three cases the direction appears to have been changed from the east to the northeast along the Atlantic coast. Eight of these areas have been traced over the districts east of the Rocky Mountains, while three periods of decidedly high pressure occurred on the Pacific coast during the month attended by unusually low temperature.

No. I.—This is a continuation of No. XI of the preceding month, the center of greatest pressure having moved northward during the night of January 31, from southern Illinois to the central portion of Minnesota. At the afternoon report the center of the greatest pressure was near Saint Paul, and during the succeeding twenty-four hours the area moved directly east to New England attended by generally clear and colder weather in all districts north of the Gulf states. On the morning of the 1st the temperature at Eastport was —10°, at Burlington —8°, and at Boston —1°.

No. II.—On the morning of the 3d this area was central near Yankton, while reports from all stations west of the Mississippi valley and on the Pacific coast indicate that this entire region was within the limits of an extended area of high barometer. The unusual pressure of 30.74 at Olympia and 30.76 at Portland occurred on the morning of the 3d, the former being a departure from the normal of +0.91. The barometer continued very high on the Pacific coast as this area moved directly south to Texas on the 3d, preceded by a light "norther" on the West Gulf coast, and attended by cold, clear weather in the interior and light rains on the coast. During the 4th and 5th the pressure increased in the Gulf and South Atlantic states, and the center passed to the east from San Antonio to Montgomery, where it changed direction to the northeast, following the general direction of the coast line immediately in rear of the severe storm traced as No. II on chart No. I.

No. III appeared on the night of the 6th in the Northwest, attended by cold northerly winds and clear weather and preceded by an area of low barometer charted as

No. IV. Morning report of the 7th places the center of this area over Iowa, where the pressure was 30.60, the barometer having risen to 30.50 over the Gulf states and central Mississippi valley, with lower temperature and cold northerly winds in Texas. This area became well defined and moved towards the South Atlantic coast during the 7th, attended by generally clear weather in all districts east of the Mississippi. High northwest winds occurred on the Middle Atlantic coast as the center advanced from the Ohio valley, but as the area passed to the east of the coast the wind at stations south of Cape May shifted to the northeast, indicating that the center continued north of or near the 40° of latitude.

No. IV.—The telegraphic reports of the 8th indicate the advance of this area from British America north of the Upper Missouri valley, and at midnight of the 8th it was central near Breckenridge, where the barometer was 30.60 and the temperature —18°, the wind had shifted to southerly at Pembina and Fort Garry, but the temperature remained at —20° at the former station and —22° at the latter. This area moved east during the 9th over the track previously given as No. I, and on the morning of the 10th was central near Boston. Light snows were reported in the Lake region and in the northern portions of the Middle states and New England, when the wind shifted to northwest, but clear, cold weather followed with the increasing pressure. High winds were reported on the coast, the maximum velocity at Eastport being NW. 35 miles, at Lewes NE. 34 miles.

No. V.—At midnight of the 17th the barometer was above the normal over the Plateau regions, from the Upper Mississippi valley to the coast of California. The crowding of the isothermal lines to the south indicated the advance of this area, which was apparently central near Yankton. During the 18th, the barometer continued to rise in the central valleys and in the Gulf states, while the central pressure increased and moved north to Minnesota. A "norther" occurred in the Western Gulf states, the temperature falling to freezing in northern Texas, and the wind reaching a velocity of 44 miles at Indianola. This area continued central near Fort Garry at the morning telegraphic report of the 19th, when the pressure was 30.86 and the temperature —30°. This was the most decided area of the high barometer during the month, and on the 19th all stations east of the Rocky Mountains were apparently within the limits of this disturbance. Northerly to westerly winds prevailed in all districts east of the 100th meridian and the temperature fell to 32° at stations in the northern portions of the Gulf and South Atlantic states. The barometric gradient increased in the western half of this area as the center moved toward the Atlantic coast, on the 19th and 20th, and severe northwesterly gales occurred at stations north of Cape Hatteras, the winds shifting to northeasterly on the North Carolina coast during the 19th. This area passed to the southeast over the Middle states on the 20th and was last observed as central over the Atlantic about 300 miles east of Norfolk.

No. VI.—Although this area has been indicated as central on the morning of the 21st in Indian Territory, the maps of normal barometric variation for the reports immediately preceding indicate that this area of increased pressure passed east from the Pacific coast over the Southern Plateau districts and New Mexico. During the 21st this area passed to the east over the Gulf states, following in the rear of low area No. XI, and disappearing to the southeast of Florida on the 22d.

No. VII.—This area, although well defined as to extent and movement, was only relatively high, its center being inclosed by an isobaric line of 30.10, while low areas of 29.50 were central in New England and Minnesota on the 23d. At the afternoon and midnight reports the center remained near Cairo, with northerly winds in the Eastern Gulf states, northwesterly winds in the Middle and South Atlantic states, west to nothwest winds in the Lower Lake region, southerly winds in the Northwest and Upper Lake region, and east to south winds in the Western Gulf states. The telegraphic reports indicate the anti-cyclonic movement of the wind, and the central pressure of 30.10 shows that this movement may occur when the central area is near or even below the normal pressure. The morning report of the 24th exhibits an extended area of high barometer on the Atlantic coast, covering all districts from Florida to the Saint Lawrence valley, and at the afternoon reports of the same day the western portion of this area was still observed on the South Atlantic coast.

No. VIII developed slowly in the southwest on the 28th, while an area of high barometer disappeared north of Minnesota, the depression traced as No. XIV apparently dividing the two areas of high barometer. On the 29th it moved eastward to the Mississippi valley and was central near Cairo at the close of the month. Rain prevailed in the Gulf states on the 29th, with cold northerly winds and a light "norther" in the Southwest.

Areas of low barometer.—Chart No. I exhibits the tracks of the centers of the areas of barometric depression as traced from the regular tri-daily reports. Of the fifteen areas traced, four, Nos. VII, IX, X, and XV, passed from the Pacific coast to the Atlantic near the northern boundary of the United States. No. II passed northeastward from the West Gulf, and all the others were first observed east of the Rocky Mountains and west of the Mississippi River.

No. I.—This area was partly described in January Review as No. XVIII, it having passed eastward from Montana to Lake Superior on the 31st, accompanied by light snow. On the morning of the 1st this depression was central near Montreal, and severe gales were reported from the Lake region, where the winds had shifted to westerly, with velocities ranging from 20 to 50 miles. This disturbance increased in severity in the south and west quadrants during the day as its center passed to the east of the coast, the barometric gradient between Portland and Burlington reaching two-tenths of an inch in one hundred miles at 3 p. m. of the 1st. Cautionary off-shore signals were ordered and fully justified at the stations on the coast from Cape Henry to Portland, and the cautionary signal at Eastport was justified by a velocity of 38 miles. The Signal Service observer at Albany, N. Y., reported on the 1st "a very high westerly wind, which increased to a gale at noon and reached its height at 12.45 p. m., having at that time a velocity of 53 miles per hour. Considerable damage is reported in this vicinity; trees were blown down, houses unroofed and several persons severely injured." The morning report of the 2d indicated that this depression had continued its easterly course over the Atlantic, followed by colder, clear weather and rapidly rising barometer.

No. II.—This storm is first located in the West Gulf, south of Galveston, at the 11 p. m. report of the 1st, and the previous reports from this region indicate that it developed south of latitude 25°. The center of this depression had passed northeastward to a point near New Orleans on the morning of the 2d, and the area of rain had extended eastward to the South Atlantic coast, with cold northerly winds, sleet and snow, in North Carolina, Tennessee, and the northern portion of the Gulf states. The temperature had fallen to 40° at Indianola, and the "norther" of the 1st continued with great severity. On the afternoon of the 2d the center was near Montgomery, with a well-defined elliptical area of 29.60, the longer axis pointing to the northeast in the direction of the storm's movement. During the eight hours preceding the p. m. report of the 2d the following heavy rainfalls were reported: at Mobile, 1.58 inches; Montgomery, 1.31 inches; New Orleans, 1.01 inches; Vicksburg, 1.07 inches; Pensacola, 1.06 inches. The barometer continued high in New England, with clear, cold weather and northerly winds during the 2d, as this depression advanced to the northeast, with falling barometer at the center, thus causing a rapid increase of the barometric gradient in the northeast quadrant. At midnight of the 2d the center had advanced to a point near Knoxville; the heavy rains had extended over the South Atlantic states, and snow was falling in Virginia, Maryland, Pennsylvania, and westward to the Ohio valley. The weather continued clear, with gentle winds or calms, on the New England coast, where the pressure was above 30.40, while the pressure at Knoxville was 29.46. As the center moved to southern Virginia during the morning of the 3d, the force of wind from the northeast increased on the Middle Atlantic and New England coasts, and the snow extended over New England, the Lake region and the Ohio valley. The barometer continued to fall at the center as this depression passed over New England, the afternoon report of the 3d giving the pressure of 29.08 at New London, 29.12 at New York, with a north wind maximum velocity 48 miles; Boston, NE. 60 miles; Thatcher's Island, SE. 88 miles. Snow continued in New England during the 3d, the wind shifted to the northwest, with rising barometer and clear and cold weather at night, as the depression disappeared to the northeast over Nova Scotia. Cautionary signals were displayed in advance of this storm on the Gulf and Atlantic coasts, and the following reports from the Signal Service observers have been received: The observer at Mobile reports, "weather during display of signal was decidedly threatening and the display was beneficial, as it prevented vessels from leaving port." The observer at Pensacola reports: "No vessels left port during display; signals fully justified; maximum velocity 40 miles per hour; no damage of any consequence occurred, as the masters of vessels were on the alert." The observer at Smithville, N. C. reports: "Cautionary signal fully justified; gale set in at 12.30 p. m. and increased until 6.45 p. m., when wind had reached a velocity of 32 miles, NE. The wind lulled at midnight and shifted to southwest with increasing velocity until it reached 32 miles at 3 a. m. Amount of rainfall during gale, 2.35 inches." Delaware Breakwater, on the 3d, "gale from the northeast 48 miles, wind shifting to southwest 58 miles." Observer at Sandy Hook reports this as the severest storm ever known at the station; wind at 7.45 a. m. reached a velocity of 84 miles from the east. The barometer stood at its lowest, 58.91, at 2 p. m. of the 3d. A number of wrecks occurred, and about two miles of the track of the Southern New Jersey Railroad, near Highlands, were washed away. The observer at Boston reports: "Heavy snow set in at 4.20 a. m. of the 3d, with puffs of brisk wind from the east-southeast, it having clouded very suddenly at 2 a. m. The barometer fell rapidly after midnight, being 30.40 at 1 a. m., 30.03 at 7 a. m., 29.70 at 10 a. m., 29.33 at 2 p. m., 29.12 at 4.15 p. m., 29.06 at 5.16 p. m. The wind rose rapidly soon after 5 a. m., and at 11.23 a. m. was E. 56 miles. Velocities taken at five minutes' intervals showed a greater speed, sometimes 66 miles, and the squalls and puffs which characterized the gale came in velocities of 60 to 90 miles. After 4 p. m. the wind backed gradually to the northeast and at 7 p. m. to northwest. At 6 p. m. the barometer began to rise; the snow ended at 10.15 p. m.; amount of precipitation 1.05 inches, or about 10 inches of snow." The observer at Portland reports: "Severe snow-storm commenced before daylight and continued until after midnight, accompanied by high winds from the northeast backing to north about 8 p. m." The gale commenced at Eastport about 1.20 of the 3d, and reached its maximum velocity of 54 miles NE. at 10.10 p. m. and ended at 3.25 a. m. on the 4th. During the display of the cautionary signal one steamer and twenty schooners remained in port." The following reports have been received from vessels near the Atlantic coast during this storm: Schooner Starlight, February 2 and 3, off Cape Fear, heavy gale from east veering to south and west; lost 10,000 feet of lumber off deck. Schooner Samuel Gilman, on February 3, off Fire Island, had terrific gale from east veering to northwest, lasting thirty hours and increasing to hurricane, with high sea; vessel hove to for nine hours and decks swept of everything." Brig Walter Smith, February 3, 38° 40′ N., 72° 56′ W., heavy gale from NE. to NW., increasing at 2 p. m. to hurricane; lost sail and had deck swept. Brig Texada, at Boston, February 6, from Mayaguez, was 8 days north of Hatteras with strong north gales and high seas, and February 3 took a heavy gale from NE., lasting 12 hours, with high seas. Brig Minnie Butler, February 3, in Boston Bay, ESE. gale, with thick snow-storm. Schooner Stephen Harding driven ashore two miles south of Sandy Hook; crew saved, but vessel probably a total loss. Brig Alice Tarlton, February 3, 37° N., 71° 30′ W., had a heavy gale from ESE. to WSW., veering to W., lasting 26 hours, with heavy sea and snow squalls.

No. III appeared as a slight depression in the Upper Missouri valley at midnight of the 3d, accompanied by snow and cold northerly winds in the region west of the upper Mississippi river and east of the Rocky Mountains. During the 4th the central area moved directly east, and at midnight it was near Lake Superior, the area of snow having extended eastward over the Upper Lake region and southward over Illinois, Iowa, and northern Missouri. Light snow fell in the Lower Lake region during the 5th, and in the northern portions of New England and the Middle states on the night of the 5th, as the area passed to the east with the pressure increasing at the center. The temperature fell to —30° at Pembina and to —31° at Fort Garry, when the wind shifted to the northwest on the 5th, and cold, clearing weather followed rapidly in the northeastern districts of the United States.

No. IV.—A well-marked depression in the Upper Missouri valley, which advanced rapidly in a southeastern direction to the northern portion of Iowa, where it was central on the morning of the 6th. The temperature continued below freezing in the regions north of the Gulf states at the a. m. report of the 6th, but increased rapidly in the Ohio valley and Middle states, as the depression moved over the Lake region, on the 6th. This area moved directly to the east after reaching the Lake region, accompanied by very light snow, and causing no marked disturbance, the barometric gradient being very slight and the barometer at the center only relatively low. The pressure continued to rise at the center as this area passed over the Atlantic east of New England, and by midnight it had disappeared to the east, followed by clear weather in all districts east of the Mississipi river.

No. V probably advanced from the Pacific coast, but its center was first approximately located north of Montana on the morning of the 7th. This depression moved over the northern districts of the United States during the 7th and 8th with an average hourly velocity of 60 miles, causing brisk to high winds in the Lake region on the 8th and on the Middle and East Atlantic coasts on the 9th. Unlike the depression which immediately preceded this, the pressure decreased at the center as it approached the coast. On the morning of the 8th the lowest isobaric line on the chart was 29.90, when the center was near Duluth, and on the morning of the 9th the isobaric line of 29.50 inclosed the center near Chatham. Cautionary signals were ordered for Grand Haven, Milwaukee, and Ludington, and cautionary off-shore signals were ordered at stations on the Atlantic coast between Lewes, Del., and Eastport, and were verified as follows: Milwaukee, 37 miles; Grand Haven, 28 miles; Breakwater, 40 miles; Sandy Hook and Thatcher's Island, 42 miles; Eastport, 36 miles. The area of precipitation extended from the Upper Mississippi valley to the New England coast, but only light snows prevailed, with partly cloudy weather.

No. VI.—Generally clear weather, continued during the 9th, with the pressure above the normal east of the Mississippi river, and winds slowly shifting to easterly and southerly in advance of this depression, which was central near Fort Shaw, in the Upper Missouri valley, at 11 p. m. on the 8th. By midnight of the 9th the lowest barometer readings were observed in Minnesota, and on the morning of the 10th this area was well defined in the Upper Lake region. The temperature increased during the 10th, and clear weather continued in the eastern districts, except in the northeastern portion of the United States, where light snows prevailed.

No. VII.—Reports from the Pacific coast on the 9th indicated the advance of a disturbance in the North Pacific, and on the morning of the 10th, easterly to southerly winds were reported from San Diego to Portland, with slowly falling barometer. At this report the center of the disturbance appeared to the west of Washington Territory, and at the p. m. telegraphic report of the same day it had moved to the east of

Portland. Rain continued on the coast and in the interior from Arizona to Idaho. Snow and cold threatening weather prevailed in the Rocky Mountain regions during the 10th as this depression advanced to the east, the temperature falling below freezing at stations in the interior of California and in the Plateau regions, after the center had passed to the east. On the morning of the 11th this area was central near Yankton, although the reports from the northern stations showed the barometer to be very low north of Minnesota. The direction of the winds as noted at the stations on the eastern slope of the Rocky Mountains, and the rapid fall of barometer at all stations in the Mississippi valley, including those in the Western Gulf states, indicate the advance of an extended trough of low barometer, which would probably include within its area all the districts east of the Rocky Mountains. The center moved eastward during the 11th, the rain area including all stations from the Gulf coast northward to Lake Superior, extending over the Lower Lake region by midnight and causing severe gales in the northern districts. At midnight of the 11th the barometer at Duluth read 28.96; at Marquette 28.88, and at Escanaba 28.95, the center of depression being apparently north of Lake Superior. Very heavy rains occurred in the northern portion of the Gulf states, Tennessee, and the Ohio valley, causing a rapid rise in the rivers of these districts. Violent westerly gales continued in the Lake region during the 12th, as the depression moved to the east-northeast over the Saint Lawrence valley and New England. A maximum velocity of 42 miles was reported at Milwaukee, and 26 miles at Grand Haven. Dangerous southerly winds veering to westerly occurred on the Middle and East Atlantic coasts on the night of the 12th.

No. VIII.—This area probably developed over the Southern Plateau region during the night of the 11th, when the barometer was below the normal in Colorado, New Mexico, Arizona, and Utah. Cold threatening weather and snow prevailed in these districts on the morning of the 12th, and the barometer continued to fall in the Southwest, with rain extending east over the Lower Mississippi valley and Tennessee. At the afternoon report of the 12th this depression was central near Fort Sill, and southerly gales prevailed on the West Gulf coast, the wind at Indianola reaching a velocity of 48 miles from the southwest. The midnight report of the 12th showed two depressions, one central near Nashville, where the barometer read 29.49, the other central immediately west of Little Rock, Ark. The storm continued during the night with great severity near the centers of the depressions, and the area of greatest rainfall extended northeastward from Texas over Arkansas, Tennessee, Kentucky, and the Ohio valley. A tornado occurred at Nashville about 11 p. m. on the 12th, accompanied by thunder and lightning and very heavy rain, and causing great destruction of property. A violent wind and thunder storm passed over the eastern portion of Lincoln County, Kentucky, late on the night of the 12th, blowing down numerous houses. At Louisville the wind averaged 42 miles per hour for several hours, blowing from the southwest, and the temperature fell 21° in six hours. The total rainfall at this station was 3.02 inches. At Frankfort the river rose at the rate of 1 foot per hour, flooding the lower portion of the city. On the 13th the Ohio river was reported rising at all stations from Pittsburgh to Cairo. The following heavy rainfalls occurred between the 11th and 13th; Austin, Tenn., 6.25 inches; Memphis, 6.14 inches; Nashville, 8.02 inches; Highlands, N. C., 3.15 inches. The Tennessee and Cumberland rivers rose rapidly, causing great loss to property. By the morning of the 13th this storm had extended over the Middle states, the lowest isobaric line being 29.60, inclosing the depression and extending from Little Rock to the eastern portion of Pennsylvania. The center was near Cincinnati on the afternoon of the 13th, where the two depressions united and afterward moved to the east as a single area, disappearing to the east of the Atlantic coast on the 14th, followed by decidedly colder and high northwest winds. A "norther" occurred in Texas immediately after this depression passed east of the Mississippi river.

No. IX.—This is the second storm of the month which approached Signal Service stations from the Pacific and crossed the mountain range to the Missouri valley, pursuing a well defined course over the districts in the eastern portion of the United States. The advance of this depression was indicated by a rapid fall in the barometer, accompanied by rain and snow on the night of the 13th in the North Pacific coast region. Rain and snow extended east and south on the 14th, and the wind veered to westerly at the northern stations on the Pacific coast. The midnight report from Humboldt, Battleford, and Edmonton on the 14th indicated the easterly movement of this depression, and cold northerly winds, with snow, prevailed from the stations named southward to the Missouri valley. During the 15th the storm passed north of the Lake region, causing only a slight disturbance within the limits of the Signal Service stations. Generally clear weather prevailed in all districts, except on the New England and Middle Atlantic coasts, where light snow prevailed, owing to the approach of a small depression which apparently developed over the Atlantic near the coast during the night of the 14th.

No. X.—The barometer fell rapidly on the Pacific coast during the 14th, as this depression advanced to the eastward, causing snow in Washington Territory and

Oregon on the morning of the 15th, when the barometer was lowest west of Olympia, the pressure at that station being 29.61. During the 15th cloudy weather and rain prevailed on the Pacific coast, except in southern California, and the area of snow extended eastward to the Upper Missouri valley. The barometer was below the normal in the districts on the eastern and western slopes of the Rocky Mountains, and by the morning of the 16th, the center had advanced to the western portion of Dakota, with slowly rising barometer on the Pacific coast, and continued snow in Montana Idaho, Utah, and Wyoming. At the afternoon of the 16th the barometer was 29.42, at Yankton, near the center of the disturbance, which had become well defined, with a decided gradient to the eastward as far as Michigan, and to the southward as far as Texas. Clear weather and rising temperature were reported from all districts east of the Rocky Mountain slope, while snow prevailed in the extreme Northwest, and in the Saskatchawan region of British America. The course of this storm changed to the northeast on the 16th, passing over Lake Superior, causing high south to west winds over the lakes, and followed by very light rain or snow as the wind shifted to westerly, with lower temperature, in the Upper Mississippi valley, and thence eastward over the Lake region. The cold northerly winds which followed this depression on the 16th were accompanied by rain in the central valleys and thence eastward to the Atlantic coast, the rain changing to snow and the weather clearing rapidly as the wind shifted. Cautionary signals were ordered at the Lake stations and on the Atlantic coast north of Wilmington, in advance of this storm. The following dangerous winds were reported: Milwaukee, maximum velocity, 42 miles; Grand Haven, 38 miles; Breakwater, Del., 42 miles; Sandy Hook, 44 miles; Boston, 36 miles; Eastport, 32 miles. Westerly gales were reported at Montreal and Quebec on the morning of the 19th, when the center of depression was northeast of Chatham, and the storm continued over Newfoundland during the 20th.

No. XI first appeared in the western portion of Dakota on the afternoon of the 19th, and advanced directly to the east during the 19th and 20th, causing light snow in the Lake region, the Ohio valley, and thence eastward over the Middle and New England states. The pressure at the center of this depression decreased from 29.90 to 29.50 in the transit from the Northwest to the New England coast. High winds occurred in the Lake region on the 21st, when the storm passed to the east, and southerly gales were reported off the coast of Nova Scotia in advance of its center.

No. XII.—This slight disturbance followed rapidly in rear of the preceding, between the 21st and 23d, first appearing on the afternoon of the 21st in British America north of Dakota. On the 22d the movement to the southeastward over the Lake region was accompanied by very light snow, but as the center passed over New England the gradient to the west increased rapidly owing to the advance of high area No. VII, and the winds became dangerous after shifting to the northwest on the Middle Atlantic coast. This storm moved directly east over the Atlantic on the 24th, and probably increased in severity, as the barometer continued to fall at the center while within the limits of observation.

No. XIII.—This area has been traced westward to the Rocky Mountains, and it probably passed from the Pacific north of Washington Territory. Vessels report stormy weather on the North Pacific during the 21st and 22d. From the morning of the 23d to the afternoon of the 24th this depression moved southeastward to the Upper Mississippi valley, attended by decidedly stormy weather throughout the Northwest and Lake region. The rain area extended southward to Tennessee and Texas, and as the center passed over the Lakes, light rains occurred in the Middle and New England states. The winds increased in force as the center advanced. On the morning of the 25th the weather was threatening on the Atlantic coast, but the afternoon report showed a change of direction in the movement, and the succeeding report showed that this area was moving from Lake Superior northeastward north of the Canadian stations.

No. XIV.—The barometer continued below the normal in the Lower Missouri valley during the 25th and 26th, while cold northerly winds and snow prevailed in the northern portion of the United States west of Lake Superior. This depression remained almost stationary until the 27th, when it moved eastward as a severe storm, the winds being strongest on the west side, where the gradient was very great. Snow prevailed in the Northwest and in the northern portion of the Lake region on the 28th, and rain fell at all stations, except those in the South Atlantic States. After reaching the southern portion of Michigan on the 28th, the center was retarded, and then moved slightly to the west between the morning and afternoon reports, after which the movement was rapidly toward the northeast, attended by violent winds from the south and west in the Lake region and on the coast north of North Carolina. A severe "norther" occurred in Texas on the 28th, and the center of this storm was near Alpena. Maximum velocity of wind reported at Grand Haven was 48 miles southwest; at Milwaukee, 47 miles west; at Indianola, 54 miles north.

No. XV.—This depression was central off the North Pacific coast at the midnight report of the 28th, when south to east winds, rain, and snow prevailed in Oregon and

Washington Territory. The barometer at Olympia fell from 30.16 to 29.75 in 8 hours, and at the morning report it had risen to 29.80, indicating that the center of this depression had passed to the north or east of that station. The midnight report of the 29th indicated the continued advance of this depression to the east.

INTERNATIONAL METEOROLOGY.

Accompanying the present review will be found three international charts, Nos. IV, V, and VI, representing the meteorological conditions over the Northern Hemisphere and portions of the Southern Hemisphere.

No. IV indicates the probable course of the principal storm areas over the Atlantic ocean during the month of January, 1880, which have been traced from observations made on board about 110 vessels, and which have been collected from various sources or received directly at this office, up to March 5th, 1880. The following is a short description of these areas and of the meteorological conditions existing over the northern portion of the north Atlantic ocean during January, 1880. On the first of the month the area (No. 1) of low pressure passed northeastward to the north of Scotland. This area was the same as described in the review for December, as low area No. XIX, and was encountered on December 31st by S. S. Leipzig in about 47° N. 37° W. (barometer 29.20 inches, or 741.7 mm.) This vessel reports "at 1.30 p. m. a sudden calm, and fifteen minutes later wind NNE., at first in heavy squalls, increasing to hurricane violence, with rapidly increasing northerly sea and heavy hail and snow squalls; towards evening wind and sea decreased, and at 8 p. m. the barometer read 30.22" or 767.6. S.S. Indiana reports December 31st, 48° N. 44° W., barometer 29.38 or 746.3, wind NNW., force 9, hard rain. In the Orkneys a gale from the SW. set in on the night of the 1st, changing on the 2d to W., with heavy snow. Low area No. II passed rapidly southeastward from the neighborhood of Hudson's Bay to Cape Sable during the 31st of December and was described as area No. XX in the review for the month. On January 1st it passed eastward south of Nova Scotia, where it was encountered by S. S. Hibernian in 45° N. 58° W., which vessel reported "fresh SE. gale, with heavy snow, latter part wind NNE., barometer 29.19 or 741.4. On the 2d it passed to the north of parallel 50° N., and was quickly followed by area No. III (No. II of the January Review, which passed over Newfoundland on the night of the 3d, and on the 4th curved to the northeast. This area was, in its turn, quickly followed by No. IV (No. III of the January Review), which passed eastward over Nova Scotia on the early morning of the 5th, and on the 6th was encountered by S. S Algeria in 48° N. 32° W., which vessel reported barometer 29.33 or 745.0, with "wind shifting in a heavy squall from south to west by south." On the 7th this area also curved to the northwards about the 30th meridian, and on the 8th, higher pressures, with diminishing westerly gales, prevailed over the western Atlantic, terminating a period of exceedingly stormy weather over this region, which set in about the 21st of December. Stormy weather, with heavy seas, continued over a small area during the 9th, 10th, and 11th, about 50° N. and 20° to 30° W.; bark Water Lily encountered a "whirlwind" on the 9th about 60 miles south of the Bermudas, and on the night of the 11th heavy rains, resulting in disastrous floods, occurred at the island of St. Kitts, W. I., but elsewhere over the Atlantic only occasional gales were reported during these days. On the 12th, low area No. V (No. VII of the January review) moved off the coast of the United States, and on the 13th passed northeastward between the Bermudas and Nova Scotia, apparently increasing somewhat in energy; on the 14th it moved eastward south of Nova Scotia, and from the 16th to 17th eastward along the fortieth parallel, increasing in extent, and with easterly to northerly winds over the Atlantic near the parallel of 50° N. S. S. Ohio sailed from Bremerhaven on the 11th, barometer 30.73 or 780.4, and had constantly falling pressure, with easterly or southerly winds until the 17th, when in 39° N. 25° W. the barometer read 29.80 or 756.9, wind SSW. On the 18th, in 37° N. 28° W. the wind, as reported by the Ohio, veered to the W., force 6, and the barometer fell to 29.65; on the 19th, same vessel, in 35° N. 32° W., at 7.35 a. m., Washington mean time, the pressure had fallen to 29.57 or 751.0, and the wind had veered to NW., force 8. Reports have not yet been received from the Azores, but at Funchal, Maderia Islands, the pressure fell rapidly, with southerly winds, from the 16th to the 19th, when it reached 29.67 or 753.6; southerly winds and low but slowly rising pressure prevailed at this station until the 23d, when the wind changed to N., with rising barometer. S. S. Hibernian sailing from 51° N. 35° W., on the 19th, to 52° N. 6° W., on the 24th had continued easterly winds, varying in strength from force 4 to 7; the pressure on this vessel was about 29.85 or 758.1 from the 19th to the 21st in 52° N. 25° W., after which it rose. On the 18th, area No. VI was central between the coast of the United States and the Bermudas; on the 19th it moved northward as a somewhat severe storm, being encountered by S. S. Leipzig in 40° N. 61° W., and by S. S. Caspian in 41° N. 67° W., the former vessel reporting SW. winds, force 7, and the latter NNE., force 5. During the night of the 19th this storm passed northward over Newfoundland. No. VII is a continuation of area No. XI of the January Review; it probably moved eastward during the 23d and 24th, attended by cloudy and rainy weather, and followed by northwesterly gales. S. S. Nederland reported low pressures and stormy winds on the 28th in 50° N. 22° W., and on the 30th in 47° N. 31° W., and the S. S. Sarmatian, on the 29th, in 48° N. 43° W., had barometer 28.89 or 733.8 mm., with WSW. wind, force 8, rain and very heavy sea, but reports as yet to hand are not sufficiently numerous to allow the tracks of these storms to be charted.

On this chart will also be found a short track over the Pacific Ocean showing the position of a cyclone encountered on the 28th of November, 1879, by the U. S. S. Ranger. The following are the positions of the vessel on three days (Greenwich dates), the 27th and 29th being from observation and the 28th by dead reckoning:—27th, in 39° 38′ N. 175° 50′ E; 28th, 38° 33′ N. 176° 38′ E; 29th, 38° 17′ N. 177° 32′ E. Below is a table of hourly observations from midnight of the 27th to 10 p. m. of the 29th, with the ship's compass course and speed, as copied from the log and from an interesting report of the storm furnished this office by Lieut. W. P. Randall, U. S. N., executive officer, U. S. S. Ranger:

Date.	Hours.	Knots.	Courses steered.	Winds.		Leeway.	Barometer.		Temperature.			Weather by symbols.	Clouds by symbols.	Clear sky in 10ths.	State of sea.
				Direction.	Force.		Height in inches.	Thermometer attached.	Air, dry bulb.	Air, wet bulb.	Water at surface.				
27th	Mid	4.0	N.	ENE.	4, 5	½	29.92	70	58	57	59	bc.	Cir. Cum.	3	S.
28th	1 a. m	1.8	SE.	E. x N.	4, 5	½	29.88	71	60	58	59	o. c.	Cum. Nim.	0	M.
	2 a. m	5.2	SE. ¾ S.	ENE.	6	½	29.85	69	60	58	59	ocd.	Cum. Nim.	0	M.
	3 a. m	6.0	SE. ½ S.	ENE.	6	½	29.82	69	59	57	59	ocd.	Cum. Nim.	0	M.
	4 a. m	5.6	SE. ¼ S.	NE. x E.	6	½	29.79	69	59	57	59	ocd.	Cum. Nim.	0	M.
	5 a. m	5.6	SE. ¾ S.	ENE.	6, 7	1	29.75	66	59	57	59	ocq.	Cum. Nim.	0	M.
	6 a. m	5.8	SE. x S.	E. x N.	6, 5	1	29.73	66	59	57	59	ocq.	Cum. Nim.	0	M.
	7 a. m	6.0	SE. x S.	E. x N.	6	1	29.70	69	60	58	59	oc.	Cum. Nim.	0	M.
	8 a. m	6.4	SSE. ½ E.	E. x N.	6	1	29.71	71	60	58	59	oc.	Cum. Nim,	0	M.
	9 a. m	5.5	SE. ½ S.	E. x N.	6	1	29.70	72	61	59	59	oc.	Cum. Nim.	0	M.
	10 a. m	4.6	SSE. ½ E.	E. x N.	6	1	29.65	70	61	60	59	op.	Cum. Nim.	0	M.
	11 a. m	4.0	SSE. ½ E.	E. x N.	6	1	29.50	68	62	61	59	od.	Cum, Nim.	0	M.
	Noon	3.5	SSE.	E. x N.	6	1	29.47	68	61	61	59	od.	Cum. Nim.	0	M.
	1 p. m	3.0	NW.	E.	5	1	29.44	69	63	62	60	ocqr.	Nim.	0	R.
	2 p. m	2.0	N. ¾ E.	E.	5	2	29.38	68	62	61	60	ocqr.	Nim.	0	R.
	3 p. m	1.8	N. x E.	E.	4, 5	2	29.33	67	62	61	60	ocqr.	Nim.	0	R.
	4 p. m	2.0	NNE.	ESE.	4, 5	2	29.29	66	62	61	60	ocqr.	Nim.	0	R.
	5 p. m	2.5	NE. x E.	E.	3, 4	2	29.20	68	63	61	60	ocqr.	Nim.	0	L.
	6 p. m	2.0	NE.	E.	3, 4	1	29.14	68	63	61	60	ocqr.	Nim.	0	L.
	7 p. m	3.2	N. x E. ½ E.	ESE.	4	½	29.10	68	64	63	60	op.	Nim.	0	L.
	8 p. m	3.6	NE. x E.	SE. x S.	4	½	29.01	69	65	64	60	op.	Nim.	0	L.
	9 p. m	4.4	E.	S.	5, 6	½	28.84	69	66	65	60	opq.	Cum. Nim.	0	R.
	10 p. m	4.0	E.	S. x W.	5, 7	1	28.72	69	64	64	60	opq.	Cum. Nim.	0	R.
	11 p. m	2.5	SE. x E.	SW.	5, 7	1	28.70	66	64	64	60	ocqp.	Cum. Nim.	0	R.
	Mid	3.8	SE. x E. ½ E.	WSW.	6, 8	1	28.63	68	64	64	60	ocqp.	Cum. Nim.	0	R.
29th	1 a. m	3.4	ESE.	WSW.	6, 9	3	28.66	63	60	57	60	ocqp.	Cum. Nim.	0	R.
	2 a. m	3.0	S. ½ W.	W. x S.	9, 11	8	28.75	62	59	57	60	ocqr.	Cum. Nim.	0	R.
	3 a. m	3.0	S. ½ W.	W. x S.	9, 11	8	28.85	62	58	56	60	ocqr.	Cum. Nim.	0	R.
	4 a. m	3.0	S. ½ W.	W. x S.	10, 9	8	29.05	60	58	57	60	ocqp.	Cum. Nim.	0	R.
	5 a. m	2.5	S. x W.	W. x S.	9	7	29.12	62	58	57	60	bcq.	Cum. Nim.	0	H.
	6 a. m	2.5	S. x W.	W. x S.	9	6	29.20	63	58	57	60	bcq.	Cum. Nim.	0	H.
	7 a. m	2.5	S. x W.	W. x S.	9	6	29.30	63	58	57	60	bcq.	Cum. Nim.	0	H.
	8 a. m	2.0	S. x W.	W. x S.	9	6	29.38	63	58	57	60	bcq.	Cum. Nim.	0	H.
	9 a. m	2.0	SSW.	W. x N.	6, 9	4	29.44	64	58	57	60	bcqp.	Nim.	0	H.
	10 a. m	2.0	SSW.	W. x N.	6, 8	4	29.56	64	57	56	60	bcqp.	Nim.	0	H.
	11 a. m	2.0	SSW.	W. x N.	6, 8	4	29.63	61	57	56	60	bcqp.	Nim.	0	H.
	Noon	2.0	SSW.	W. x N.	8, 10	4	29.62	59	56	55	60	ocqr.	Nim.	0	H.
	1 p. m	2.0	SSW.	W. x N.	8, 10	5	29.61	59	56	54	60	ocqr.	Nim.	0	H.

Date.	Hours.	Knots.	Courses steered.	Winds.		Leeway.	Barometer.		Temperature.			Weather by symbols.	Clouds by symbols.	Clear sky in 10ths.	State of sea.
				Direction.	Force.		Height in inches.	Thermometer attached.	Air, dry bulb.	Air, wet bulb.	Water at surface.				
29th	2 p. m	2.0	SSW.	W. x N.	8, 10	5	29.65	60	56	53	60	ocqr.	Nim.	0	H.
	3 p. m	2.0	SSW.	W. x N.	8, 10	5	29.72	60	56	53	60	boq.	Nim.	3	H.
	4 p. m	2.0	SSW.	WNW.	8, 10	5	29.72	60	55	53	60	boq.	Nim.	5	H.
	5 p. m	2.0	SW. x S.	WNW.	8, 10	6	29.74	59	54	52	59	boq.	Cum.	8	H.
	6 p. m	2.0	SW. x S.	WNW.	8, 10	6	29.78	63	53	51	59	boq.	Cum.	8	H.
	7 p. m	2.0	SW. x W.	WNW.	7, 8	3	29.78	65	54	51	59	boq.	Cum.	6	H.
	8 p. m	2.0	SW. x W.	WNW.	8, 9	3	29.84	63	54	51	59	boq.	Cum.	6	H.
	9 p. m	2.4	SW.	WNW.	7, 9	4	29.87	63	53	50	59	boq.	Cir. Cum. Nim.	4	H.
	10 p. m	2.2	SW.	W. x N.	6, 9	5	29.92	58	52	50	59	bcpq.	Cir. Cum. Nim.	3	H.

It is remarked that the easterly winds, in advance of the centre of cyclone, were only fresh to strong breezes except heavy squalls (force 7) at 5 a.m., and that as the wind veered to southwesterly it increased to a heavy gale, with very heavy seas, during which the decks were swept and considerable damage done to the vessel. S. S. Lackawanna, at 7.35 a. m., Washington mean time, of the 29th, was in 34° 38′ N. 160° 12′ E., and reported barometer 29.65 (aneroid), wind WSW., force 5–6, cloudy, and long sea swell from the WSW.

Chart No. V shows, by isobaric and isothermal lines, the mean pressure and temperature for the month of July, 1878, at 7.35 a. m., Washington mean time, as deduced from the International Simultaneous Observations. The barometer observations have been corrected for temperature and reduced to sea level. For stations lying outside the area included within the lines and for those in the Southern Hemisphere, the means are shown by figures, indicating the temperature in degrees Fahr., and the pressure in English inches. The paucity of observations over the Pacific Ocean is to be regretted, but it has been thought better to draw a few lines, indicating the means of observations received, than to leave the space blank. If these means are considered as fair approximations to the monthly means, the area of highest pressure over the Northern Hemisphere, for this month, will be found covering the greater part of the eastern half of the north Pacific Ocean; the maximum readings (about 30.50 inches, or 774.7 m. m.) occurring in the ten degree square, bounded by the parallels 30° and 40° N., and meridians of 140° and 150° W. The prevailing winds over this region show a decided circulation around this centre of elevation, being northwesterly off the American coast: northeasterly, brisk to high, along the 25th parallel westward to the Honolulu Islands, and southerly from the northwestern margin of this high pressure area to Behring Sea. The second area of maximum pressure is found over the north Atlantic Ocean, central to the southwest of the Azores, the means at Ponta Delgada and Angra, being respectively, 30.32, or 770.1, and 30.31, or 769.9. The low area over the north Atlantic, having continued its journey northward, is central to the north of the extreme stations, viz: Godthaab and Stykkisholm, where the prevailing winds are southerly. An interesting feature of the distribution of the atmospheric pressure over the north Atlantic during the four months, April, May, June, and July, is found in the gradual northward motion of the high and low pressure areas, until the centre of the high pressure of July is found to occupy nearly the same geographical position as the centre of the low area of April. Over western Europe and Asia, excepting the east and south portions of Hindostan, the mean pressure is decidedly lower than during the preceding month of June, with an easterly motion of the central depression. The area of low, which during the month of June occupied the central northern portion of Hindostan, moved to the eastward, and during July is found over the Province of Scinde, the mean for the latter month exceeding that of the former at all the India stations except Agra, Bombay, Deesa, and Kurrachee. The west monsoons and heavy rains which set in along the Bombay coast during June increased throughout July, the rainfalls at the stations of Bombay and Poona, for these months, being, respectively, for June, 19.82 and 1.94 inches, and July, 48.24 and 10.53 inches. Along the Bengal coast the southerly monsoons continued to blow throughout the month, while in the upper valley of the Ganges, the Northwestern Provinces, the northwesterly winds of June gave way to the easterly winds of July. Over Siberia and Russia the lowest pressures are found at Kasan and Ekaterinburg, around which stations a decidedly circular motion of the winds is observable.

On chart No. VI are traced the paths of the principal storm areas which traversed the Northern Hemisphere during the month of July, 1878. The general distribution of these tracks agrees with the areas of mean low pressure shown on chart No. V, while their general direction is easterly, inclining towards the northeast over the oceans and towards the southeast over the land areas. The tracks over the Behring Sea region and Alaska are based upon tri-daily observations at Saint Michael's and Saint Paul's Island, and are probably nearly correct, while the succession of meteorological changes occurring at these stations and at those in Washington Territory, and York Factory, B. A., indicate a connection between some of these areas and those moving eastward over British America.

TEMPERATURE OF THE AIR.

The general distribution of temperature for Feburary, 1880, is shown by the isothermal lines on chart No. II. As in the preceding month, the temperature continued above the normal in all districts east of the 100th meridian, and many reports show that it has been the warmest February which has occurred in many years in the eastern districts of the United States. The temperature has fallen at the Rocky Mountain stations and in the districts on the Pacific coast, where it has ranged from 2° to 6° below the normal. An excess of 6°.5 is reported in the Lower Lake region and 6°.2 in the Middle states. In the western portion of the continent, especially in the northern districts, the temperature has been unusually low. The table of comparative temperatures for the several districts is printed on the right side of chart No. II.

The following notes are of interest as indicating the unusually high temperatures of the month in various sections: Houston, Ala., mildest winter for many years, the present month unusually warm. Sandy Springs, Md., month exceptionally warm. Waltham, Mass., mean temperature of the month 5° above the average. Westborough, Mass., remarkably mild month. Fall River, Mass., month unusually warm, no frost in ground. Litchfield, Mich., month very warm, frost entirely out of ground. Brookhaven, Miss., month unusually warm. Grafton, N. H., from the 10th to 29th, month unusually warm, five heavy thaws occurring during that period. Palermo, N. Y., warmest February in past 12 years. Cleveland, Ohio, warmest February in past 25 years, excepting 1857. Snowville, Va., month very warm and dry.

Minimum temperatures.—Maine: —15° at *Orono and —12° at Eastport. *New Hampshire:* —27° on summit of Mount Washington and —21° at * Dunbarton. *Vermont:* —22° at * Strafford and —12° at Burlington. *Massachusetts:* —20° at * Billerica, —5° at Boston and —6° at Springfield. *Rhode Island:* 2° at Newport. *Connecticut:* 2° at New Haven and New London. *New York:* —20° at * Schroon Lake, 1° at Buffalo, 2° at Oswego, —7° at * Ithaca, —10 at Albany, and 10° at New York City. *Pennsylvania:* —12° at * Wellsborough, 2° at * Catawissa, 10° at Pittsburgh and 12° at Philadelphia. *Delaware:* 18° at * Dover. *Maryland:* 0° at * Cumberland, 11° at * Woodstock, * Fallston, *Owing's Mills and *Sandy Springs, and 15° at Baltimore. *District of Columbia:* 14° at Washington. *Virginia:* —1° at * Mount Solon, 18° at Lynchburg, and 22° at Norfolk. *West Virginia:* —6° at * Helvetia and 3° at Morgantown. *North Carolina:* 15° at * Franklin and *Highlands, 30° at Wilmington, and 33° at Cape Lookout. *South Carolina:* 36° at Charleston, and 31° at *Aiken. *Georgia:* 25° at *Gainesville, and 31° at Atlanta, * Forsyth, and * Thomasville. *Florida:* 34° at * Houston, 36° at Pensacola, 52° at Punta Rassa, and 64° at Key West. *Alabama:* 28° at *Green Springs and 34° at Mobile. *Mississippi:* 27° at * Fayette and 31° at Vicksburg. *Louisiana:* 22° at * Okalooska, 29° at Shreveport, and 43° at New Orleans. *Texas:* 1° at Fort Elliott, 10° at Pilot Point, 19° at Fort McKavett, 24° at Stockton, and 37° at Edinburg and Brownsville. *Ohio:* 3° at * Bellefontaine, 19° at Cincinnati and 11° at Columbus, Cleveland, and Toledo. *Kentucky:* 12° at *Bowling Green and 22° at Louisville. *Tennessee:* 7° at *Austin, 11° at Nashville, 25° at Memphis, and 28° at Chattanooga. *Arkansas:* 16° at * Mount Ida and 32° at Little Rock. *Michigan:* —12° at Escanaba, —8° at Alpena and Marquette, 6° at Port Huron, 8° at Grand Haven, and 11° at Detroit and * Lansing. *Indiana:* 7° at * New Corydon, 11° at Fort Wayne, 14° at Indianapolis, and 18° at * New Harmony. *Illinois:* —2° at * Geneseo and * Riley, 12° at Chicago, 13° at Springfield, and 22° at Cairo. *Missouri:* 2° at * Corning and * Oregon, 7° at * Kansas City, and 14° at Saint Louis. *Kansas:* —4° at Dodge City, —3° at Fort Leavenworth, 4° at *Manhattan, and 8° at Lawrence. *Wisconsin:* —20° at * Embarrass, —19° at * Neillsville, —5° at La Crosse, and 0° at Madison. *Iowa:* —12° at * Cresco and * Nora Springs, —6° at * Glenwood, 1° at Des Moines, 2° at Dubuque, and 9° at Keokuk. *Nebraska:* —23° at *Fort Sidney, —8° at North Platte and *Fort McPherson, and 0° at Omaha. *Indian Territory:* 15° at Fort Gibson and 17° at Fort Sill. *Minnesota:* —28° at * Breckinridge, —22° at Duluth, and —18° at Saint Paul. *Dakota:* —35° at Pembina, —23° at Deadwood, and —14° at * Morriston. *Colorado:* —17° at * Fort Collins, —16° at * Hermosa, and —8° at Denver. *New Mexico:* —3° at Santa Fé, 9° at Socorro, 17° at La Mesilla. *Wyoming:* —28° at * Fort Fred Steele and —10° at Cheyenne. *Utah:* —19° at *Coalville and 3° at Salt Lake City. *Nevada:* —26° at * Boca, and 5° at Winnemucca and * Carson City. *Arizona:* —11° at Prescott, —9° at Apache, and 25° at Yuma and Phœnix. *Idaho:* —13° at *Fort Hall and 11° at Boise City. *Montana:* —28° at Virginia City. *California:* 18° at Campo, 24° at Visalia, 27° at Red Bluff, 35° at San Diego, and 38° at San Francisco. *Oregon:* 14° at Umatilla, 20° at Roseburg, and 26° at Portland. *Washington Territory:* 25° at Olympia.

Maximum temperatures.—Maine: 58° at Portland and 45° at Eastport. *New Hampshire:* 56° at * Grafton and 40° on summit of Mount Washington. *Vermont:* 56° at *Charlotte and 73° at Burlington. *Massachusetts:* 66° at * Somerest, 64° at Boston, and 62° at Springfield. *Rhode Island:* 56° at Newport. *Connecticut:* 65° at New Haven and 62° at New London. *New York:* 66° at * Schroon Lake, 65° at New York City, 57° at Buffalo, 61° at * Ithaca, and 58° at Albany. *Pennsylvania:* 72° at Pittsburg, 69° at *Catawissa, and 67° at Philadelphia. *Delaware:* 70° at * Dover. *Maryland:* 68° at * Woodstock and * Cumberland, and 67° at Baltimore. *District of Columbia:* 70° at Washington. *Virginia:* 80° at * Johnsontown, 78° at Norfolk, and 70° at Lynchburg. *West Virginia:* 71° at Morgantown and 68° *Helvetia. *North Carolina:* 81° at Wilmington and * Weldon, 67° at Cape Lookout, and 65° at *Highlands. *South Carolina:* 78° at *Aiken and Charleston. *Georgia:* 82° at * Thomasville, 81° at Augusta, and 80° at Savannah. *Florida:* 90° at * Houston, 83° at Key West, 81° at Jacksonville, and 79° at Punta Rassa. *Alabama:* 79° at *Green Springs and 77° at Mobile. *Mississippi:* 82° at Vicksburg and 79° at *Brookhaven. *Louisiana:* 83° at *Okalooska, 78° at Shreveport, and 77° at New Orleans. *Texas:* 91° at Rio Grande, 87° at Concho and Castroville, 82° at Stockton, 78° at Fort Elliott, and 76° at Denison and Henrietta. *Ohio:* 69° at Bellefontaine and * Wooster, 67° at Cincinnati, and 64° at Toledo. *Kentucky:* 69° at Bowling Green and Louisville. *Tennessee:* 78° at Knoxville and 74° at Memphis, *McMinnville, and Chattanooga. *Arkansas:* 75° at Little Rock and 72° at *Mount Ida. *Michigan:* 66° at * Niles, 64° at * Lansing, 60° at Detroit, 58° at Alpena and Grand Haven, 50° at Marquette, and 40° at Escanaba. *Indiana:* 69° at * New Corydon and * Logansport, and 65° at Indianapolis, * Spiceland, and *New Harmony. *Illinois:* 73° at *Anna, 68° at Cairo, 67° at Springfield, and 63° at Chicago. *Missouri:* 72° at *Frankford and * Pierce City, and 71° at Kansas City and Saint Louis. *Kansas:* 77° at * Independence, 71° at * Yates Center, 70° at Dodge City, and 67° at Leavenworth. *Wisconsin:* 58° at * Beloit, 56° at La Crosse, 55° at Madison, and 40° at * Embarrass. *Iowa:* 68° at Des Moines, 67° at Keokuk, 60° at *Glenwood, and 59° at Dubuque. *Nebraska:* 68° at * Fort McPherson, and 66° at * Fort Sidney, North Platte, and Omaha. *Indian Territory:* 79° at Fort Sill and 75° at Fort Gibson. *Minnesota:* 59° at Saint Paul, 62° at Duluth, and 49° at Breckinridge. *Dakota:* 70° at * Morriston, 50° at Deadwood, and 36° at Pembina. *Colorado:* 60° at * Fort Collins, 59° at Denver, and 48° at * Hermosa. *New Mexico:* 74° at La Mesilla, 66° at Socorro, and 51° at Santa Fé. *Wyoming:* 59° at Cheyenne and 52° at * Fort Fred Steele. *Utah:* 45° at Salt Lake City and *Coalville. *Nevada:* 53° at Carson City and 50° at Winnemucca. *Arizona:* 77° at Tucson, 73° at Yuma, and 56° at Prescott. *Idaho:* 55° at Fort Hall and 53° at Boise City. *Montana:* 40° at Virginia City. *California:* 70° at Los Angeles, 69° at Red Bluff, 64° at Sacramento and Visalia, 63° at San Diego and Campo, and 62° at San Francisco. *Oregon:* 53° at Umatilla, 52° at Portland, and 51° at Roseburg. *Washington Territory:* 49* at Olympia.

Ranges of temperatures at Signal Service stations.—The monthly ranges will appear from an examination of the maxima and minima just given. The greatest daily ranges vary in New England from 32° at Thatcher's Island, 35° at New Haven and Newport to 46° on the summit of Mount Washington. Middle Atlantic states, 24° at Baltimore, Philadelphia, and Sandy Hook to 36° at Albany and Norfolk. South Atlantic states, 21° at Cape Lookout, 25° at Jacksonville, Charleston, and Atlanta to 32° at Augusta. Eastern Gulf states, 11° at Key West, 19° at New Orleans, 25° at Cedar Keys to 27° at Montgomery. Western Gulf states, 23° at Galveston, 29° at Vicksburg, 31° at Little Rock to 41° at Corsicana. Ohio valley and Tennessee, 26° at Cincinnati and Cairo, 31° at Chattanooga, 35° at Pittsburg to 37° at Morgantown. Lower Lake region, 31° at Oswego, Erie, and Toledo to 37° at Rochester. Upper Lake region, 25° at Chicago, 32° at Marquette, 38° at Duluth to 42° at Alpena. Upper Mississippi valley, 26° at Dubuque, 36° at Saint Paul, 38° at Saint Louis to 46° at Keokuk. Red River of the North valley, 45° at Pembina to 47° at Breckenridge. Missouri valley, 32° at Omaha, 44° at Leavenworth to 51° at North Platte. Texas, 33° at Eagle Pass, 45° at Fredericksburg, 41° at Stockton, 40° at Rio Grande City to 64° at Fort Elliott. Eastern Rocky Mountain slope, 37° at Fort Gibson, 40° at Dodge City to 44° at Fort Sill. Rocky Mountains, 35° at Cheyenne, 40° at Denver to 43° at Santa Fé. Middle Plateau, 25° at Salt Lake City to 36° at Winnemucca. California, 21° at San Francisco, 28° at Sacramento, 30° at Red Bluff to 34° at Los Angeles.

Frost was reported very generally from all States and Territories north of the thirty-seventh parallel. In Florida on the 4th and 16th, and in the remaining states of the Eastern Gulf, 3d, 4th, 6th, 7th, 9th, 10th, 14th, 15th, 16th, 22d. Western Gulf states, 1st to 6th, 13th, 14th, 15th, 16th, 18th, 19th, 28th, 29th. At Henrietta, Tex., on the 28th peach blossoms reported killed by frost. Indian Territory, 1st, 4th, 5th, 6th, 7th, 9th, 14th, 21st, 23d. California, 1st to 4th, 6th to 20th, 28th and 29th.

Ice was reported generally throughout the northern sections of the country, as will be seen by reference to the chapter on navigation. In North Carolina it formed on the 4th, 5th, 7th, 8th, 16th, 20th 21st. Tennessee, 2d, 4th, 5th, 6th, 7th, 15th, 19th, 20th; Memphis, 3d, Gayoso Bayou frozen over. Texas, 4th, 5th, 6th, 7th, 19th, 28th, 29th. California, San Francisco, 11th, 16th, 17th, 19th, 20th.

Ground frozen.—San Francisco, 16th; Pilot Point, Tex., 28th, ¼ inch; Cairo, Ill., 29th; Melissa, Tex., 4th, 5th, 6th, 7th, 28th, 29th.

PRECIPITATION.

The general distribution of the rainfall, including melted snow, for the month, is illustrated upon chart No. III, as accurately as possible from about 500 reports. This chart shows the area of maximum precipitation over Western Tennessee, and areas of minimum precipitation over the eastern slope of the Rocky Mountains and the Red River of the North valley. In the left-hand corner of the same chart will be found a table of average rainfalls for the month of February, which shows large excesses for the present month over the region of heaviest rainfall and in the Saint Lawrence valley. An excess of about one inch is also found in the Lake region and Florida. In the Middle and South Atlantic and Eastern Gulf states and to the west of the Mississippi valley deficiencies occur, which are found to be largest on the Pacific coast.

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[1] Those marked with a star (*) are reported by voluntary observers or U. S. Army post surgeons.

Special heavy rains.—1st, New Ulm, Tex., 2.06 inches; San Antonio, Tex., 2.05 inches. 1st and 2d, Mesquite, Tex., 5.00 inches; Melissa, Tex., 2.90 inches; Brookhaven, Miss., 2.50 inches; Shreveport, La., 3.30 inches; White Plains, N. Y., 3.85 inches; Fort Barrancas, Fla., 2.61 inches. 2d, Mobile, 2.80 inches. 2d and 3d, Cape Lookout, N. C., 2.91 inches. 3d, Penn Yan, N. Y., 2.86 inches. 9th, Mayport, Fla., 3.11 inches. 11th to 13th, Austin, Tenn., 6.25 inches; Memphis, Tenn., 6.14 inches; Nashville, Tenn., 8.02 inches; Laconia, Ind., 3.34 inches; Highlands, N. C., 3.15 inches. 13th, Helvetia, W. Va., 2.09 inches in 30 hours. 19th, Santa Barbara, Cal., 9.93 inches in 46 hours. 19th and 20th, Lompoc, Cal., 4.40 inches. 27th, Melissa, Tex., 3.00 inches; Clarksville, Tex., 3.75 inches. 27th and 28th, Little Rock, Ark., 5.24 inches; Mount Ida, Ark., 3.00 inches. 28th and 29th, Mesquite, Tex., 5.00 inches; New Ulm, Tex., 2.44 inches.

Largest monthly rainfalls, including melted snow.—Nashville, Tenn., 12.37 inches; Mesquite, Tex., 10.75 inches; Austin, Tenn., 9.89 inches; Memphis, 9.44 inches; Little Rock, Ark., 7.95 inches; McMinnville, Tenn., 7.65 inches; New Ulm, Tex., and College Hill, Ohio, 7.50 inches; Cedar Keys, Fla., 7.35 inches; Cape Hatteras, N. C., and White Plains, N. Y., 7.13 inches; Saint Augustine, Fla., 6.91 inches; Brookhaven, Miss., 6.50 inches; Melissa, Tex., 6.40 inches; Mayport, Fla., 6.39 inches; Laconia, Ind., and Shreveport, La., 6.19 inches; Lompoc, Cal., 6.18 inches; Jacksonville, 6.17 inches; Montgomery, 6.11 inches; Ashwood, Tenn., 6.10 inches; Clarksville, Tex., 6.00 inches; Fort Barrancas, Fla., 5.78 inches; Cape Lookout, N. C., 5.77 inches; Mobile, Ala., 5.73 inches; Mount Ida, Ark., 5.70 inches; Portland, Oreg., 5.67 inches; Highlands, N. C., and Margaretta, Ohio, 5.55 inches.

Smallest monthly rainfalls, including, melted snow.—Indio, Cal., Fort Lyon, Colo., Stockton, Tex., and Breckinridge, none; Fort Wallace and Dodge City, Kans., Fort McPherson, Nebr., Yuma, Ariz., and El Paso, Tex., trace; Pilot Point, Tex., 0.01 inch; Fort Hartsuff, Nebr., 0.02 inch; Socorro, N. Mex., and North Platte, 0.03 inch; Fort Elliott, Tex., and Manhattan, Kans., 0.05 inch; Cheyenne, Wyo., 0.09 inch; De Soto and Howard, Nebr., and Fort Verde, Ariz., 0.13 inch; Fort Sidney and Omaha, Nebr., 0.14 inch; Vail, Iowa, and Tucson, Ariz., 0.15 inch; Prescott, Ariz., 0.26 inch; Des Moines, Iowa, 0.17 inch; Glenwood, Iowa, and Plattsmouth, Nebr., 0.18 inch; Pembina, Dak., 0.20 inch; Wickenburg, Ariz., 0.25 inch; Fort Garland and Denver, Colo., 0.32 inch; Corning, Mo., 0.35 inch; Fort Fred Steele, Wyo., and Phœnix, Ariz., 0.38 inch; Nora Springs, Iowa, 0.40 inch; Camp Sheridan, Nebr., 0.42 inch; Lawrence and Wellington, Kans., and La Mesilla, N. Mex., 0.43 inch; Camp Grant, Ariz., 0.48 inch; Florence, Ariz., 0.49 inch; Genoa, Nebr., and Holton, Kans., 0.50 inch.

Rainy days.—The number of days on which rain or snow has fallen varies as follows: New England, 12 to 23; Middle Atlantic states, 6 to 13; South Atlantic states, 7 to 12; Eastern Gulf states, 4 to 13; Western Gulf states, 8 to 16; Lower Lake region, 15 to 25; Upper Lake region, 8 to 20; Ohio valley and Tennsssee, 9 to 17; Upper Mississippi valley, 7 to 11; Missouri valley, 2 to 5; Red River of the North valley, 0 to 9; Eastern Rocky Mountain slope, 1 to 12; Texas, 1 to 16; Rocky Mountains, 2 to 7; Middle Plateau, 9 to 13; California, 8 to 10; Oregon, 14 to 18.

Cloudy days.—The number varies in New England from 5 to 16; Middle Atlantic states, 5 to 12; South Atlantic states, 4 to 13; Eastern Gulf states, 3 to 15; Western Gulf states, 10 to 20; Lower Lake region, 9 to 16; Upper Lake region, 11 to 15; Ohio valley and Tennessee, 8 to 13; Upper Mississippi valley, 1 to 8; Missouri valley, 2 to 4; Red River of the North valley, 6 to 9; Eastern Rocky Mountain slope, 4 to 7; Texas, 0 to 19; Rocky Mountains, 3 to 7; Middle Plateau, 9 to 12; California, 5 to 9.

Hail was reported from the various stations as follows: Lompoc, Cal., 22d; Elmira, Ill., 24th; Mount Sterling, Ill., 20th; Fort Madison, Iowa, 24th; Yates Centre, Kans., 18th; Kansas City, Mo., 25th; Ashley, Mo., 20th, 28th; Fort Sill, Ind. T., 12th; Henrietta, Tex., 28th; Coleman and Fort Concho, Tex., 1st; Denison, Tex., 12th, La Crosse, Wis., 28th; Duluth, Minn., 11th.

Snow fell on the following dates in the various districts: New England, 1st to 17th, 19th, 21st, to 24th; Middle Atlantic states, 1st, 2d, 3d, 4th, 5th, 7th, 8th, 9th, 10th, 11th, 13th, 14th, 15th, 18th, 19th, 21st, 23d; North Carolina, 2d, 3d, 6th, 20th, 21st; Georgia, 2d, 5th, 6th, at Gainesville snow fell to the depth of two inches on the 2d; Lower Lake region, 1st to 10th, 13th to 16th, 18th to 23d, 29th; Upper Lake region, 1st to 16th, 18th to 29th; Ohio valley, 1st to 7th, 9th, 13th, 14th, 15th, 18th, 19th to 23d, 29th; Tennessee, 2d, 3d; Mississippi, Louisiana, and Arkansas, 2d; Upper Mississippi valley, 1st to 7th, 13th, 14th, 17th, 18th, 20th, 25th, 26th, 28th, 29th; Texas and Indian Territory, 1st, 2d, 3d, 4th, 12th, 13th, 14th, 29th. Missouri valley, 1st, 2d, 3d, 4th, 6th, 7th, 8th, 9th, 11th, 12th, 13th, 15th, 16th, 22d, 24th to 28th. Rocky Mountains, 1st to 6th, 10th, 11th to 19th, 22d to 29th. Middle Plateau, 2d, 3d, 9th, 10th, 11th, 13th, 15th, 16th, 18th, 19th, 21st to 29th. California, 11th, snow on summit of Mount Diablo and along the Coast Range southeast of San Francisco; 22d, snow storm prevailed on summit of San Pablo; 23d, snow on Coast Range. Oregon, 10th, 14th to 19th. Washington Territory, 12th, 13th, 14th, 16th, 17th, 18th.

Largest monthly snowfalls.—Emigrant Gap, Cal., 98.75 inches; Summit, Cal., 75 inches; Cisco, Cal., 71 inches; Alta, Cal., 49 inches; Colfax, Cal., 48 inches; Truckee, Nev., 46.50 inches; Surry, Me., 34 inches; Boca, Nev., 30 inches; Little Mountain, Ohio, 29.50 inches; Ogden, Utah, 25.50 inches; Palermo, N. Y., 25 inches; Coalville, Utah, 24.50 inches; Lunenburg, Vt., and Penn Yan, N. Y., 23.50 inches; Nile, N. Y., and Newport, Vt., 23 inches; Mount Washington, 21.60 inches; Cleveland, Ohio, 21.50 inches; New Corydon, Ind., 20.10 inches; Cornish, Me., and Stafford, Vt., 20 inches; Grafton, N. H., 19.50 inches; Rowe, Mass., 19 inches; Lima, N. Y., 18.50 inches; Clinton, Mass., 18 inches; Gardiner, Me., 17.75 inches; Woodstock, Vt., 16.70 inches; Norwalk, Ohio, 16.58 inches; Orono, Me., 16.50 inches; Helvetia, W. Va., 16.25 inches; Dunbarton, N. H., and Carson, City, Nev., 16 inches; Duluth, Mich., 15.50 inches; Waterburg, N. Y., 15.40 inches; Hermosa, Colo., 15.30 inches; Auburn, N. H., and Alpena, Mich., 15 inches; Amherst, Mass., and Litchfield, Pa., 14.50 inches; Westborough, Mass., 14 inches; Antrim, N.H., 13.50 inches; Paterson, N. J., 13.25 inches; Hudson, Ohio, New Bedford, Mass., and Tehachapi, Cal., 13 inches; Ithaca, N. Y., 12.60 inches; Starkey, N. Y., 12.50 inches; Ruggles, Ohio, 12 inches; Wellsborough, Pa., 11.80 inches; Waltham, Mass., 11.50 inches; Northport, Mich., 11.30 inches; North Lewisburg, Ohio, 11.30 inches; Fort Collins, Colo., 10.50 inches; Morriston, Dak., Minneapolis, Minn., New Castle and Dyberry, Pa., Embarrass, Wis., Ardenia, White Plains, and Hector, N. Y., and Keene, Cal., 10 inches.

Snow from a cloudless sky.—Colorado Springs, 4th; Coleman, Tex., 14th; Detroit, Mich., 7th; Springfield, Mass., 5th; Starkey, N. Y., 19th.

The depth of snow on ground at end of month was reported as follows: In Maine, trace to 6 inches; New Hampshire, 0 to 12 inches; Vermont 2 to 6 inches; Massachusetts, New York, and Pennsylvania, trace; Lower Michigan, trace to 1 inch; Upper Michigan, 2 to 12 inches; Wisconsin, trace to 4 inches; Minnesota, 2 to 6 inches; Iowa, ⅛ to 2½ inches; Nebraska, trace to 2 inches; Dakota, 1 to 10 inches; Colorado, 1 to 20 inches at Hermosa; Wyoming Territory, trace to 3 inches; Montana, 1 inch at Virginia City; Utah, ½ to 6 inches; Nevada, trace at Winnemucca.

Floods.—Mesquite, Tex., 28th and 29th, heavy rain storm, fields badly washed, cornfields considerably damaged. New Orleans, 2d, high water broke the levee seven miles below the city; 7th, another break from 150 to 200 feet wide was reported at Kennerville, La. Louisville, 17th, river rose rapidly, flooding the lower floor of houses on Seventh and Water streets. Memphis, 11th, 12th, very heavy rain storm, cellars flooded, gas extinguished, and eight bridges across Gayoso Bayou injured or destroyed; city sewers and crossings badly injured; Wolfe River rose rapidly, carrying away $5,400 worth of logs; all trains on roads leading into city were delayed. Albany, N. Y., 14th, sudden rise in the river, flooding cellars on Quay street, also at foot of Broadway and Maiden Lane, causing considerable damage.

Precipitation during January, received after issue of January review.—Arizona: Whipple Barracks, 0.41 inch; Fort Lowell, 0.62; Fort Verde, 1.08; Fort Apache, 1.24; Fort Grant, 0.65. *California:* Benicia Barracks, 1.32; Angel Islands, 2.56; Fort Yuma, trace; Fort Gaston, 8.45; Fort Bidwell, 3.10; Oakland, 1.71; Poway, 1.13; San Gorgonia, 1.78; San Buenaventura, 1.41; Campo, 3.00. *Dakota:* Fort Sisseton, 0.30; Fort Sully, 0.00; Fort Totten, 0.40; Fort Meade, 0.38. *Idaho:* Fort Lapwai, 0.92; Fort Cœur d'Alene, 3.74; Lewiston, 0.34. *Michigan:* Fort Brady, 2.40; Petoskey, 1.53; Ypsilanti, 2.05. *Montana:* Fort Benton, 0.24; Fort Shaw, 0.10; Fort Ellis, 0.87; Fort Keogh, 0.14; Fort Logan, 0.15; Fort Assinniboine, 0.10; Blackfeet Agency, 0.48. *Oregon:* Fort Stevens, 28.94; Fort Klamath, 2.34; Fort Harney, 0.56; Eola, 7.92; Albany, 11.19. *Texas:* Fort Ringgold, 0.22; Fort Brown, 3.13; Fort Davis, 1.68; Coleman, 2.03; Edinburgh, 1.48; Brownsville, 3.87. *Washington Territory:* Fort Colville, 2.07; Fort Canby, 22.28; Fort Townsend, 3.40; Neah Bay, 25.70; Bainbridge Island, 17.62; Dayton, 3.37. *Florida:* Biscayne, 3.80; Okahumpka, 4.25; Daytona, 3.68; Orlando, 6.01. *Massachusetts:* New Bedford, 1.86; Williamstown, 3.39. *Missouri:* Oregon, 1.59. *New Jersey:* Dodge Mine, 2.36; Deckertown, 1.94. *New York:* Port Jervis, 2.65. *Nevada:* Carson City, 1.00. *North Carolina:* Sulphur Springs, 2.00. *Minnesota:* Breckenridge, 0.01.

RELATIVE HUMIDITY.

The percentages of mean relative humidity for the month range as follows: New England, 68 to 75; Middle Atlantic states, 60 to 77; South Atlantic states, 58 to 80; Eastern Gulf states, 68 to 79; Western Gulf states, 62 to 78; Ohio valley and Tennessee, 60 to 71; Lower Lake region, 68 to 75; Upper Lake region, 62 to 77; Upper Mississippi valley, 59 to 71; Missouri Valley, 48 to 63; Red River of the North valley, 90 to 95; Eastern Rocky Mountain slope, 48 to 56; Texas, 26 at Stockton to 79 at Edinburg; Western Plateau, 36 at Yuma to 69 at Boise City; California, 58 to 72; Oregon, 79 to 83. *High stations* report the following averages not correct for altitude: Virginia City, 57; Cheyenne and Denver, 51; Santa Fé, 47; Mount Washington, 87.

WINDS.

The *prevailing directions of the wind* are shown by arrows flying with the wind on chart No. II. On the coast of North Carolina, in Florida, and thence along the Gulf coast to New Orleans they are *northeasterly*, but elsewhere south and east of Nebraska, Iowa, and Wisconsin they are *southerly*, inclining to *westerly* in the Lake region and along the East and Middle Atlantic coasts. Along the south coast of New England, at Baltimore, Augusta, Atlanta, and from Nebraska northward, they are *northwesterly*.

Total movements of the air.—The following are the *largest* total movements recorded in miles at the Signal Service stations during the month: Delaware Breakwater, 13,730 miles; Cape May, 13,029; Wood's Holl, Mass., 12,987; Sandy Hook, 12,276; Thatcher's Island, Mass., 11,929; Cape Lookout, N. C., 10,668; Kittyhawk, N. C., 10,664; North Platte, 10,620; Cape Henry, 10,443; Indianola, Tex., 10,264; Breckenridge, Minn., 10,354; Barnegat, N. J., 10,134; Milwaukee, 9,965; Cheyenne, 9,894; Grand Haven, 9,793; Cape Hatteras, 9,757; Port Huron, 9,258; Erie, 9,069; Newport, 8,893. The *smallest* are: Stockton, Tex., 1,259 miles; Roseburg, Oreg., 2,055; Nashville, 2,105; Visalia, Cal., 2,151; La Mesilla, N. M., 2,181; Uvalde, Tex., 2,411; Santa Fé, 2,608; Deadwood, Dak., 2,634; Lynchburg, Va., 2,695; Augusta, Ga., 2,770; San Antonio, Tex., 3,343; Salt Lake City, 3,392; Portland, Oreg., 3,451; Olympia, Wash. T., 3,458; Silver City, N. M., 3,562; Boise City, Idaho, 3,602; Los Angeles, Cal., 3,700.

Local storms.—Pilot Point, Tex., 24th, very severe wind storm, attaining a velocity of W. 59 miles, causing considerable damage to trees and fencing. Cincinnati, 18th, severe whirlwind of small diameter passed near the southern railway bridge, destroying considerable property. Nashville, 12th, during the progress of the heavy wind and rain storm, between the hours of 10 and 11 p. m., two small tornadoes were formed within the limits of the city, passing over it from SW. to NE., causing a large destruction to property. The average width between the paths of the two storms was 1½ miles, and over the central portion for a constant width of a ½ mile no damage was done. The northern tornado commenced its work of destruction at a point about two miles southwest of the signal office, and passed to the northeast a distance of three or four miles, where all traces of the whirlwind's action disappeared. Property to the value of about $30,000 was all destroyed in its path. Trees from 1½ to 2 feet in diameter were uprooted or twisted off, and the *débris* carried in the direction of the whirl, which was from right to left. The southern tornado descended near Hillsborough Pike, where a small barn was first demolished; it then rose, passing entirely over several houses without injury; reaching the earth again in a short interval it moved to the custom house, which it damaged to the amount of $8,000; heavy blocks of stone weighing several tons were thrown from the walls, and the whole of one side torn down. After unroofing several buildings and destroying the spire of St. Paul's church the whirlwind disappeared. In the tracks of both tornadoes, the peculiar bounding action of the whirling cloud was easily discernible.

Sand storms.—Umatilla, Oreg., 12th, 14th; Stockton, Tex., 12th, 24th; Fort Garland, Colo., 16th, 17th.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily indications for February, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verifications to be 88.0 per cent. The percentages for the four elements are: weather, 90.0; direction of the wind, 86.3; temperature, 88.2; barometer, 87.5 per cent. By geographical districts they are: for New England, 88.3; Middle states, 92.2; South Atlantic states, 86.7; Eastern Gulf states, 88.8; Western Gulf states, 87.9; Lower Lake region, 90.2; Upper Lake region, 88.7; Tennessee, and the Ohio valley, 87.2; Upper Mississippi valley, 84.0; Lower Missouri valley, 85.3; Northern Pacific region, 92.6; Central Pacific coast region, 93.1; Southern Pacific coast region, 92.9. There were 10 omissions to predict out of 3,567, or 0.28 per cent. Of the 3,557 predictions that have been made, 139, or 3.65 per cent., are considered to have entirely failed; 89, or 2.50 per cent., were one-fourth verified; 385, or 10.83 per cent., were one-half verified; 145, or 4.08 per cent., were three-fourths verified; 2,808, or 78.94 per cent., were fully verified, so far as can be ascertained from the tri-daily weather maps.

Cautionary signals.—166 cautionary signals were displayed during the month, of which 156, or 94.0 per cent., were justified by winds of 25 miles per hour or over at, or within a radius of 100 miles of, the station. 107 off-shore signals were displayed, of which 98, or 91.6 per cent., were fully justified; 106, or 99.1 per cent., were justified as to direction; 98, or 91.6 per cent., as to velocity; and 1, or 0.9 per cent., was not justified either as to direction or velocity. 65 of the off-shore were changed from cautionary. 273 signals of both kinds were displayed, of which 254, or 93.0 per cent., were fully justified. The above does not include signals ordered for 50 display stations, where the velocity is only estimated. 51 cases of winds of 25 miles and over per hour, from scattering stations, were reported, and for which signals had not been ordered.

NAVIGATION.

In the table on the right-hand side of Chart No. III are given the highest and lowest readings of the Signal Service river-gauges for the month, with the dates of the same.

The *Missouri* remained frozen over at Yankton until the 24th, when observations were resumed; at Omaha and Leavenworth the variation in the height of water has not exceeded 4 feet during the whole month. The *Mississippi* continued frozen at Saint Paul and La Crosse throughout the month; thence southward to Saint Louis the range at any station did not reach 4 feet for the entire month; at Cairo the river fell slowly from the 1st to the 11th; on the 13th it commenced to rise rapidly, and by the 24th had risen to 43 feet 5 inches, or 3 feet 5 inches above the danger line, after which it fell slowly to the end of the month, reaching 41 feet 10 inches on the 29th; at Memphis it fell slowly from the 1st to 12th, after which it rose to the end of the month, when it was within 8 inches of danger line; at Vicksburg it was within 1 foot of danger line (41 feet) on the 1st, but continued slowly falling until the 17th, when it reached 27 feet 3 inches; on the 18th it commenced rising, and at the end of the month had reached 38 feet 8 inches; at New Orleans it fell slowly from the beginning of the month to the 19th, after which it rose to end of month, when it was within 9 inches of danger line. The *Ohio* at Pittsburgh fell slowly from the 1st to the 10th; on the 12th it commenced to rise rapidly, and on the 14th reached 21 feet 7 inches, or 19 inches above danger line, after which it fell slowly until the 26th, and remained low to end of month; at Cincinnati it fell slowly from the 1st to the 11th; on the 12th a rapid rise set in which continued to the 17th, when the water reached 53 feet 3 inches, or 39 inches above danger line; it then fell slowly to end of month; at Louisville it remained almost stationary until the 14th, when a rapid rise set in, which on the 18th and 19th reached 30 feet 6 inches, or 6 feet 6 inches above the danger line, after which it fell rapidly to end of month. The *Tennessee* at Chattanooga continued low and almost stationary until the 14th, rose rapidly to the 17th, fell to 6 feet on the 26th and rose slightly to end of month. The *Cumberland* at Nashville rose from the 1st to the 7th to 14 feet 2 inches, fell to the 11th to 10 feet 4 inches, after which it rose rapidly, and on the 19th and 20th reached 44 feet 2 inches, or 26 inches above danger line, whence it fell to 14 feet 10 inches on the 26th, and rose to 32 feet 4 inches by end of month. The *Savannah* at Augusta rose 11 feet on the 3d, fell 11 feet by the 9th, and remained almost stationary to end of month. On the *Red River* at Shreveport navigation has continued without interruption throughout the month, the river continuing to rise slowly from the 14th to the 29th; on the 15th the zero of river-gauge at this station was lowered 3 feet 6 inches, to correspond with the low water of 1879, but the readings given in the table for the present month are above the zero of 1878.

Ice in rivers and harbors.—The following notes respecting ice in rivers, &c., are of interest: *Columbia River.*—Umatilla, Oreg., 1st, 2d, floating ice in river. *Missouri.*—Plattsmouth, Nev., 16th, ice broken up; 29th, ice gorge broke away from east half of pile bridge, and during the night river froze over the third time this month; Leavenworth, floating ice 1st to 7th, clear of ice 8th, floating ice 21st. *Mississippi.*—Saint Paul, river frozen over throughout the month. La Crosse, 9th, ice firm, crossing very good; 27th, ice getting thin, many large open places obstructing all travel. Davenport, floating ice 2d, 4th to 10th, 13th, 14th, 18th to 22d, 29th. Keokuk, heavy floating ice 1st to 10th, small quantities of ice 11th; 12th, ice breaking up along Illinois shore; 13th to 16th, heavy floating ice; 17th, river free; 19th, small quantities of ice; 20th to 23d, heavy ice; 24th, river clear. Burlington, river full of floating ice 1st to 11th, 13th, 14th, 15th, 20th, 21st, 22d; clear of ice 12th, 16th, 23d. Saint Louis, light floating ice 4th, 5th, 6th. *Rock River.*—Rockford, Ill., 17th, free of ice; 19th, small quantities of floating ice; 20th, river partly covered with thin ice; 21st, frozen over; 23d, small quantities of floating ice; 24th, river clear. *Ohio.*—Wellsburg, W. Va., 5th, first ice in the river at this point this winter. *Monongahela.*—Morgantown, 5th, frozen over; 10th, ice breaking up; Pittsburgh, 8th, floating ice. *Allegheny.*—Pittsburgh, 8th, floating ice. *Susquehanna.*—Litchfield, Pa., 26th, river entirely clear of ice. *Delaware.*—Port Jervis, N. Y., 14th, floating ice; Philadelphia, 10th, ice formed in river during night. *Hudson.*—Albany, 16th, floating ice; 18th, nearly free of ice; 24th and 25th, full of floating ice; Ardenia, 28th, river entirely clear of ice, vessels moving. *Connecticut.*—Springfield, Mass., river free of ice throughout the month. *Lake Superior.*—Duluth, harbor frozen over 1st to 29th. Marquette, harbor covered with ice throughout the month. *Lake Michigan.*—Chicago, 1st, lake frozen; 2d, ice breaking up; 4th, lake frozen; 10th, lake clear. *Grand River.*—Grand Haven, Mich., river frozen over or full of slush ice from 1st to 21st. *Lake Huron.*—Port Huron, 4th, ice-bridge formed across the bay from Fort Gratiot light-house to Point Edwards; 9th, ice bridge broke to-day. *Saint Clair River.*—Port Huron, 4th, clear of ice; 9th, 19th, floating ice. *Lake Erie.*—Cleveland, 5th, shore ice forming around the piers in the lake; 7th, 9th, large quantities of floating ice in lake and river. *Maumee River.*—Toledo, 2d, covered with thin ice; 5th, frozen from shore to shore; 15th, free of ice; 20th, thin ice; 28th, schooner arrived from Cleveland. *Buffalo Creek.*—Buffalo, N. Y., 3d, frozen over; 18th, ice broke up and passed out; 21st, frozen over; 25th, ice broken up. *Lake Champlain.*—Burlington, 1st, floating ice in lake; 2d, harbor frozen over. Charlotte, Vt., 2d, lake freezing over, ice bridge firm; 6th, crossing ice on foot; 11th, teams crossing; 29th, lake still frozen.

High tides.—Atlantic City, N. J., 3d; Sandy Hook, 3d, carrying away jetty in front of office, and also the track of the New Jersey Southern Railroad for several miles, all telegraphic communication interrupted for 24 hours.

TEMPERATURE OF WATER.

The temperature of water as observed in rivers and harbors, with average depths at which the observations were taken, are given in the table on left side of Chart No. II. At the following stations observations were not made on the date indicated on account of ice: at Alpena, Duluth, Escanaba and Marquette no observations were made throughout the month; at Buffalo, 3d to 18th, and 21st to 25th; Burlington, 2d to 29th; Chicago, 1st, 2d, 4th to 9th; Cleveland, 3d; Detroit, 2d to 11th, 13th to 17th, and 19th to 22d; at Grand Haven, 1st to 21st; New York City, 4th and 5th; Toledo, 5th to 11th. On account of breakage of thermometer no observations were made at San Francisco throughout the month, and at New York City from the 19th to 29th. Observations were commenced at Delaware Breakwater on the 15th.

ATMOSPHERIC ELECTRICITY.

Thunder storms were reported in the various States and Territories on the following dates: New York, 12th, 18th, 20th, and 26th. South Atlantic states, 2d, 3d, 18th, and 19th. In the Gulf states, 12th, 13th, 14th, 18th, and 24th. Tennessee, and the Ohio valley, 11th, 12th, 13th, 18th, and 28th. Upper Lake region, 11th, 12th, 18th, 22d, 24th, 25th, 26th, 27th, and 28th. Missouri, 11th, 12th, 13th, 18th, 24th, 25th, and 28th. Iowa, 11th, 24th, 25th, and 29th. Indian Territory and Texas, 1st, 11th, 12th, 17th, 18th, 20th, 24th, 25th, 27th, 28th, and 29th. California, on the 10th.

Auroras.—Harvard College Observatory, Cambridge, Mass., looked for every clear evening, none seen; 11th, 20th, 29th, evenings, hazy or cloudy. New Corydon, Ind., 8th, 10 p. m.; Muscatine, Iowa, 19th, 7 to 10 p. m.; Gardiner, Me., 1st, 29th; Cumberland, Md., 26th; Starkey, N. Y., 6th, 10th, 20th, 27th, 29th; Pembina, 29th; Eastport, 6th, 7th, (29th, 9 to 11.30 auroral arch 20° in height and extending from NNW. to NNE.)

Telegraphic communication interfered with by atmospheric electricity.—Fort Sill, 12th, 24th; Jacksborough, Tex., 24th; Henrietta, Tex., 24th; Mason, Tex., 27th.

OPTICAL PHENOMENA.

Solar halos observed in the various districts on the following dates: New England, 4th, 5th, 7th, 8th, 19th, 11th, 18th, 20th, 21st, 22d, 24th, 25th, 27th. Middle Atlantic states, 1st, 2d, 6th, 9th, 10th, 11th, 17th, 18th, 20th, 24th, 25th, 27th, 29th. South Atlantic states, 7th, 9th, 25th, 27th, 28th. Eastern Gulf states, 7th, 9th, 11th, 27th, 28th. Western Gulf states, 5th, 6th, 19th, 27th. Lower Lake region, 2d, 3d, 5th, 6th, 13th, 14th, 15th, 18th, 20th, 21st, 27th. Upper Lake region, 2d, 9th, 11th, 14th, 15th, 16th, 18th, 29th. Ohio valley, 2d, 12th, 16th, 22d, 23d, 24th. Upper Mississippi valley, 2d, 3d, 5th, 15th, 16th, 17th, 18th, 22d, 23d, 24th, 25th, 26th, 27th, 28th, 29th. Missouri valley, 2d, 4th, 6th, 10th, 12th, 13th, 14th, 15th, 17th, 20th, 22d, 24th, 27th, 29th. Rocky Mountains, 6th, 8th, 9th, 10th, 15th, 16th, 17th, 23d, 27th, 28th. Western Plateau, 8th, 20th, 27th, 28th. California, 8th, 17th, 26th. Oregon, 7th.

Lunar halos were observed in the various districts on the following dates: New England, 2d, 20th, 21st, 22d, 24th, 25th, 27th. Middle Atlantic states, 14th, 16th, 17th, 18th, 20th, 21st, 23d to 27th. South Atlantic states, 9th, 16th, 17th, 19th, 25th. Eastern Gulf states, 16th, 17th, 18th, 19th, 21st, 23d to 27th. Western Gulf states, 15th, 17th, 18th, 19th, 20th to 27th, 29th. Lower Lake region, 9th, 12th, 14th, 15th, 16th, 21st, 22d, 24th. Upper Lake region, 12th, 15th, 16th, 17th, 19th, 20th, 22d, 25th. Upper Mississippi valley, 14th to 19th, 21st to 29th. Ohio valley and Tennessee, 15th, 16th, 17th, 18th to 25th. Missouri valley, 3d, 14th, 16th, 17th, 18th, 22d, 23d, 24th. Rocky Mountains, 17th, 18th, 19th, 20th, 21st, 22d. Western Plateau, 17th, 18th, 19th, 21st, 22d, 25th. California, 25th. Oregon, 18th, 20th.

Mirage.—Oregon, Mo., 9th, 14th; Genoa, Nebr., 1st, 2d, 3d, 7th, 8th, 29th; Pembina, 5th.

MISCELLANEOUS PHENOMENA.

Sunsets.—The characteristics of the sky at sunset, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from 130 stations show 3,745 observations to have been made, of which 32 were reported doubtful; of the remainder, 3,110, or 83.8 per cent., were followed by the expected weather.

Meteors.—New Corydon, Ind., 1st, 6th, 7th; Cedar Vale, Kans., 8th; Woodstock, Md., 1st, 16th, 24th, 26th; Fayette, Miss., 13th; Oregon, Mo., 7th, 27th; Waterburg, N. Y., 7th, 14th, 17th; North Volney, N. Y., 28th; Starkey, N. Y., 16th; Boise City, Idaho, 12th, 20th; Madison, Wis., 17th; Rochester, 5th.

Zodiacal light.—Harvard College Observatory, Cambridge, Mass., looked for every clear evening; distinctly visible on the 2d, 8th; visible 1st, 4th, 5th, 6th, 7th, 9th; observations on other evenings hindered by moonlight, clouds, or haze. Southington, Conn., visible on the 7th and 8th. New Corydon, Ind., on the 1st, 4th, 5th, 7th, 8th, 9th, 10th. Muscatine, Iowa, on the 5th and 8th; Cresco, Iowa, on the 7th, 8th, 11th, 12th, 29th; Monticello, Iowa, on the 3d and 9th; Fort Dodge, Iowa, on the 4th and 5th; Cedar Vale, Kans., from the 1st to 9th, 11th, 13th, 14th, 27th, 28th; Somerset, Mass., on the 1st, 4th to 9th, 11th, 27th; Fall River, Mass., on the 1st and 29th; Oregon, Mo., on the 3d, 5th, 6th, 7th, 8th, 9th, 28th; Austin, Nebr., on the 6th; Atco, N. J., on the 1st, 2d, 3d, 4th, 6th, 7th, 8th, 9th, 10th, 12th, 16th; Waterburg, N. Y., on the 1st, 5th, 6th, 7th, 8th, 9th; Starkey, N. Y., on the 25th; Bellefontaine, Ohio, on the 7th, 9th, and 19th; Coalville, Utah, on the 3d and 28th; Wytheville, Va., on the 3d, 6th, and 28th; Woodstock, Vt., seen on clear evenings in the latter part of the month. Lynchburg, Va., on the 3d, 4th, 6th, 7th; Fort Whipple, Va., on the 23d. Mr. Chas. Hasselbrink remarks as follows in reference to observations made by him at Havana, Cuba: "February 28th, visible at about 7 p. m.; does not extend more than 30° above the true horizon. The borders or sides of the triangular shape less defined than ever; has at times the appearance of a mass of dust illumined by some source of light; not constant; intensity varies at intervals; real intermittence. The inclination on the horizon is not considerable. The axis approaches the perpendicular and forms with the horizontal line an angle of about 80°; commences vanishing at about 8 p. m. February 29th, not visible; western region cloudy."

Polar bands.—New Corydon, Ind., 9th, 16th, 20th, and 27th; Guttenburg, Iowa, 22d; Yates Center, Kans., 17th; Gardiner, Me., 8th, 21st, 22d, and 25th; Thornville, Mich., 22d; Auburn, N. H., 3d and 27th; Freehold, N. J., 2d, 12th, and 24th; Vineland, N. J., 28th; Wytheville, Va., 2d, 6th, 11th, and 20th.

Prairie and forest fires.—Glenwood, Iowa, 23d; Creswell, Kans., 2d, 3d, 5th to 15th, 17th to 29th; Yates Center, Kans., 18th; Independence, Kans., 4th to 11th, 14th, 17th to 29th; Fort Sill, 25th; Dodge City, 7th and 9th; Fort Gibson, 2d, 4th, 6th, 8th, 9th, 10th, 11th, and 22d; Chattanooga, Tenn., 24th and 25th.

Sun spots.—The following record of observations, made by Mr. D. P. Todd, Assistant, has been forwarded by Prof. S. Newcomb, U. S. Navy, superintendent Nautical Almanac Office, Washington, D. C.:

Date.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	
Feb. 1880.									
1st, 10 a. m..	0	5	0	0	0	0	2	14	
2d, 9 a. m..	0	0	0	0	0	0	2	14	Faculæ.
3d, 4 p. m..	1	3	0	0	1	3	3	11	
4th, 9 a. m..	0	0	0	0	0	0	3	11	Faculæ.
5 p. m..	0	0	0	0	0	0	3	11	
5th, 3 p. m..	0	0	0	0	0	0	3	11	
6th, 3 p. m..	0	0	0	0	0	0	3	11	
7th, 2 p. m..	0	0	0	0	0	0	3	11	
8th, 9 a. m..	0	7	0	0	0	0	3	18*	
9th, 2 p. m..	0	0	0	0	0	0	3	18*	
11th, 3 p. m..	0	0	2	10	0	0	1	8	
14th, 8 a. m..	0	0	1	8	0	0	0	0	Several extensive fields of faculæ. Spots probably disappeared by solar rotation.
21st, 3 p. m..	1	3	0	0	1	3	1	3	
22d, 11 a. m..	0	3	0	0	0	3	1	6	
23d, 9 a. m..	0	0	0	0	0	0	1	6	
24th, 8 a. m..	0	0	0	0	0	0	1	3	
4 p. m..	0	0	0	0	0	0	1	3	
25th, 9 a. m..	0	3	0	0	0	0	1	6	
26th, 3 p. m..	0	0	0	0	0	0	1	1	
27th, 12 m....	0	0	0	0	0	0	1	1	
29th, 12 m....	1	1	0	0	0	0	2	2	Several broad areas of faculæ.

* Approximated.

Mr. Wm. Dawson, at Spiceland, Ind., reports: "1st, a large group of 12 spots in NE. quadrant, one large spot south of the group; both group and spot, 4′ from E. edge; 3d, 3 groups, 18 spots; one new spot at E. edge; 4th, 3 groups, 8 spots; 5th, 3 groups, 8 spots; 6th, 3 groups, 22 spots; 8th, 4 groups, 15 spots; 10th, 4 groups, 25 spots; 15th, no spots; 20th, one spot very close to edge; 21st, 3 spots near E. edge; 22d, 3 spots, 1 group; 24th, 6 spots, 1 group; 26th, 1 large spot and 2 little ones near it, nearly S. of center." Mr. F. Hess, at Fort Dodge, Iowa, reports: 1st, noon, 2 groups in NE. quadrant—upper, 2 large and 10 or 12 small spots and faculæ; lower, one large spot and faculæ: 2d, 9 a. m., same—in all 3 large and 6 small spots, no faculæ; 3d, 9 a. m., same, and a large new spot near NE. limb and 1 in SE. quadrant and faculæ; 4th, no sun all day; 5th, 9 a. m., two large and one small spot in NW. quadrant, one large spot in SW. quadrant, one large spot in NE. quadrant and faculæ; 6th, 9 a. m., same four large spots and several small ones—nothing new since yesterday; 7th, 9 a. m., same four large spots nearer to W. limb—nothing new; 8th, 10 a. m., four groups, 3 in NW. quadrant, 1 in SW. quadrant; 9th, 10 a. m., five groups, 4 in NW. quadrant, 1 in SW. quadrant—in all 15 distinct spots and many faculæ; 10th, 10 a. m., same five groups of 15 spots—3 spots very large; 11th, 10 a. m., only 6 spots; first two groups have disappeared by rotation; 12th, 10 a. m., four large and seven small spots and many faculæ in NW. quadrant; 13th, 10 a. m., one large and five small spots, a new group of faculæ near E. limb; 14th, 10 a. m., no spots, but two groups of faculæ near NE. and NW. limbs; 15th to 20th, no spots or faculæ; 21st, noon, one large spot and brilliant faculæ near SE. limb; 22d, noon, one large spot and 2 distinct smaller ones besides a number of others indistinct; 23d, noon, one large spot and two smaller ones, no faculæ; 24th, noon, same as on previous day; 25th, no observation made; 26th, 8 a. m., same group near center E. and W., nothing new; 27th and 28th, no observations; 29th, noon, one large spot in SW. quadrant and a group of faculæ near SE. limb.

NOTES AND EXTRACTS.

[Nature, February 5, 1880.]

Results of an inquiry into the periodicity of rainfall.—Mr. G. M. Whipple, the author, has collected the following series of rainfall observations, all of which contain more than fifty years' records:

Station.	Periods.	No. of years.	Authority.
Paris	1689–'96, 1699–1754, 1773–'97, 1804–'75.	161	Annuaire de l'Observatoire de Montsouris, 1879.
Padua	1725 to 1878	154	MSS. from P. Denza.
England (Symons' table)	1726 to 1865	140	B. A. Report, 1866.
Milan	1764 to 1878	115	MSS. from P. Denza.
London	1813 to 1878	66	Dines and Symons.
Madras	1813 to 1877	65	Nature, vol. xviii, p. 565.
Philadelphia	1810 to 1867	58	Smithsonian tables, p. 97.
Edinburgh	1822 to 1878	57	Nature, vol. xviii, p. 97.
New Bedford	1814 to 1867	54	Smithsonian tables, p. 90.
Rome	1825 to 1878	54	MSS. from P. Denza.

To these he added an eleventh, forming a series by combining together the annual rainfall for 1822 to 1875 at London, Paris, and Edinburgh, which increased the total number of years of observation to 978.

These he has discussed after a method described at length in the paper, and determined for every series the curves which represent the variation in the means of the amount of annual rainfall for each of the years comprising the series on the assumption of the presence of a cycle, which he varies in duration from five to fifteen years.

The computed curves are then compared with the actual curves representing the observations, and the number of coincidences and non-coincidences in the epoch of maximum and minimum determined.

The results show that in no one case is there any indication of a period of any integral number of years from five to thirteen inclusive running through them.

It also became evident that for the same epoch the curves of variation differ widely for localities comparatively close together. For example, taking the eleven-year cycle for Padua and Milan, stations only about 130 miles apart, both well situated for observing rain, and no mountain range intervening, the variation curves are as follows:

Year	1800 +11*n*	1801 +11*n*	1802 +11*n*	1803 +11*n*	1804 +11*n*	1805 +11*n*	1806 +11*n*	1807 +11*n*	1808 +11*n*	1809 +11*n*	1810 +11*n*
Padua	—1.3	—0.3	—1.7	+1.1	+4.2	+4.2	—4.9	+3.4	—2.8	—2.8	+1.7
Milan	—5.0	+1.5	+0.2	—1.9	—2.5	—0.0	+3.0	+4.7	—5.6	+2.6	+2.8

These show that the years of greatest rainfall at Padua are represented by the formula [1804 or 5 + 11n] and of least by [1806 + 11n], whilst for Milan the maximum occurs at [1807 + 11n] and the minimum at [1808 + 11 n].

Numerous other instances of incongruity are found in every one of the cycles, leading forcibly to the conclusion that either no short term of exactly five, six, seven, eight, nine, ten, eleven, twelve, or thirteen years exists in the annual amount of rainfall at any of the stations whose observations have been discussed in the paper, or that the effect of abnormal falls is so great that it cannot be eliminated by upwards of a hundred years' observations.

In any case the author thinks it may now be stated with certainty that all predictions as to rainy or dry years, based upon existing materials, must in future be considered as utterly valueless.

Movements of storms.—In his twelfth contribution to meteorology Prof. Elias Loomis writes as follows:

Rate of progress of barometric minima.—Dr. Neumayer has given for each month in the years 1876 and 1877 the average daily progress of barometric minima in Europe expressed in myriameters. I have reduced these values to English miles per hour, and the results are shown in column 4 of the following table. For the purpose of comparison, I have placed in column 2 the velocities deduced from three year's observations in the United States as published in this Journal, vol. x, p. 1. I have also reduced to a tabular form the velocities given in the monthly reports of the Signal Service since November, 1875, and have determined the averages for each month. These results are shown in column 3 of the table. They are derived from forty-four months of observation, and refer to the region between the Atlantic ocean and the meridian of 100° from Greenwich.

	Loomis.	Sig. Ser.	Europe.
January	26.7	33.3	15.8
February	32.0	28.5	14.0
March	30.5	30.2	18.2
April	27.5	24.1	14.9
May	23.5	23.6	12.7
June	21.6	23.5	14.5
July	24.9	27.6	14.7
August	18.4	22.8	14.5
September	22.9	21.5	15.0
October	25.8	21.4	19.7
November	29.0	25.5	15.8
December	29.3	34.0	15.8
Year	26.0	26.3	15.5

The average velocity of storm centers in the United States is seen to be 69 per cent. greater than it is in Europe. In my tenth paper (this Jour., vol. xvii, p. 3) I determined the average velocity of storm centers on the Atlantic ocean to be 14 miles per hour, which is somewhat less than the value above found for the continent of Europe.

It appears then to be an established fact that storms travel more rapidly over the eastern portion of the United States than they do over the Atlantic ocean or the continent of Europe. What cause can be assigned for this inequality? The winds on the Atlantic ocean are certainly stronger than they are over either of the continents, and it is believed that the winds of central Europe are generally stronger than the winds of the United States. * * * In my first paper (this Jour., vol. viii, p. 7), from a comparison of a large number of cases, I showed that generally the stronger the wind on the west side of a storm the less the velocity of the storm's progress. If the more rapid progress of storm centers in the United States results from a difference in the velocity of winds it seems probable that the effect is produced by means of the vapor which is precipitated. From the Rocky Mountains to the Atlantic ocean storms advance from a dryer to a more humid atmosphere. In Europe, while storms travel eastward, they advance from a humid to a dryer atmosphere. Upon the Atlantic Ocean the vapor on the western side of storm centers generally has a greater tension than it has upon the eastern side, owing to the warm water of the Gulf Stream. In my eighth paper (this Jour., vol. xv, p. 11) I have sworn that in the vicinity of Newfoundland storms are frequently delayed several deys, and this result is apparently due to the abundant precipitation of vapor in that region. In my first paper (this Jour., vol. viii, p. 6) I have shown that when a storm center advances eastward most rapidly, the rain area generally extends to an unusual distance on the east side; and the storm center advances less rapidly than usual when the rain area extends but little on the east side. These facts seem to indicate that in Europe the center of rain area must precede the center of least pressure by a less distance than it does in the

United States. I have endeavored to decide this question by a comparison of observations. * * *

From these observations we must conclude that storms may travel eastward even through the center of the rain area is somewhat west of the center of low pressure. In my tenth paper (this Jour., xvii, p. 12) I have shown that the change of wind which accompanies a barometric minimum generally begins at the surface of the earth before it does at elevated stations, indicating that the west wind in the rear of the storm pushes under the east wind, lifting it from the surface of the earth, so that a change of wind and an increase of barometric pressure is observed at the surface before there is any change of wind at the elevation of 2,000 or 3,000 feet. This movement of the winds does not prevent the storm center from advancing eastward, but the storm advances less rapidly than when the center of the rainfall is considerably east of the center of low pressure, as is generally the case in the United States.

Published by order of the Secretary of War.

ALBERT J. MYER,
Brigadier-General (Brevet Assigned), Chief Signal Officer, U. S. A.

PAPER 41.

MONTHLY WEATHER REVIEW, MARCH 1880.

INTRODUCTION.

In preparing this Review the following data, received up to April 14th, have been used, viz, the regular tri-daily weather charts, containing the data of simultaneous observations taken at 139 Signal Service stations and 14 Canadian stations, as telegraphed to this office; 140 monthly journals and 158 monthly means from the former and 12 monthly means from the latter; reports from 27 sunset stations; 234 monthly registers from voluntary observers; 46 monthly registers from United States Army-post surgeons; marine records; international simultaneous observations; monthly reports from voluntary observers in and the local weather service of Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

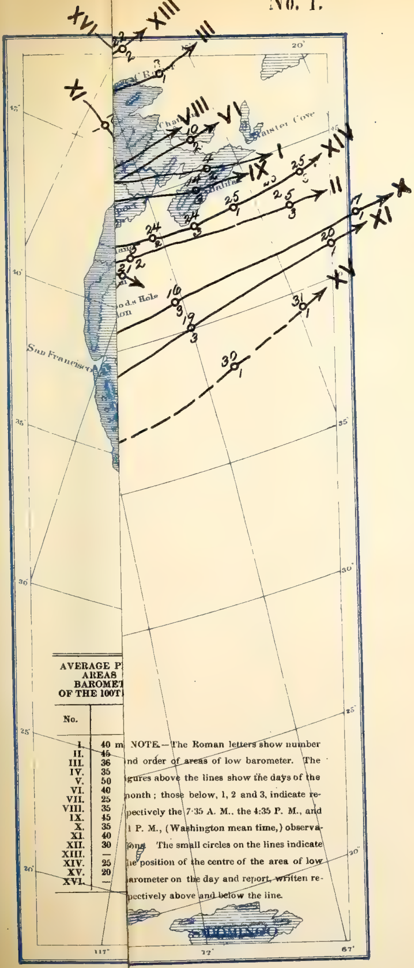
Barometric pressure.—The pressure for the month is remarkable for its equitable distribution from the Mississippi valley eastward to the Atlantic Ocean. As compared with the March averages of the preceding eight years the distribution is decidedly abnormal. From the Missouri valley eastward to the Atlantic an excess of pressure prevailed, averaging 0.05 inch above the normal and reaching 0.08 above over Lake Ontario. There was a slight deficiency in the pressure of the South Atlantic and Eastern Gulf states. An excess of 0.03 above prevailed at San Diego and San Francisco and of 0.06 above at Portland, Oreg. The mean at Virginia City was 0.03 below.

Local barometric ranges.—The barometric ranges in the Atlantic states regularly increased to the northward from 0.34 inch at Key West to 1.09 at Norfolk, 1.18 at New York city, and 1.48 at Thatcher's Island, with an extreme range of 1.57 at Burlington, Vt. The range on Mount Washington, however, was but 0.96, being 0.50 below the average of the surrounding New England stations. A similar increase northward occurs from an average of 0.55 along the Gulf coast to an average of 1.30 in the Ohio valley and Missouri. Unusual ranges occurred in the Lake region and Upper Mississippi valley. The average range for the Lower Lake region is 1.40, the Upper Lake region 1.50, and the Upper Mississippi valley 1.60. Extreme ranges of 1.70 occurred at Milwaukee, Dubuque, and La Crosse, of 1.73 at Madison, Wis., and 1.84 at Fort Buford. On the Pacific coast the range regularly increased to the northward from 0.44 at Los Angeles to 1.28 at Olympia and 1.39 at Umatilla. The pressure over the Plateau and Rocky Mountain districts ranged from 0.45 in the southern part to 0.92 in the northern.

Areas of high pressure.—During the month twelve areas of high pressure have appeared within the limits of the Signal Service maps. The most notable area is No. II, which remained stationary and without decided change of pressure in the North Pacific coast region from the 5th to the 15th.

No. I.—This area, central in the Ohio valley the morning of the 1st, moved slowly eastward, and was central during the 2d on the Middle Atlantic coast, and by the morning of the 3d had withdrawn eastward over the Atlantic Ocean. The highest pressure during its passage was reported from Cape Henry at midnight, the barometer being 0.48 above the normal. Cautionary signals were displayed on the morning of the 2d at Fort Macon, Cape Lookout, and Cape Hatteras. These signals were justified, but remained displayed until the morning of the 4th in connection with low area No. I.

No. 1.



AVERAGE P
AREAS
BAROMET
OF THE 100T

No.	
I.	40 m
II.	45
III.	36
IV.	35
V.	50
VI.	40
VII.	25
VIII.	35
IX.	45
X.	35
XI.	40
XII.	30
XIII.	—
XIV.	25
XV.	20
XVI.	—

NOTE.—The Roman letters show number
nd order of areas of low barometer. The
gures above the lines show the days of the
nonth; those below, 1, 2 and 3, indicate re-
pectively the 7·35 A. M., the 4:35 P. M., and
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pectively above and below the line.

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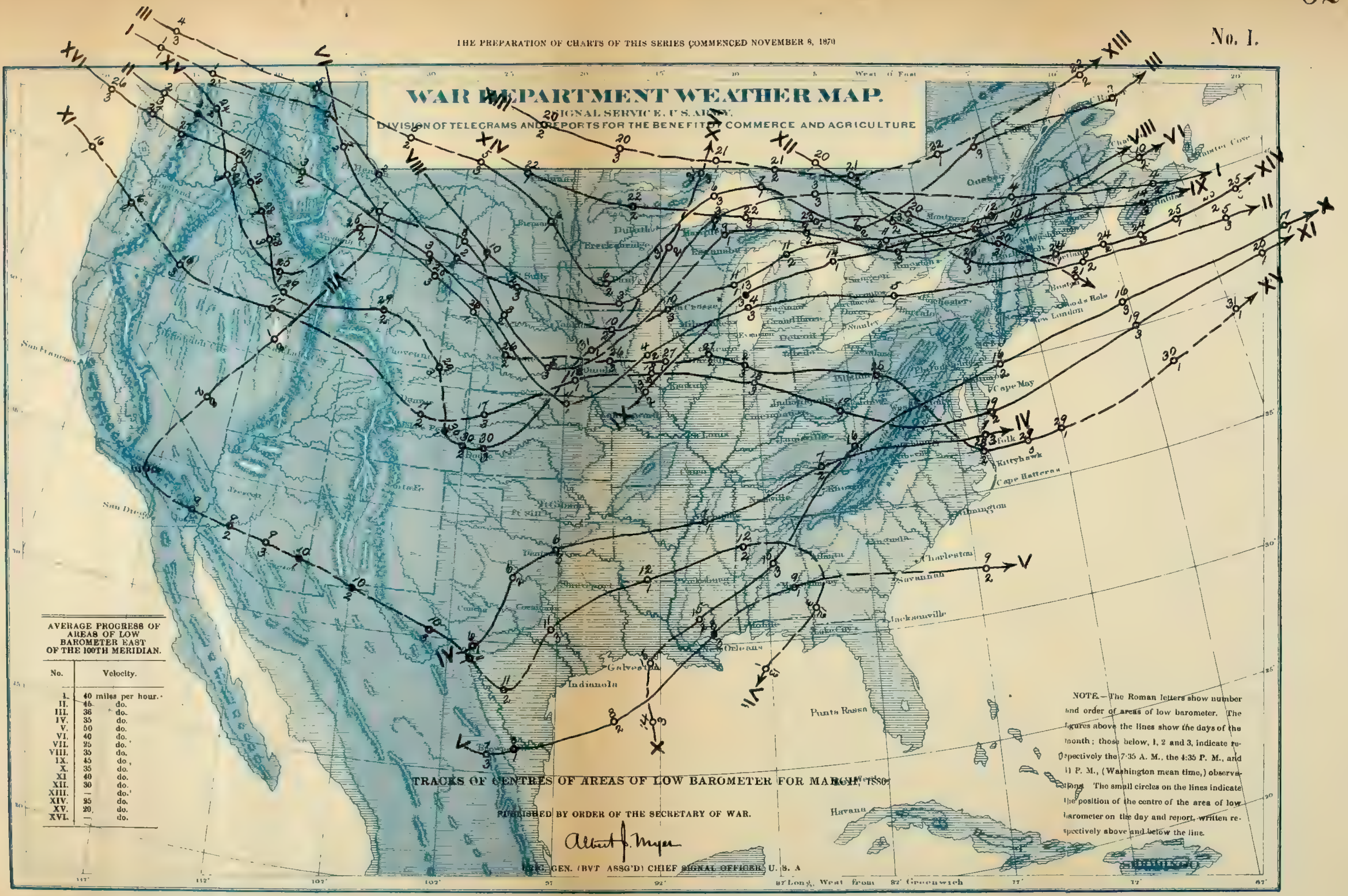
No. I.

THE PREPARATION OF CHARTS OF THIS SERIES COMMENCED NOVEMBER 8, 1870

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE



TRACKS OF CENTRES OF AREAS OF LOW BAROMETER FOR MARCH, 1880.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

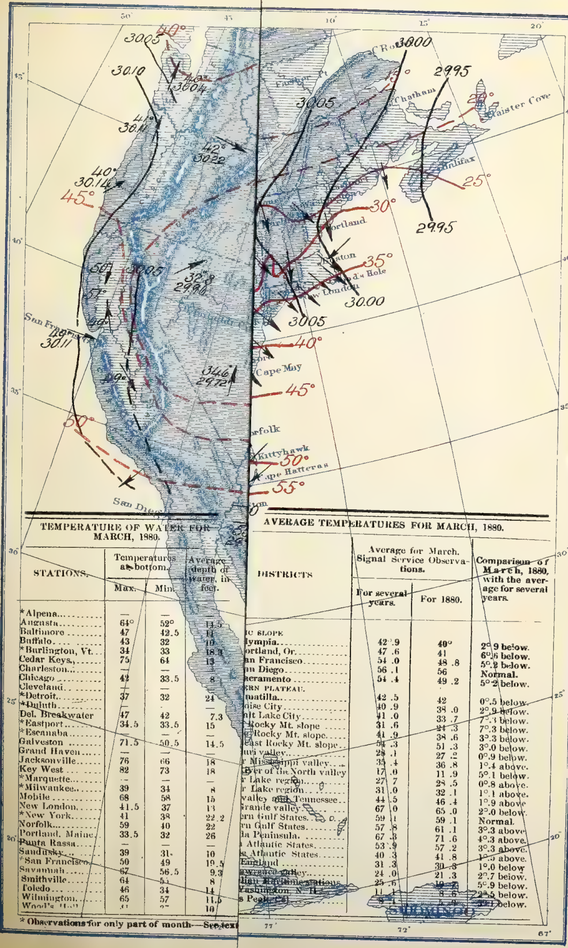
Albert J. Myer

BRIG. GEN. (BVT ASSG'D) CHIEF SIGNAL OFFICER, U. S. A

AVERAGE PROGRESS OF AREAS OF LOW BAROMETER EAST OF THE 100TH MERIDIAN.

No.	Velocity.
I.	40 miles per hour.
II.	45 do.
III.	36 do.
IV.	35 do.
V.	50 do.
VI.	40 do.
VII.	25 do.
VIII.	35 do.
IX.	45 do.
X.	35 do.
XI	40 do.
XII.	30 do.
XIII.	— do.
XIV.	25 do.
XV.	20 do.
XVI.	— do.

NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7:35 A. M., the 4:35 P. M., and 11 P. M., (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above and below the line.



TEMPERATURE OF WATER FOR MARCH, 1880.

STATIONS.	Temperatures at bottom.		Average depth of water, in feet.
	Max.	Min.	
*Alpena	—	—	—
Augusta	64°	52°	14.5
Baltimore	47	42.5	11
Buffalo	43	32	10
*Burlington, Vt.	34	33	18.3
Cedar Keys	75	64	13
Charleston	—	—	—
Chicago	42	33.5	8
Cleveland	—	—	—
*Detroit	37	32	24
*Duluth	—	—	—
Del. Breakwater	47	42	7.3
*Eastport	34.5	33.5	15
*Escanaba	—	—	—
Galveston	71.5	50.5	14.5
Grand Haven	—	—	—
Jacksonville	76	66	18
Key West	82	73	18
*Marquette	—	—	—
*Milwaukee	39	34	8
Mobile	68	58	15
New London	41.5	37	13
*New York	41	38	22.2
Norfolk	59	40	22
Portland, Maine	33.5	32	26
Punta Rassa	—	—	—
Sandusky	39	31	10
*San Francisco	50	49	19.5
Savannah	67	56.5	9.3
Smithville	64	55	8
Toledo	46	34	14
Wilmington	65	57	11.5
Wood's Holl	41	37	10

* Observations for only part of month—See text

AVERAGE TEMPERATURES FOR MARCH, 1880.

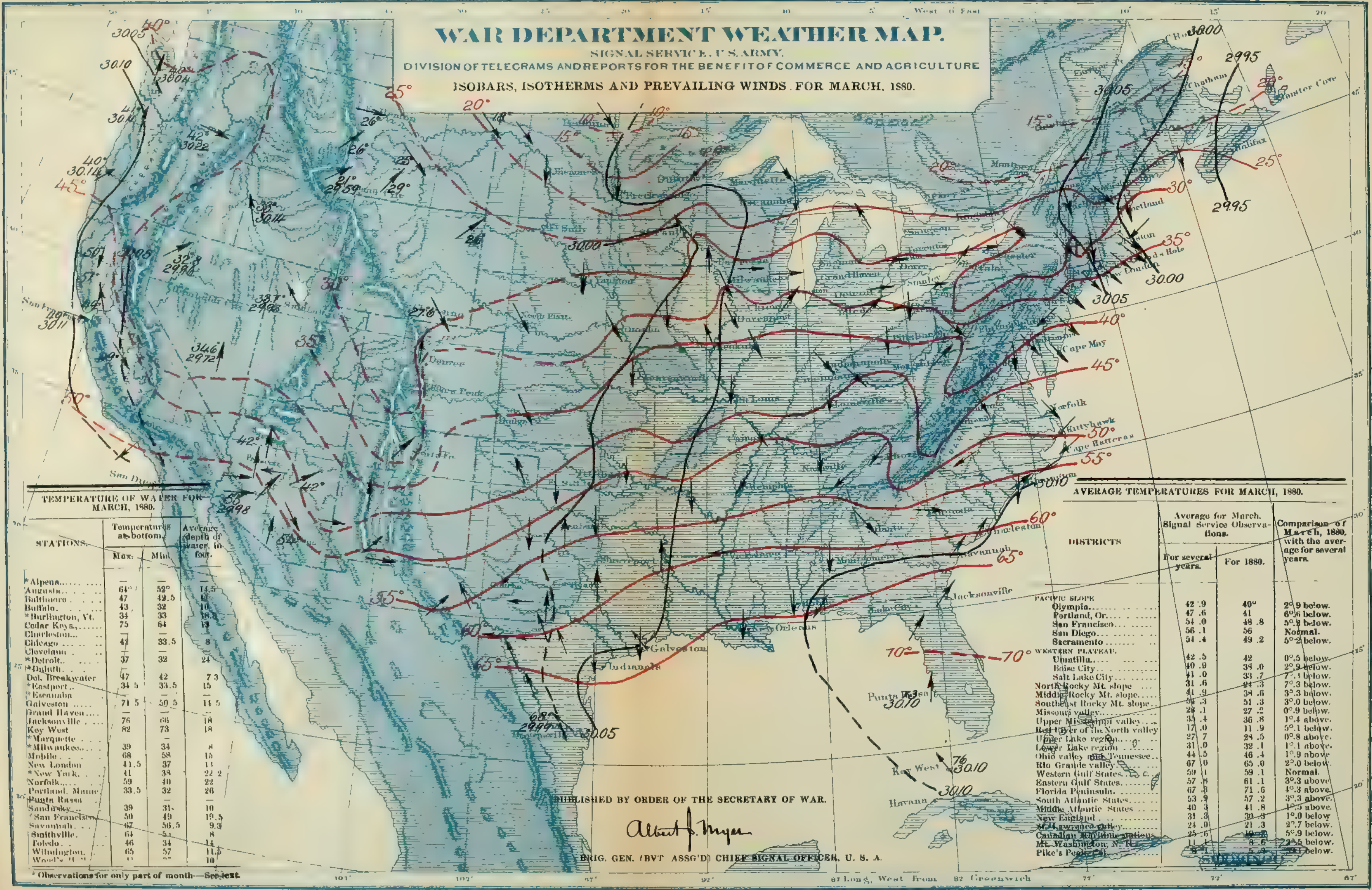
DISTRICTS	Average for March. Signal Service Observations.		Comparison of March, 1880, with the average for several years.
	For several years.	For 1880.	
IC SLOPE			
lympia	42°.9	40°	2°.9 below.
ortland, Or.	47 .6	41	6°.6 below.
an Francisco	54 .0	48 .8	5°.2 below.
an Diego	56 .1	56	Normal.
acramento	54 .4	49 .2	5°.2 below.
ERN PLATEAU.			
matilla	42 .5	42	0°.5 below.
oise City	40 .9	38 .0	2°.9 below.
alt Lake City	41 .0	33 .7	7°.3 below.
Rocky Mt. slope	31 .6	24 .3	7°.3 below.
e Rocky Mt. slope	41 .9	38 .6	3°.3 below.
east Rocky Mt. slope	54 .3	51 .3	3°.0 below.
uri valley	28 .1	27 .2	0°.9 below.
r Mississippi valley	35 .4	36 .8	1°.4 above.
iver of the North valley	17 .0	11 .9	5°.1 below.
r Lake region	27 .7	28 .5	0°.8 above.
r Lake region	31 .0	32 .1	1°.1 above.
valley and Tennessee	44 .5	46 .4	1°.9 above
Grande valley	67 .0	65 .0	2°.0 below.
ern Gulf States	59 .1	59 .1	Normal.
rn Gulf States	57 .8	61 .1	3°.3 above
da Peninsula	67 .3	71 .6	4°.3 above.
Atlantic States	53 .9	57 .2	3°.3 above.
e Atlantic States	40 .3	41 .8	1°.5 above.
England	31 .3	30 .3	1°.0 below
awrence valley	24 .0	21 .3	2°.7 below.
dian Maritime stations	25 .6	19 .7	5°.9 below.
Washington, N. H.	11 .1	8 .6	2°.5 below.
s Peak, Col	8 .1	5 .0	3°.1 below.

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE

ISOBARS, ISOTHERMS AND PREVAILING WINDS FOR MARCH, 1880.



TEMPERATURE OF WATER FOR MARCH, 1880.

STATIONS.	Temperature at bottom.		Average depth of water, in feet.
	Max.	Min.	
*Alpena	—	—	—
Augusta	64°	52°	14.5
Baltimore	47	42.5	11
Buffalo	43	32	10
*Burlington, Vt.	34	33	18.8
Cedar Keys	75	64	13
Charleston	—	—	—
Chicago	43	33.5	8
Cleveland	—	—	—
*Detroit	37	32	24
*Duluth	—		
Del. Breakwater	47	42	7.3
*Eastport	34.5	33.5	15
*Escanaba	—	—	—
Galveston	71.5	50.5	14.5
Grand Haven	—	—	—
Jacksonville	76	66	18
Key West	82	73	18
*Marquette		—	
*Milwaukee	39	34	8
Mobile	68	58	15
New London	41.5	37	13
*New York	41	38	22.2
Norfolk	59	40	22
Portland, Maine	33.5	32	26
Punta Rassa		—	—
Sandusky	39	31	10
*San Francisco	50	49	19.5
Savannah	67	56.5	9.3
Smithville	64	51	8
Toledo	46	34	14
Wilmington	65	57	11.5
Wood's Holl	[illegible]	[illegible]	10

* Observations for only part of month—See text.

AVERAGE TEMPERATURES FOR MARCH, 1880.

DISTRICTS	Average for March. Signal Service Observations.		Comparison of March, 1880, with the average for several years.
	For several years.	For 1880.	
PACIFIC SLOPE			
Olympia	42°.9	40°	2°.9 below.
Portland, Or.	47 .6	41	6°.6 below.
San Francisco	54 .0	48 .8	5°.2 below.
San Diego	56 .1	56	Normal.
Sacramento	54 .4	49 .2	5°.2 below.
WESTERN PLATEAU.			
Umatilla	42 .5	42	0°.5 below.
Boise City	40 .9	38 .0	2°.9 below.
Salt Lake City	41 .0	33 .7	7°.3 below.
North Rocky Mt. slope	31 .6	24 .3	7°.3 below.
Middle Rocky Mt. slope	41 .9	38 .6	3°.3 below.
Southeast Rocky Mt. slope	54 .3	51 .3	3°.0 below.
Missouri valley	28 .1	27 .2	0°.9 below.
Upper Mississippi valley	35 .4	36 .8	1°.4 above.
Red River of the North valley	17 .0	11 .9	5°.1 below.
Upper Lake region	27 .7	28 .5	0°.8 above.
Lower Lake region	31 .0	32 .1	1°.1 above.
Ohio valley and Tennessee	44 .5	46 .4	1°.9 above
Rio Grande valley	67 .0	65 .0	2°.0 below.
Western Gulf States	59 .1	59 .1	Normal.
Eastern Gulf States	57 .8	61 .1	3°.3 above
Florida Peninsula	67 .3	71 .6	4°.3 above.
South Atlantic States	53 .9	57 .2	3°.3 above.
Middle Atlantic States	40 .3	41 .8	1°.5 above.
New England	31 .3	30 .3	1°.0 below
St. Lawrence valley	24 .0	21 .3	2°.7 below.
Canadian Maritime stations	25 .6	[illegible]	5°.9 below.
Mt. Washington, N. H.	11 .1	8 .6	2°.5 below.
Pike's Peak, Col.	8 .1	5 .9	[illegible] below.

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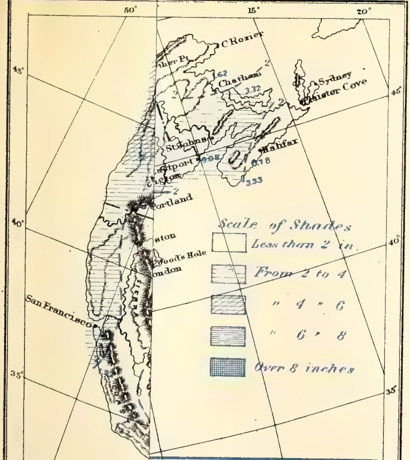
Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

No. III.



San D

AVERA

DISTRICTS.

St. Lawrence Valley...
New England.........
Middle Atlantic States.
South Atlantic States..
Florida Peninsula......
Eastern Gulf States....
Western Gulf States. ..
Tennessee..............
Ohio Valley............
Lower Lake Region . ..
Upper Lake Region. ...
Upper Mississippi Vall
Minnesota..............
Lower Missouri Valley.
Upper Missouri Valley.
North Pacific Coast Reg
Middle Pacific Coast Reg
South Pacific Coast Reg

S ABOVE LOW-WATER MARK, MAR., 1880.

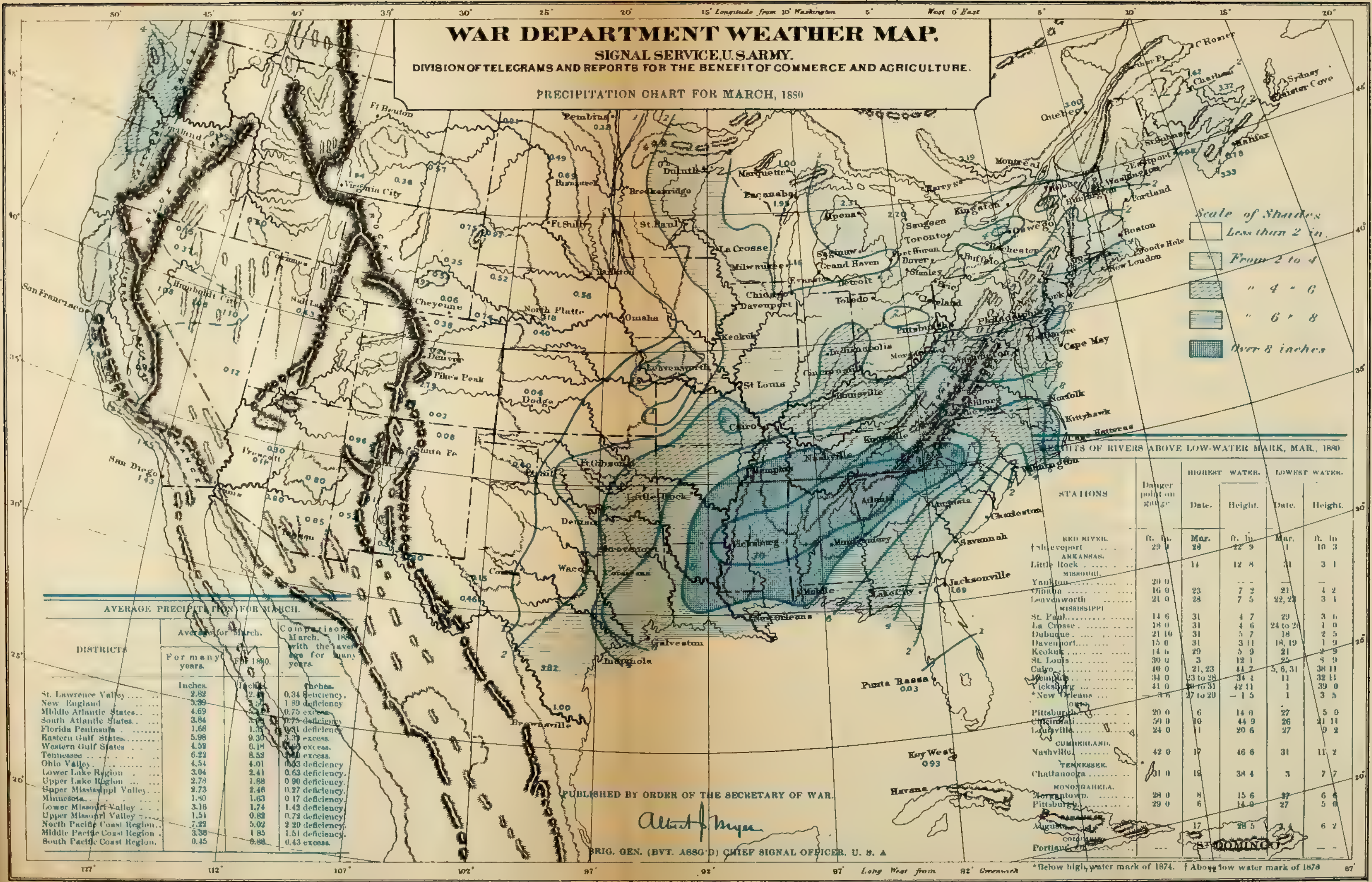
Danger point on gauge.	HIGHEST WATER.		LOWEST WATER.	
	Date.	Height.	Date.	Height.
ft. in.	Mar.	ft. in.	Mar.	ft. in
29 9	28	22 9	1	10 3
	14	12 8	31	3 1
20 0	—	— —	—	—
16 0	23	7 2	21	4 2
21 0	28	7 5	22, 23	3 1
14 6	31	4 7	29	3 6
18 0	31	4 6	24 to 26	1 0
21 10	31	5 7	18	2 5
15 0	31	3 11	18, 19	1 9
14 6	29	5 9	21	2 9
30 0	3	12 1	25	8 9
40 0	21, 23	44 7	5, 6, 31	38 11
34 0	23 to 28	34 4	11	32 11
41 0	29 to 31	42 11	1	39 0
— 3 6	27 to 29	— 1 5	1	3 5
20 0	6	14 0	27	5 0
50 0	10	44 9	26	21 11
24 0	11	20 6	27	9 2
42 0	17	46 6	31	11 2
31 0	19	38 4	3	7 7
28 0	8	15 6	27	6 6
29 0	6	14 0	27	5 0
	17	28 5	3, 4	6 2
---				— —

ST DOMINGO

117°   72   67°

k of 1874. † Above low water mark of 1878

No. III.



WAR DEPARTMENT WEATHER MAP.

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DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

PRECIPITATION CHART FOR MARCH, 1880

AVERAGE PRECIPITATION FOR MARCH.

DISTRICTS	Average for March. For many years.	Average for March. For 1880.	Comparison of March, 1880, with the average for many years.
	Inches.	Inches.	Inches.
St. Lawrence Valley	2.82	[illegible]	0.34 deficiency.
New England	3.39	[illegible]	1.89 deficiency
Middle Atlantic States	4.69	[illegible]	0.75 excess.
South Atlantic States	3.84	[illegible]	0.75 deficiency
Florida Peninsula	1.68	[illegible]	0.31 deficiency
Eastern Gulf States	5.98	9.30	[illegible] excess.
Western Gulf States	4.52	6.1[illegible]	[illegible] excess.
Tennessee	6.22	8.52	[illegible] excess.
Ohio Valley	4.54	4.01	0.53 deficiency
Lower Lake Region	3.04	2.41	0.63 deficiency.
Upper Lake Region	2.78	1.88	0.90 deficiency.
Upper Mississippi Valley	2.73	2.46	0.27 deficiency.
Minnesota	1.80	1.63	0.17 deficiency.
Lower Missouri Valley	3.16	1.74	1.42 deficiency.
Upper Missouri Valley	1.54	0.82	0.72 deficiency.
North Pacific Coast Region	7.22	5.02	2.20 deficiency.
Middle Pacific Coast Region	3.36	1.85	1.51 deficiency.
South Pacific Coast Region	0.45	0.88	0.43 excess.

HEIGHTS OF RIVERS ABOVE LOW-WATER MARK, MAR., 1880

STATIONS	Danger point on gauge	HIGHEST WATER. Date.	HIGHEST WATER. Height.	LOWEST WATER. Date.	LOWEST WATER. Height.
	ft. in.	Mar.	ft. in.	Mar.	ft. in.
RED RIVER.					
†Shreveport	29 0	28	22 9	1	10 3
ARKANSAS.					
Little Rock	—	14	12 8	31	3 1
MISSOURI.					
Yankton	20 0		— —	—	—
Omaha	16 0	23	7 2	21	4 2
Leavenworth	21 0	28	7 5	22, 23	3 1
MISSISSIPPI					
St. Paul	14 6	31	4 7	29	3 6
La Crosse	18 0	31	4 6	24 to 26	1 0
Dubuque	21 10	31	5 7	18	2 5
Davenport	15 0	31	3 11	18, 19	1 9
Keokuk	14 6	29	5 9	21	2 9
St. Louis	30 0	3	12 1	25	8 9
Cairo	40 0	21, 23	44 7	5, 6, 31	38 11
Memphis	34 0	23 to 28	34 4	11	32 11
Vicksburg	41 0	29 to 31	42 11	1	39 0
*New Orleans	— 3 6	27 to 29	— 1 5	1	3 5
OHIO.					
Pittsburgh	20 0	6	14 0	27	5 0
Cincinnati	50 0	10	44 9	26	21 11
Louisville	24 0	11	20 6	27	9 2
CUMBERLAND.					
Nashville	42 0	17	46 6	31	11 2
TENNESSEE.					
Chattanooga	31 0	18	38 4	3	7 7
MONONGAHELA.					
Morgantown	28 0	8	15 6	27	6 6
Pittsburgh	29 0	6	14 0	27	5 0
[illegible]					
Augusta	[illegible]	17	28 5	[illegible]	6 2
COLUMBIA.					
Portland, Or.	---				— -

*Below high water mark of 1874. † Above low water mark of 1878

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Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

No. II.—This area appeared on the Pacific coast during the 5th, the p. m. barometer at Red Bluff being 0.25 above the normal. During the 6th it moved slightly northward to the North Pacific coast region, where it remained until the afternoon of the 15th, the highest pressure being regularly reported at Olympia, rising at that station from 0.40 above the normal during the 6th to 0.67 above on the 8th and 0.66 on the 12th. This area gradually dissipated in advance of low area No. XI. During the increase of pressure from the 6th to the 8th rain fell in the North Pacific coast region. During the 8th, while this pressure was increasing in Washington Territory, the barometer fell sharply in the southern half of the Pacific coast region in connection with low area No. VII, which, moving southwestward from Wyoming, was central at midnight in southern California. Exceedingly high winds were reported in Northern and central California, and the maximum velocities of N. 44 miles at San Francisco and N. 36 miles at Sacramento were reported. In San Francisco Bay two schooners and one barge were sunk and eight other vessels more or less damaged. At Willows, Cal., a terrific gale prevailed during the forenoon, moving a church form its foundations and seriously damaging it. At Colusa several buildings were blown down and others seriously damaged; at Maxwell a warehouse was blown down; in Napa Valley many buildings were blown down and large trees uprooted; at Dayton a barn blown down; at Livermore considerable damage was done; at San Leandro and in El Dorado County many trees were blown down. The minimum temperatures for the Pacific coast generally occurred during the continuance of this area.

No. III.—This area appeared on the afternoon of the 5th in the Missouri valley. It moved northeastward through the Ohio valley to New England and Nova Scotia, thence withdrawing northeastward over the Atlantic Ocean by midnight of the 7th. The maximum pressure was reported from Halifax on the 7th, the barometer being 0.47 above the normal. In connection with this area cautionary signals were displayed on the morning of the 6th at Grand Haven, Milwaukee, and Ludington, and were lowered on the 7th, having been justified; maximum velocity 26 miles NW. at Milwaukee. At midnight of the 6th cautionary signals were displayed on the Atlantic coast from Sandy Hook southward to Fort Macon, which, remaining displayed during the passage of low area No. IV, are treated of in connection therewith.

No. IV.—This area appeared in the Northwest at midnight of the 6th; its pressure increased until the morning of the 7th, Fort Garry barometer 30.81, or 0.64 above the normal. On the morning of the 7th the cautionary signal at Indianola was changed to cautionary off-shore, and in the afternoon a similar signal was ordered at Galveston. These signals were lowered during the afternoon of the 8th, having been justified by wind velocities of N. 28 and N. 36 miles. Moving eastward, on the morning of the 8th it was central in the province of Quebec—Rockliffe barometer 0.62 above the normal, and during the 9th it gradually withdrew eastward over the Atlantic Ocean. The passage of this area was marked by the minimum temperatures for the month at most stations in the Lower Lake region, New England, and New York, the lowest readings being 1° below zero at Burlington on the 8th and Eastport on the 9th. In connection with this area signals displayed for advancing low area No. III were changed at midnight of the 7th on the New Jersey coast from cautionary to off-shore, and were fully justified by velocities ranging from 26 to 36 miles from the north and northwest. Cautionary off-shore signals were ordered the morning of the 8th at Boston and Portland, and the cautionary signals at Newport and Wood's Holl were changed to cautionary off-shore. These signals were lowered that evening, justified by wind velocities of NW. 36 at Thatcher's Island and NW. 28 at Boston.

No. V.—This pressure appeared in the Northwest the morning of the 9th, Fort Garry barometer 0.41 above the normal. Moving eastward through Canada it reached New Brunswick by midnight of the 11th, Chatham barometer 0.52 above the normal. During its passage minimum temperatures for the month occurred at scattering stations in the Upper Lake region, the lowest readings reported being 6° below zero at Marquette and 8° below zero at Alpena on the 10th. Off-shore signals were displayed at Sandy Hook at noon, from New London northward along the coast to Thatcher's Island in the afternoon, and at Eastport at midnight of the 10th. The signal at Eastport was lowered during the afternoon of the 11th, and at other stations changed during that day to cautionary in connection with advancing low area No. VIII. The signals at New England stations were justified by velocities ranging from N. 26 at Eastport to W. 35 at Wood's Holl.

No. VI.—This area appeared in the Northwest on the 11th, and at midnight the pressure at Fort Garry was 30.91, or 0.80 above the normal, and the temperature 18° below zero. Moving eastward at midnight of the 12th, the highest pressure was at Rockliffe, 30.68, or 0·74 above the normal. During the 13th the area withdrew eastward over the Gulf of Saint Lawrence. In connection with advancing low area No. VII cautionary signals were displayed during the 12th from Norfolk along the coast northward to Thatcher's Island, and were lowered on the morning of the 14th, having been generally justified by velocities ranging from 26 NE. at New York to 44 NE. at Delaware Breakwater, along the New Jersey coast, and N. 34 at Thatcher's Island.

No. VII.—This appears to have been a part of the last area. On the 13th, moving southward from Manitoba, the highest pressure at midnight was central in the Missouri valley—Omaha barometer 0.45 above the normal. The area extending from the Lower Missouri valley southward to Texas remained substantially unchanged until the 17th, when, moving eastward, the highest pressure in the afternoon was at Cincinnati, the barometer being 0.33 above the normal. It withdrew slowly eastward from the New England coast over the Atlantic Ocean during the 18th. During the passage of this area minimum temperatures of the month occurred as follows: In the Upper Mississippi and Lower Missouri valleys on the 14th (lowest reading 7° below zero at Saint Paul and Omaha); in Tennessee and part of the Ohio valley, the 16th and 17th, (lowest reading at Indianapolis, 21°); in the Western Gulf states from the 14th to the 17th (lowest reading 23° at Corsicana on the 14th). At midnight on the 13th, the wind continuing brisk at Indianola, off-shore signals, which had been lowered that morning, were again displayed at Galveston, Indianola, and Port Eads, and were continued to midnight of the 14th, wnen they were lowered, having been justified by velocities of 43 miles north at Indianola and 31 miles at Galveston. On the afternoon of the 16th cautionary signals, displayed in advance of low area No. X, were changed on the New Jersey coast to cautionary off-shore signals, and the cautionary signals from Cape Lookout to Cape Henry were continued. Cautionary signals were displayed at Smithville and Wilmington on the morning of the 17th. The New Jersey coast signals were lowered the afternoon of the 17th, fully justified by velocities ranging from 25 NW. at Barnegat to 42 NW. at Cape May. Those on the North Carolina coast were lowered at midnight of the 17th, fully justified by velocities ranging from 32 NE. at Fort Macon to 48 NE. at Kittyhawk.

No. VIII.—This area appeared on the North Pacific coast during the 18th, the pressure at Olympia, from the 19th to midnight of the 21st, ranging from 0.48 to 0.59 above the normal. The area gradually dissipated during the 22d. While the pressure was increasing during the 18th and 19th occasional light rain fell in Oregon; otherwise clear weather generally prevailed on the Pacific coast.

No. IX.—This area followed low area No. XI, central in the Northwest at midnight of the 19th, moved slowly southward to Texas, where it dissipated on the 22d. The highest pressure occurred at Dodge City on the afternoon of the 20th, 0.35 above the normal. Cautionary signals were displayed at New Orleans and Port Eads at midnight of the 21st, and were lowered at midnight of the 22d. Reports, as yet received, do not show that they were justified. From the 20th to the 22d easterly winds with maximum velocities, ranging from 27 to 38 miles, were reported from the Texas coast.

No. X.—The pressure in the Northwest rose very rapidly on the 23d in rear of low area No. XIV. At the afternoon report the pressure at Breckinridge was 0.40 above the normal. Moving eastward with increasing pressure on the morning of the 24th, it was central in the Upper Lake region, Marquette barometer 0.63 above the normal. Moving slowly eastward, it passed off the Middle Atlantic coast during the 25th. During its passage the minimum temperatures of the month occurred in the Middle Atlantic states, the southern half of New England, and in Ohio. During the 23d the cautionary signals ordered for low area No. XIV were changed to off-shore from Norfolk northward to Portland, and on the following morning at Eastport. These signals were lowered during the 24th, having been fully justified by velocities ranging from 30 NW. at Portland to 54 NW. at Wood's Holl on the New England coast, and from 36 NW. at New York to 56 NW. at Sandy Hook and Cape Henry, and 44 N. at Kittykawk along the Middle Atlantic coast.

No. XI.—This area appeared in the Northwest on the 28th, and moving eastward continued over the Upper Lake region during the 29th and 30th. During the 31st it gradually disappeared. The highest pressure was reported from Marquette the morning of the 30th, 0.42 above the normal. During the 29th occasional high winds were reported from Lakes Erie and Huron. No signals were displayed during the passage of this area.

No. XII.—During the 29th and 30th the pressure rose considerably above the normal on the Central Pacific coast, but fell below the normal on the 31st. The highest pressure reported was at Roseburg on the 30th, 0.24 above the normal. Occasional light rain or snow fell during these days on the northern half of the Pacific coast region.

Areas of low pressure.—During the month of March sixteen of these areas passed over the country comprised within the limits of the Signal Service weather maps. Of these six first appeared on the Pacific coast north of California, six came from Manitoba or Saskatchewan, one developed in the Upper Mississippi, and two in the valley of the Lower Rio Grande. The areas of most marked interest are No. II and No. XV. During the passage of No. II violent storms occurred in the Lake region during the 4th and 5th. In connection with area No. XV there prevailed in the Lower Missouri and Upper Mississippi valleys during the 26th and 27th a succession of violent dust and wind storms which have rarely been equalled in those districts for duration and violence.

No. I.—This area apparently entered British America north of Washington Territory on the morning of the 1st, during which day rain fell in the North Pacific coast region and in western Montana. Central in Montana on the morning of the 1st, it moved southeast and by midnight had reached the Missouri valley, Breckinridge barometer 0.53 and Yankton barometer 0.51 below the normal. On the morning of 2d cautionary signals were ordered for Indianola and Port Eads. During the afternoon signals were displayed for Lake Michigan. The center on the morning of the 3d was in southwestern Minnesota, and in the afternoon over Lake Superior. On the morning of the 3d, cautionary signals on the North Carolina coast displayed for high area No. I were continued, and cautionary signals were displayed northward along the Atlantic coast to New York, and in the afternoon from New Haven northward to Thatcher's Island, at Smithville, Wilmington, and Galveston. At midnight the cautionary signals on Lake Michigan were lowered, having been fully justified by velocities of SE. 26 at Grand Haven and S. 27 at Milwaukee; cautionary signals were then ordered for the Maine coast. During the day brisk to high southerly winds, with rain, prevailed in the Lake region and on the Atlantic slope. The storm moving eastward, on the morning of the 4th was central in the lower Saint Lawrence valley, and during the day passed eastward through New Brunswick over the Atlantic Ocean. The morning of the 4th all signals on the Atlantic coast were lowered, having been fully justified, except at Eastport, with maximum velocities of SE. 40 at Cape Hatteras, W. 48 at Delaware Breakwater, SW. 36 at Sandy Hook, SE. 40 at Wood's Holl, and SW. 29 at Thatcher's Island. The signals in the Gulf of Mexico were lowered at midnight, having been justified, except at Galveston. During the passage of this area the maximum temperatures of the month in the state of Maine occurred.

No. II.—The track of this area was very similar to that of No. I. Appearing in British Columbia at midnight of the 1st, it moved southeastwardly through Montana and Dakota to the Lower Missouri valley, where it was central on the morning of the 4th, Omaha and Leavenworth barometers 0.55 below the normal. It thence moved northeastwardly and was central that afternoon in eastern Iowa. Cloudy and threatening weather, with fresh to brisk winds, prevailed in the Lake region. Cautionary signals were then ordered for Lake Michigan, and at midnight were displayed at Sandy Hook and Delaware Breakwater. The storm, central in Michigan at midnight of the 4th, reached Lake Ontario on the morning of the 5th. Its passage was marked by violent winds in Ohio, Michigan, and Indiana, which are elsewhere treated under the heading of local storms. Maximum velocities were reported of 72 miles W. at Toledo, 36 NE. at Alpena, 33 SW. at Cleveland, and 40 W. at Columbus. Cautionary signals were ordered at that time from Cape Hatteras northward to Eastport. At noon they were changed to cautionary off-shore from Cape Hatteras to New York and from Wood's Holl to Portland. Cautionary off shore signals were ordered at Savannah and Charleston, and cautionary from Smithville to Cape Lookout. The cautionary signals for Lake Michigan were then lowered, having been fully justified by wind velocities of W. 34 at Milwaukee and W. 42 at Grand Haven. Moving eastward the area was central on the 5th off the Maine coast, and at midnight southeast of Nova Scotia. All signals on the Atlantic coast were lowered at midnight of the 5th, except from Delaware Breakwater southward to Fort Macon, which were lowered the morning of the 6th. Except at Charleston and Savannah these signals were fully justified, the following wind velocities being reported: 32 S. at Smithville, 35 SW. at Cape Lookout, 42 SW. at Delaware Breakwater, 36 W. at New Haven, 44 SW. at Thatcher's Island, and 35 N. at Eastport. During the passage of this area the maximum temperatures of the month occurred in the Atlantic states (except Maine), in the Lower Lake region, the Ohio valley, Texas, and at most stations in the Gulf states.

No. III.—The course of this area was nearly parallel with the tracks of Nos. I and II, except that it was farther northward. Its course from midnight of the 4th to midnight of the 5th was probably southeastward from the coast of British Columbia to Manitoba. During that time cloudy weather, southerly winds, with rain or snow, generally prevailed from Oregon eastward to Dakota. Moving southeastward from Manitoba it was central, with increased pressure, in Minnesota on the morning of the 6th, and in connection with high area No. III, cautionary signals were displayed on Lake Michigan. Changing its course to the northeast, its center was over Lake Superior at midnight of the 6th. Cautionary signals were then ordered for North Carolina and the New Jersey coasts. The afternoon of the 7th the area was in Ontario. Cautionary signals were then ordered from New York eastward to Wood's Holl, and at midnight the cautionary signals were changed to cautionary off-shore signals, and on the following morning, as the storm passed northeastward over the Gulf of Saint Lawrence, cautionary off-shore signals were displayed from Newport northward to Portland, and a cautionary signal was ordered for Eastport. The signals for Lake Michigan were lowered at midnight of the 7th, having been justified. The signals along the Atlantic coast had already been fully justified, but were all continued as cautionary signals until midnight of the 9th, in connection with high area No. IV and low area No. IV.

No. IV.—The pressure in the valley of the Rio Grande decreased during the 5th, and on the morning of the 6th the barometer at Mason was 0.16 below the normal. The area moving northeastward was central at midnight in Indian Territory. A cautionary signal was then displayed at Indianola. Moving northeastwardly the area was central afternoon of the 7th in the Ohio valley, and by midnight of that date had passed eastward through Virginia over the Atlantic ocean. The cautionary signals continued along the Atlantic coast from Smithville northward to Wood's Holl during the 7th were fully justified, but were continued from New York to Delaware Breakwater as cautionary off-shore, and elsewhere as cautionary, in connection with low area No. V and high area No. IV. They were fully justified by velocities ranging from 28 to 34 miles E. on the New Jersey coast, and from 26 to 32 miles NE. on the North Carolina coast. The signals on the Texas coast were continued till the 8th in connection with high area No. IV, and are considered in connection therewith.

No. V appeared in the valley of the Rio Grande at midnight of the 8th and moved thence northeastwardly over the Gulf of Mexico. On the morning of the 9th it was central in Alabama, and during the day moved eastward through Georgia over the Atlantic ocean. Cautionary signals were displayed midnight of the 8th at Cedar Keys, Savannah, and Charleston, and the signals on the Carolina coast displayed in connection with high area No. IV were continued. The signals as far north as Wilmington were lowered at midnight of the 9th and northward to Cape Henry on the morning of the 10th. They were all justified, excepting at Charleston and Savannah, by the following wind velocities: Cedar Keys, SW. 28; Fort Macon, NE. 32, and Cape Henry, NE. 40 miles.

No. VI.—This area moved southward along the eastern slope of the Rocky Mountains during the 7th, from Saskatchewan to Montana, where it was central at midnight, Fort Keogh barometer 0.36 below the normal. From this point a branch moved southwestwardly through Utah into California and is subsequently described as low area No. VII. The main branch moving southeastward at midnight of the 8th was central in the Lower Missouri valley, Omaha barometer 0.13 below the normal. Cautionary signals were then ordered for Lake Michigan. On the morning of the 9th this area was central in northwestern Michigan with high area No. IV in the Saint Lawrence valley to the eastward and advancing high area No. V to the eastward in the Upper Missouri valley. During the day the area moved eastward while cloudy weather, with snow, prevailed in the Lake region. Signals on Lake Michigan were lowered at midnight, having been fully justified by wind velocities of NW. 38 at Milwaukee and W. 32 at Grand Haven. Central, morning of the 10th in the lower Saint Lawrence valley, during the day it moved northeastward over the Gulf of Saint Lawrence.

No. VII.—This area was central as a part of No. VI, in Montana midnight of the 7th; its course thence is an unusual one. Moving soutwestward it was central in Utah the morning of the 8th, and in southern California at midnight; Visalia barometer 0.28 below the normal. At that time, in connection with high area No. II, high northerly winds prevailed in central California, doing considerable damage, as has been noted in a description of that area. Changing its course to the southeastward it passed through Arizona on the 9th, New Mexico on the 10th, and reached the valley of the lower Rio Grande the afternoon of the 11th; Brownsville barometer 0.38 below the normal. Cautionary signals were displayed at Galveston, Port Eads, and Cedar Keys during the 10th, and the signal ordered at Indianola the previous night was continued. Moving northeastward the area was central in Arkansas at midnight, and on the morning of the 12th in northern Alabama. On the morning of the 12th, in connection with high area No. VII, the cautionary signals at Port Eads, Galveston, and Indianola were changed to cautionary off-shore signals. The area moving from Alabama southward, over the eastern part of the Gulf of Mexico, gradually filled up during the 13th. On the morning of that day all signals in the Gulf were lowered, having been justified, except at Galveston; maximum wind velocities: Cedar Keys, N. 25; Indianola, N. 36.

No. VIII.—Advancing southeastward from Manitoba this area was central the morning of the 10th in the Upper Missouri valley; Bismarck barometer 0.23 below the normal. In the afternoon a cautionary signal was displayed at Milwaukee, and on the morning of the 11th at Grand Haven and Ludington. At the latter date the area, with increasing pressure, was over Lake Michigan; thence moving northeastward, with but little energy, it passed over the Gulf of Saint Lawrence during the 12th. The signals on Lake Michigan, continued in connection with high area No. VII, were lowered the morning of the 14th, having been justified by a wind velocity of 29 W. at Grand Haven. No other signals were displayed, nor were any other high winds reported in connection with this area.

No. IX.—During the 13th the pressure fell sharply in the Upper Mississippi valley, and at midnight a well defined area of low pressure, accompanied by brisk, variable winds and snow, covered the Upper Lake region. Moving northeastward the area was central the afternoon of the 14th in the Saint Lawrence valley, and during the night it withdrew northeastward through Nova Scotia over the Atlantic ocean. No signals were displayed during the passage of this area, and no high winds have been reported.

No. X.—At midnight of the 14th a sharp barometric fall occurred in the Western Gulf states, and on the morning of the 15th an area of low pressure was central in Louisiana; New Orleans and Mobile barometers 0.14 below the normal. It was central that afternoon in Alabama. Cautionary signals were then displayed at Port Eads, Cedar Keys, and from Cape Henry southward to Fort Macon. Moving northeastward the area, with decreasing pressure, was central at midnight in Tennessee; Montgomery barometer 0.23 below the normal. Cautionary signals were then ordered at Milwaukee, Toledo, Sandusky, and for the New Jersey coast, and on the following morning like signals were displayed for the rest of Lake Erie, the southern half of New England and Wood's Holl. Central the morning of the 16th in Kentucky, it passed off the New Jersey coast over the Atlantic that day. During the day the signals on Lakes Michigan and Erie were lowered, and those along the New Jersey coast were changed to off-shore, in connection with high area No. VII. The signals along the Atlantic coast were all justified by north to east winds, with velocities ranging from 26 miles at Thatcher's Island, to 30 miles at Sandy Hook. The signals on Lakes Erie and Michigan were but partly justified. Brisk northeast winds, with heavy snow, prevailed on these lakes, and wind velocities of NE. 27 at Grand Haven, and NW. 37 at Sandusky were reported.

No. XI.—This area appeared on the Oregon coast on the morning of the 16th. During the 16th and 17th it moved southeastward through Colorado and Utah to Kansas where it was central at midnight of the latter date; Dodge City barometer 0.22 below the normal. On the morning of the 18th it reached the Lower Missouri valley, and moving eastward was central at midnight in Ohio; Louisville and Indianapolis barometers 0.21 below the normal. At this time a barometric trough extended from the Lake region southward to the Gulf, and a subsidiary area—in connection with which cautionary signals had that morning been displayed at Indianola and Galveston—was central in Alabama. Cautionary signals were then ordered from Kittyhawk southward to Fort Macon, and the signals on the Texas coast—not justified—were lowered. On the morning of the 19th the area was central in Virginia, and during the day passed northeastward over the Atlantic ocean. Cautionary signals were ordered that morning from Norfolk northward to Wood's Holl. The signals along the New Jersey coast were changed that afternoon to off-shore. All signals on the Atlantic coast were lowered at midnight, except at Newport and Wood's Holl, where they remained displayed until the morning of the 20th. These signals were generally justified by velocities varying from S. 26 at Thatcher's Island to 28 NW. at Cape Lookout; 36 NW. at Chincoteague, and 44 NW. at Cape Henry.

No. XII.—This area first appeared on the morning of the 20th northward of Lake Huron. At that time brisk west to south winds prevailed in the Lake region, with maximum velocities of 26 and 28 miles on Lake Michigan. It was central in the afternoon in Ontario; Toronto barometer 0.24 below the normal. By an easterly course it reached Vermont at midnight. During the day brisk to high westerly winds, with snow, prevailed on Lake Huron and in the Lower Lake region. The following maximum wind velocities were reported: 32 to 42 W. on Lake Huron, 25 NW. to 37 W. on Lake Erie, from 32 to 40 NW. on Lake Ontario. No signals were displayed in connection with this area in the Lake region. At midnight of the 20th cautionary off-shore signals were displayed from Chincoteague northward along the Atlantic coast to Eastport. By the morning of the 21st this area had passed southeast through Maine over the Atlantic ocean. The signals from Eastport southward to Chincoteague were lowered that afternoon. These signals, except at Eastport, were fully justified, the following wind velocities having been reported: Thatcher's Island, NW. 30; Wood's Holl, NW. 44; Sandy Hook, NW. 40; Chincoteague, NW. 32.

No. XIII passed too far to the northward of the limits of the Signal Service stations to permit its course to be accurately chartered. It was apparently central in the northern part of Manitoba the morning of the 20th. Passing through the region to the north of the Upper Lakes during the 21st, it moved easterly over the Gulf of Saint Lawrence during the 22d. During the 21st maximum velocities, ranging from 26 to 29 miles, were reportod from several stations on Lakes Superior, Michigan, and Huron. In the afternoon cautionary signals were ordered for Lake Erie, which, not justified in connection with this area, were continued until midnight of the 23d, in connection with advancing low area No. XIV.

No. XIV.—This area was central in Manitoba on the morning of the 2d. During the afternoon cautionary signals were ordered for Lakes Superior and Michigan, and signals ordered on Lake Erie, in connection with the previous area, were continued. Moving eastward it was central at midnight over Lake Superior, and on the morning of the 23d was to the northward of Lake Huron. At that time cautionary signals were ordered for the New Jersey coast and Lakes Ontario and Huron, except at Alpena, where signals had been displayed the midnight previous. In the afternoon the storm was central in Ontario, and at midnight in northern New York. That afternoon cautionary signals were displayed from Cape Hatteras to Cape Henry, and from New York northward along the Atlantic coast to Eastport. The signals along the New Jersey coast having been fully justified as cautionary signals in connection with this area, were changed to cautionary off-shore signals for advancing high area No. X, and a similar change of signals was made from New York northward to Portland at midnight, and at Eastport the following morning. The signals for the entire Upper Lake region, and at Sandusky and Toledo on Lake Erie, were lowered at midnight, having been fully justified by the following wind velocities: Duluth, 32 SW.; Marquette, 33 NW.; Escanaba, Milwaukee, and Grand Haven, 36 NW.; Alpena and Detroit, 35 NW.; and Sandusky, 50 NW. On the morning of the 24th the area was central, with diminishing pressure in Maine; Portland barometer 0.52 below the normal. Warnings were then sent for Picton, Halifax, Saint John, and Yarmouth, and, in connection with advancing high area No. X, cautionary signals were displayed at Norfolk, and from Cape Lookout southward along the Atlantic coast to Smithville. The area moving slowly eastward during the 24th, through Nova Scotia, passed over the Atlantic ocean during the 25th. The signals at Cleveland, Erie, and at stations on Lake Ontario, were lowered the afternoon of the 24th, having been fully justified. All the signals along the Atlantic coast were lowered during the 25th, having been justified by violent northerly gales. The following are the highest wind velocities reported: Eastport, 52 NE.; Thatcher's Island, 62 NW.; Wood's Holl, 54 NW.; Sandy Hook and Cape Henry, 56 NW.; Kittyhawk, 44 N.

No. XV.—This area appeared in British Columbia the afternoon of the 24th; Portland barometer 0.46 and Fort Benton barometer 0.45 below the normal. Moving southeastward it was in Idaho the morning of the 25th, and by an easterly path was central in Nebraska the afternoon of the 26th; Omaha barometer 0.75 below the normal. At that time the pressure in the entire Missouri and Upper Mississippi valleys ranged from 0.45 to 0.75 below the normal. Cautionary signals were displayed on that morning for Lakes Erie and Huron, and the signals displayed on the preceding day, in connection with high area No. X, for Lakes Michigan and Superior, were continued. In the afternoon cautionary signals were displayed at Kittyhawk and Cape Henry, and for the New Jersey and Texas coasts. At midnight the area was central in Iowa, at which time the pressure of the greater part of the Lower Missouri and Upper Mississippi valleys was 0.60 below the normal. At that time brisk easterly winds prevailed in the entire Lake region and Mississippi valley, generally accompanied by rain, and brisk northerly winds from the Missouri valley westward. On the morning of the 27th the area was central in eastern Iowa—Davenport barometer 1.04 below the normal—in the afternoon in northern Illinois, and at midnight in northwestern Ohio. During the day violent wind storms, which are elsewhere treated of in detail, occurred in the Upper Mississippi and Lower Missouri valleys and in the Upper Lake region. Westward from the Mississippi valley to the Rocky Mountain slope, but little or no rain falling, remarkable dust storms prevailed. During the day the following barometer readings occurred, being the lowest on record since the Signal Service stations were opened: Saint Louis, 29.16; Davenport, 28.87; Keokuk, 28.95; Milwaukee, 28.94; Dubuque, 28.98. On the morning of that day cautionary off-shore signals were ordered for the Texas coast, at Port Eads, and New Orleans, and cautionary signals were ordered for the remaining Gulf stations, for Lake Ontario, and at all stations along the Atlantic coast, where cautionary signals were not then displayed, except in Maine, where they were hoisted later in the day. On the morning of the 28th a trough of low pressure extended from Lake Erie southeastward to the New Jersey coast. At that time the pressure of the Lower Lake region, New England, the Middle Atlantic states, and North Carolina, ranged from 0.50 to 0.70 below the normal. By afternoon the area had passed southeastward off the Virginia coast. The signals in the Lake region were all lowered during the day, having been fully justified, maximum wind velocities having been reported at Duluth, 44 NE.; Milwaukee, 40 E.; Alpena, 35 E.; Toledo, 48 SW.; Oswego, 28 NE. The signals from Wood's Holl southward along the Atlantic coast to Cape Henry, from Charleston to Jacksonville, and at Gulf stations, were lowered in the morning, and from Boston northward to Eastport at midnight of the 28th; these signals were fully justified, the following maximum wind velocities having been reported: Indianola, 40 S.; Cedar Keys, 42 SW.; Jacksonville and Charleston, 29 SW.; Cape Hatteras, 56 SW.; Chincoteague, 49 SE.; New York and Eastport, 30 NE.; Boston, 40 E. Brisk easterly winds continued on the New Jersey coast during the day, and the cautionary signals lowered the morning of the 28th were followed at midnight by cautionary off-shore signals from Sandy Hook southward to Cape Henry, and at the same time on the North Carolina coast; the cautionary signals were lowered at Smithville and Wilmington, and changed to cautionary off-shore signals from Macon to Kittyhawk. These signals were continued until the 31st, in connection with high area No. XII. After leaving the North Carolina coast on the 28th this storm evidently moved northeastward, inducing, in connection with high area No. XII, the brisk to high northerly winds, which continued to prevail along the Maine and Massachusetts coasts from the 28th until midnight of the 31st.

No. XVI.—This area appeared on the coast of British Columbia, midnight of the 26th, and moving slowly southeastward reached Utah the morning of the 29th and Kansas the 30th, Dodge City barometer at midnight 0.36 below the normal; changing its course to the northeast, it was central the morning of the 31st in the Lower Missouri valley, Omaha barometer 0.35 below the normal. Cautionary signals were then ordered for Grand Haven, Milwaukee and sections 1 and 3. Continuing its northeasterly course, by midnight of the 31st it passed into the region north of Lake Superior. The cautionary signals on Lake Michigan were lowered April 1st, justified by velocities of 26 E. and 40 W.

INTERNATIONAL METEOROLOGY.

Three international charts, Nos. IV, V, and VI, accompany the present review. They exhibit the meteorological conditions of the Northern Hemisphere and portions of the Southern Hemisphere for the months of August, 1878, and February, 1880. No. IV indicates the probable course of five of the principal storm-areas occurring over the north Atlantic ocean during the month of February, 1880. Two of these, Nos. I and II, appear to have passed in a northeasterly course after arriving at the fortieth meridian, and to have produced southerly gales along the British coasts in two or three days after leaving Newfoundland. The latter of these was encountered by the S. S. Hibernian on the 10th and 11th; this vessel reports on the 10th in 53° N. 28° W. heavy SE. gale, with heavy rain; 11th, 53° N. 30° W., barometer 28.15, terrific hurricane from SE. to NW. No. III appears to have slowly developed during the 8th in the southwest quadrant of area No. I; on the 9th and 10th it was encountered by the ship Iron Cross in about 40° N. 16° W. This vessel reports "on the 9th, at 4 p. m., in 42° N. 16° W., barometer 29.45, wind veering from SSW. to SW.; at 11 p. m. a heavy NW. gale commenced, which reached its maximum force about 2 a. m. of the 10th, squalls of nearly hurricane force of 15 minutes duration occurring about every 30 minutes; the barometer arose from 29.48 at 8 p. m. of the 9th to 30.51 at 8 a. m. of the 11th, when the vessel was in 37° N. 17° W." No. IV appeared over mid-ocean on the 12th, and from the 13th to the 18th remained, as an extensive area of remarkably low pressure, over the eastern half of the Atlantic. Steamers Sardinian and Leipzig report the following, barometer error of former vessel being about —0.35, of latter quite small:

1880.	Steamship Sardinian.				Steamship Leipzig.			
	Lat.	Long.	Barometer.	Wind.	Lat.	Long.	Barometer.	Wind.
February 15..	54° N.	20° W.	28.20	SSE. 9.	50° N.	12° W.	28.92	SW. 6.
16..	53° N.	25° W.	28.00	ENE. 6.	46° N.	16° W.	28.86	NW. 5.
17..	51° N.	32° W.	28 68	NNE. 6.	49° N,	19° W.	28.74	WNW. 7.
18..	49° N.	40° W.	28.75	N. 7.	49° N.	23° W.	28.77	W. 6.

The following remarks accompany the observations forwarded by the Sardinian: "On February 15th, 16th, and 17th, the barometer read from 28.00 to 28.50, the wind, at times, gaining a force of 7 or 8 (Beaufort) to light and variable, and backing twice round from ESE. through NE. and N. to NW. and W.; on the 19th the barometer rose with a steady wind from N., force 7, 8, 6, and 4, thus restoring the equilibrium without any great force of wind. The sea, during this time, was very confused." No. V developed during the 15th on the coast of North Carolina, and on the 16th and 17th moved rapidly eastward south of Nova Scotia. On the 15th it was encountered by Brig George, in 38° 26′ N. 72° 48′ W., which vessel reports as follows: "On the morning of the 15th, from 12 midnight to 2 a. m., wind from NE. to E., moderate, but having the appearance of rain. From that time up to time of observation (7.35 a. m., Washington mean time), baffling winds from ENE. to ESE. and even to SE., with heavy squalls of rain; at 10 a. m. wind commenced to back to NNE. and set in in good earnest; at 2 p. m. took in foresail and reefed mainsail; at 4 p. m., wind N. heavy; 12 midnight, NW. wind with heavy sea." On this chart will also be found the probable course of two storms encountered by the S. S. Gaelic over the north Pacific ocean on December 22d and 26th, 1879, respectively. During the storm of the 26th the barometer fell to 29.15, the gale commenced at SE. and veered to SW. and N., attaining a force of 11 (Beaufort) with a mountainous sea.

Chart No. V shows by isobaric and isothermal lines the mean pressure and temperature, and, by small arrows, the prevailing direction of the wind, at 7.35 a. m., Washington mean time, over the Northern and portions of the Southern Hemisphere for the month of August, 1878. The barometer observations have been corrected for temperature and reduced to sea-level. At stations lying outside the area included within the lines and for those in the Southern Hemisphere the means are shown by figures indicating the temperature in degrees, Fahr., and the pressure in English inches. As compared with the preceding month (July, 1878,) the pressure over the ocean areas, (especially over the eastern portions) is decidedly lower: thus at St. Michael's and St. Paul's Island, Behring's Sea, the mean pressure fell from 29.78 and 29.82 to 29.69 and 29.78, while the means of the observations between 30 and 50 N. are also lower. Over the Atlantic the region of 30.30 entirely disappeared, the area of 30.10 which during July covered the greater part of the north Atlantic and northeastern margin of which extended to Ireland and Land's End, diminished so that in August it was included between the parallels of 20° and 40° N. The area of low pressure over the northern portion of the north Atlantic, which during July was probably central to the north of Godthaab and Stykkisholm, is found during August central between the parallels of 50° and 60° N., and probably about 20° W. The isobar 29.80 includes the greater part of the ocean between 48° and 51° N., and 30° and 10° W., the British Isles, the North Sea, and portions of Denmark, Sweden, and Norway. Over western Europe and Asia the means show a general increase of pressure, and during the latter part of the month (August, 1878), northerly winds set in along the coast of China. The monthly rainfalls reported by the co-operating stations in Hindostan show an increase in amount at all stations, except Bombay, Poona, Allahabad, and Chittagong; increase, 16.13 inches at Deesa and 6.27 at Goalpara. At Bombay the decrease is 28.15 inches.

On Chart No. VI are traced the paths of thirty of the principal storm areas, which traversed the Northern Hemisphere during the month of August, 1878. The general distribution of these tracks corresponds to that of low pressures, as shown on Chart No. V. Among the most notable storms of the month the following may be mentioned. No. I, typhoon along the coast of China, from July 30th to August 1st; the lowest pressures were experienced at Nagasaki on the 2d, with S. to WSW. winds, and at Tokio on the 3d, with SSW. and SW. winds. At these stations the greatest daily velocities of the month were recorded during the passage of this area, namely, Nagasaki, on the 2d, 506 miles, and Tokio, on the 3d, 260 miles; at the former station on the 1st rainfall of 7.45 inches was recorded with SE. and S. winds. On the 5th, S. S. Peking in 35° N. 157° W. reports barometer 29.70, wind SSW., 41 miles, veering on the 6th, to N. by W. 25 miles. No. IX was accompanied by SW. gales along the coast of Alaska from the 1st to the 4th, the maximum velocity of the month, SW. 74 miles per hour, being registered at St. Michael's on the 2d. No. XII, described in the Monthly Weather Review for August, 1878, as low area No. IV, was accompanied in its passage over the eastern portion of the United States by exceedingly severe thunder-storms, and by a destructive tornado at Wallingford, Conn. No. XVI, described as low area No. VIII, in the review for August, 1878, which developed into a hurricane over the western portion of the Gulf of Mexico on the 16th and 17th. No. XVII (No. VI, August Review), accompanied by severe gales on the 19th and 20th, from 35° N. to the Gulf of Saint Lawrence, and between the meridians of 55° and 61° W. No. XX was quite severe in the region of Hudson's Bay and Davis Straits, a vessel being driven ashore on the west coast of Hudson's Bay during a heavy NE. gale on the 23d, and on the 25th meteorological observations on board the schooner Florence in Davis Straits were omitted on account of "heavy storm." No. XXI over the east Atlantic on the 18th and 19th. No. XXV over the north Pacific on the 25th. No. XXVI, which progressed very slowly as a hurricane of great severity from the Bahamas to the Bermudas; it was encountered on the 25th in 26° N. 76° W., on the 26th, 29° N. 71° W., 27th, in 31° N. 71° W., on the 28th it passed over the Bermudas, and on the 29th was encountered in 36° N. 55° W.

TEMPERATURE OF THE AIR.

The mean temperatures for March, 1880, are shown by the isothermal lines upon chart No. II. As is shown by the table of average temperatures on that chart the temperature was above the normal in all districts from the Mississippi valley eastward to the Atlantic ocean, except New England, Saint Lawrence valley, and Canadian Maritime Provinces. In the Plateau and Rocky Mountain districts, Missouri and Red River of the North valleys, and on the Pacific coast the temperature was below the normal. The greatest excess of temperature prevailed in Florida, and the greatest deficiencies are reported from the Canadian Maritime Provinces, 5°.9 below; Red River of the North valley, 5°.1 below; Portland, Oreg., 6°.6 below; North Rocky Mountain slope, 7°.3 below. The temperature has been unusually low from the northern half of the Pacific Coast region eastward to the Red River of the North valley. The table of comparative temperatures for the several districts is printed on the right side of chart No. II.

Maximum temperatures.—Maine: 56° at Portland. *New Hampshire:* 37° at Mount Washington and 57° at *Dunbarton. *Vermont:* 53° at Burlington and 63° at *Charlotte. *Massachusetts:* 72° at Boston. *Rhode Island:* 60° at Newport. *Connecticut:* 69° at New Haven. *New York:* 70° at New York and 58° at Oswego. *New Jersey:* 73° at Barnegat; 74° at *Trenton, *Vineland, and *New Lisbon. *Pennsylvania:* 75° at Philadelphia and 69° at *Catawissa. *Delaware:* 73° at Delaware Breakwater. *Maryland:* 76° at Baltimore and *Emmittsburg. *District of Columbia:* 79° at Washington. *Virginia:* 81° at Norfolk and 77° at Lynchburg. *West Virginia:* 71° at Morgantown. *North Carolina:* 82° at Wilmington, 79° at Charlotte, and 83° at *Weldon. *South Carolina:* 80° at Charleston and 82° at *Aiken. *Georgia:* 85° at Savannah and 84° at Augusta. *Florida:* 87° at Key West, 79° at Pensacola, and 93° at *Houston. *Alabama:* 85° at Montgomery. *Mississippi:* 85° at Vicksburg. *Louisiana:* 81° at New Orleans and 85° at *Point Pleasant. *Texas:* 99° at Eagle Pass, 97° at Rio Grande City, 87° at Stockton, 84° at Denison, 86° at Fort Elliott, 80° at Indianola, and 104° at *Fort Ringgold. *Ohio:* 70° at Cincinnati and 63° at Cleveland. *Kentucky:* 77° at Louisville. *Tennessee:* 76° at Memphis and Knoxville. *Arkansas:* 78° at Little Rock and *Mount Ida. *Michigan:* 57° at Port Huron and 48° at Escanaba. *Indiana:* 70° at Indianapolis and 76° at *Laconia. *Illinois:* 71° at Cairo, 60° at Chicago, and 75° at *Anna. *Missouri:* 76° at Saint Louis and 84° at *Corning. *Kansas:* 85° at Dodge City and *Wellington, 76° at Leavenworth. *Wisconsin:* 60° at La Crosse. *Iowa:* 80° at Des Moines and *Logan. *Nebraska:* 80° at North Platte and 79° at Omaha, 84° at *Howard. *Indian Territory:* 88° at Fort Sill and 78° at Fort Gibson. *Minnesota:* 62° at Saint Paul and 55° at Duluth, 54° at Breckinridge. *Dakota:* 68° at Fort Buford and Yankton, 45° at Pembina, and 72° at *Olivet and *Morriston. *Colorado:* 73° at Denver and 25° at Pike's Peak, 70° at *Fort Collins. *New Mexico:* 81° at La Mesilla and 63° at Santa Fé. *Wyoming:* 69° at Cheyenne. *Utah:* 62° at Salt Lake City and 51° at *Coalville. *Nevada:* 84° at *Tulasco Wells, 65° at Winnemucca, and 56° at Pioche. *Arizona:* 87° at Tucson, 78° at Fort Verde and 72° at Fort Apache. *Idaho:* 64° at Boise City. *Montana:* 72° at Fort Keogh and 68° at Fort Benton. *California:* 88° at *Livermore, 78° at Red Bluff, 69° at San Diego. *Oregon:* 58° at Portland and 69° at Umatilla. *Washington Territory:* 58° at Olympia.

Minimum temperatures.—Maine: —1° at Eastport and —5° at *Orono. *New Hampshire:* —13° at Mount Washington and —1° at *Dunbarton. *Vermont:* —1° at Burlington and —4° at *Lunenburg and *Newport. *Massachusetts:* 12° at Boston and Springfield and 2° at *South Lee. *Rhode Island:* 14° at Newport. *Connecticut:* 12° at New Haven and 10° at *Southington. *New York:* 16° at New York and 8° at Oswego, 1° at *Plattsburg Barracks and —2° at *Madison Barracks. *New Jersey:* 18° at Barnegat and Atlantic City, 13° at *Newark. *Pennsylvania:* 18° at Pittsburgh and 6° at *Franklin. *Delaware:* 25° at Delaware Breakwater and 22° at *Dover. *Maryland:* 22° at Baltimore and 13° at *Owings' Mills. *District of Columbia:* 21° at Washington. *Virginia:* 27° at Norfolk, 30° at Lynchburg and 18° at *Mount Solon. *West Virginia:* 20° at Morgantown and *Helvetia. *North Carolina:* 33° at Charlotte and 31° at Kittyhawk, 25° at *Franklin and *Highlands. *South Carolina:* 40° at Charleston and 37° at *Aiken. *Georgia:* 43° at Savannah, 35° at Augusta and 34° at *Gainesville, 32° at *McPherson Barracks. *Florida:* 63° at Key West and 40° at Pensacola, 36° at *Fort Barrancas. *Alabama:* 35° at Mobile and Montgomery and 34° at *Green Springs. *Mississippi:* 35° at Vicksburg and 34 at *Fayette. *Louisiana:* 42° at New Orleans and 34° at Shreveport, 38° at *Point Pleasant. *Texas:* 32° at Indianola and Rio Grande City, 24° at Eagle Pass, 15° at Stockton, 14° at Denison and —2° at Fort Elliott. *Ohio:* 28° at Cincinnati and 15° at Cleveland, 8° at *North Lewisburg. *Kentucky:* 27° at Louisville. *Tennesssee:* 29° at Nashville and 28° at *Clarksville and *Ashwood. *Arkansas:* 32° at Little Rock and 28° at *Mount Ida. *Michigan:* —16° at Escanaba, —8° at Alpena, 11° at Detroit and Port Huron. *Indiana:* 21° at Indianapolis and 18° at *Wabash. *Illinois:* 28° at Cairo, 19° at Chicago, and 10° at *Anna. *Missouri:* 23° at Saint Louis and —4° at *Oregon. *Kansas:* —8° at Dodge City and 4° at Leavenworth, —4° at *Creswell. *Wisconsin:* —1° at La Crosse, 10° at Milwaukee, and —12° at *Neillsville. *Iowa:* —3° at Des Moines, —21° at *Vail, 19° at *Glenwood, and 18° at *Logan. *Nebraska:* —21° at North Platte and —7° at Omaha. *Indian Territory:* —10° at Fort Sill. *Minnesota:* —30° at Breckinridge, —18° at Duluth, and —7° at Saint Paul. *Dakota:* —31° at Pembina, —23° at Forts Buford and Stevenson, and —16° at Yankton. *Colorado:* —10° at Denver, —14° at Pike's Peak, and —12° at *Fort Collins. *New Mexico:* 24° at La Mesilla and 0° at Santa Fé. *Wyoming:* —17° at Cheyenne and —42° at *Fort Fred Steele and —34° at *Fort Fetterman. *Utah:* 5° at Salt Lake City and —20° at *Coalville. *Nevada:* 2° at Winnemucca and 5° at Pioche, 0° at *Carson City and 2° at *Tulasco Wells. *Arizona:* 30° at Florence and Phœnix, 11° at Prescott, and 18° at Fort Apache. *Idaho:* 10° at Boise City. *Montana:* —24° at Fort Keogh, —18° at Fort Benton, and —22° at Virginia City. *California:* 19° at Campo, 39° at San Diego and San Francisco, 31° at Visalia, 28° at Red Bluff, 15° at *Fort Bidwell; and —10° at *Truckee. *Oregon:* 12° at Umatilla, 19° at Roseburg, 25° at Portland, and —4° at *Fort Harney. *Washington Territory:* 23° at Olympia.

Ranges of temperature at Signal Service stations.—The monthly ranges will appear from an examination of the maxima and the minima just given. The greatest daily ranges vary in New England from 21° at Wood's Holl, 27° at Springfield, Mass., to 51° at Eastport and 42° on Mount Washington. For Middle Atlantic states from 23° at Sandy Hook and New York, 25° at Albany to 32° at Norfolk. South Atlantic states, 16° at Portsmouth, N. C., 26° at Atlanta, 28° at Jacksonville to 31° at Augusta. Eastern Gulf states, 13° at Key West, 21° at Cedar Keys to 26° at Pensacola and 33° at Montgomery. Western Gulf states, 19° at Galveston, 25° at Little Rock, 27° at Vicksburg to 37° at Corsicana. Tennessee and Ohio valley, 22° at Cairo to 29° at Morgantown and Nashville, and 36° at Knoxville. Lower Lake region, 24° at Buffalo to 27° at Detroit and Rochester and 30° at Oswego. Upper Lake region, 26° at Chicago, 32° at Port Huron to 35° at Duluth and 50° at Alpena. Upper Mississippi valley, 24° at Springfield, Ill., 27° at Davenport to 36° at Saint Paul and 38° at Des Moines. Red river of the North valley, 35° at Pembina and 43° at Breckinridge. Missouri valley, 32° at Leavenworth, 39° at Yankton and Bismarck to 43° at Fort Buford. Texas, 30° at Denison and Rio Grande City to 45° at Concho. Eastern Rocky Mountain slope, 35° at Fort Gibson to 44° at Dodge City, 49° at Fort Elliott and 52° at North Platte. Middle Plateau district, 29° at Pioche, 32° at Boise City and Salt Lake City to 42° at Winnemucca. California, 20° at San Francisco, 30° at Sacramento and Visalia to 33° at Los Angeles and 37° at Red Bluff.

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* Those marked with a star (*) are reported by U. S. Army post surgeons or voluntary observers.

Frost has generally prevailed to the 31st along the entire Rocky Mountain slope southward to latitude 35° and eastward to the Atlantic ocean; southward of that parallel the following cases are reported: Near Mayport, Fla., light on the 30th; Savannah, Ga., light on the 30th and 31st, slightly injuring plants in low places; Augusta, Ga., 25th, 26th, 30th, 31st, heavy frost, damaging gardens; Clarksville, Tex., 14th to 17th, materially injuring corn, fruit, and garden vegetables; 14th to 17th, New Ulm and Austin, Tex.; Mesquite, 13th to 15th, killed corn planted in February, destroyed all early fruits; Melissa, Tex., 14th, 15th, gardens injured; Aiken, S. C., 31st; Mississippi, 17th, near Fayette; Quitman, Ga., 31st, light on low grounds; Gainesville, Ga., 17th, 23d, 24th, and on 30th, 31st killing beans and tomato tops; Houston, Fla., 29th, 30th; Green Springs, Ala., 17th, 30th. On the Pacific coast frost was frequent to end of month in the northern half—in California it has been reported as follows: Salinas City, frequent; Mount Saint Helena, 4th, (8th, hardy orange trees killed to the ground, other trees seriously injured); Lompoc, frequent. Point San Jose, 13th, 16th; Caliente, 25th, freezing Eucalypti trees; at Charleston, S. C., 30th, slightly injuring garden vegetables; at Charlotte, N. C., 31st, injuring fruit trees and vegetables; Atlanta, Ga., 17th, 29th; Texas, Fredericksburg, 10th to 19th, killing all vegetables and injuring wheat badly; Boerne, 14th to 16th, very severe, doing considerable damage to vegetation; San Antonio, 16th, seriously damaging fruit and crops; Uvalde, 15th; Brackettsville, 12th, killing all vegetables; Pilot Point, 15th, damaging vegetables and fruit; Concho, 26th; Castroville, 13th, 16th, injuring fruit and crops; Montgomery, Ala., 29th, 30th, in country near; Little Rock, Ark., 17th; Indianola, Tex., 15th, 16th.

Ice was general north of parallel 37°. In North Carolina, at Weldon, 23d; Lenoir, 25th, 31st; Statesville, 25th, 30th; Charlotte, 30th; in Tennessee, at Ashwood, 25th; Texas, Melissa, 14th, 15th; Austin, 14th to 17th; Castroville, 15th; San Antonio, 16th, ½ inch thick. California: Point San José, 13th; San Francisco, 4th, sidewalks frozen, 12th, 29th; Sacramento, 15th; Los Angeles, 16th. Georgia: Augusta, 31st.

PRECIPITATION.

The general distribution of the rainfall, including melted snow, for March, 1880, is illustrated upon chart No. III, as accurately as possible from about 500 reports. This chart shows the area of maximum precipitation over Tennessee, northern Mississippi, Alabama, and northwestern Georgia. The minimum precipitation in amounts less than one inch fell over the Plateau, the Rocky Mountain districts, a portion of the central Missouri and the greater part of the Missouri valley. In the left-hand corner of the same chart will be found a table of average rainfalls for the month of March. Large excesses over the average for the present month are reported from the Gulf states and Tennessee, and a slight excess from the Middle Atlantic states, and the South Pacific Coast region. From all other districts differences are reported, being small except in New England, Lower Missouri valley, the North and Middle Pacific Coast regions.

Unusually heavy rains.—2d, Denison, Tex., 2.01 inches in 10 hours and 20 minutes; Melissa, Tex., 2.00 inches in 14 hours. 3d, Memphis, 1.28 inches in 8 hours; Little Rock, Ark., 2.15 inches in 8 hours. 3d, Franklin, N. C., 2.60 inches in 22 hours; Chattanooga, Tenn., 2.17 inches in 16 hours. 4th, Highlands, N. C., 2.70 inches in 21 hours; Duluth, 0.98 inch (melted snow) in 4 hours and 15 minutes. 7th, Austin, Tenn., 2.18 inches in 11 hours. 8th, New Orleans, 2.81 inches in 8 hours; Galveston, 1.24 inches in 8 hours; Cape Henry, Va., 1.02 inches in 8 hours; Fayette, Miss., 2.80 inches. 9th, Gainesville, Ga., 8th, 9th, 2.65 inches in 22 hours; Mobile, 3.49 inches in 8 hours; Montgomery, 1.34 inches in 8 hours; Charlotte, N. C., 1.69 inches in 8 hours.

10th, PointPleasant, La., 2.51 inches Green Springs, Ala., 10th, 11th, 1.97 inches in 18 hours; Forsyth, Ga., 10th, 11th, 3.10 inches in 25 hours. 11th, Little Rock, Ark., 2.11 inches in 16 hours; Corsicana, Tex., 1.58 inches in 8 hours; Vicksburg, 10th, 11th, 2.27 inches in 16 hours; Augusta, 1.53 inches in 8 hours; Denison,Tex., 1.20 inches in 8 hours; Point Pleasant, La., 3.00 inches; Mount Ida, Ark., 3.20 inches in 22 hours; New Ulm, Tex., 10th, 11th, 3.75 inches, Atlanta, 1.02 inches in 8 hours; Melissa, Tex., 2.00 inches in 9 hours; 11th, 12th, Statesville, N. C., 3.10 inches in 18 hours; Ashwood, Tenn., 2.75 inches in 24 hours. 12th, Nashville, 2.78 inches in 16 hours; Memphis, 2.75 inches in 8 hours; Atlanta, 1.13 inches in 8 hours; Austin, Tenn., 2.74 inches; Gainesville, Ga., 13th to 16th, 5.72 inches in 82 hours. 13th, Montgomery, 1.52 inches in 8 hours; Franklin, N. C., 14th to 16th, 4.10 inches. 14th, Fort Barrancas, Fla., 2.48 inches in 9 hours. 15th, Chattanooga, 1.83 inches in 8 hours; Knoxville, 1.05 inches in 8 hours; Vicksburg (14th, 15th), 4.63 inches; Pensacola, Fla., 1.25 inches in 7 hours; Point Pleasant, La. (14th, 15th), 5.01 inches in 37 hours; Austin, Tenn., 2.80 inches. 16th, Highlands, N. C., 2.55 inches; Montgomery, Ala., 1.67 inches in 6 hours; Pensacola, Fla., 1.64 inches in 6 hours and 20 minutes; Green Springs, Ala., 14th to 16th, 4.95 inches; Fort Barrancas, Fla., 2.09 inches in 10 hours, Atlanta, 1.32 inches in 8 hours. 18th, Point Pleasant, La., 2.00 inches in 8 hours; Shreveport, 1.40 inches in 6 hours; Fayette, Miss., 2.10 inches. 19th, Forsyth, Ga., 9.20 inches in 8 hours; Augusta, 1.71 inches in 6 hours; Smithville, 1.22 inches in 8 hours; Chincoteague, Va., 1.43 inches in 8 hours; Cape Lookout, N. C., 1.73 inches in 8 hours; Portsmouth, N. C., 1.82 inches in 6 and one-half hours. 21st, New Ulm, Tex., 2.50 inches in 12 hours; Galveston, 1.70 inches in 8 hours; Castroville, Tex., 1.18 inches in 14 hours. 26th, New Corydon, Ind., 26th, 27th, 2.29 inches in 17 hours; Fort Leavenworth, Kans., 1.60 inches in 6 and one-half hours, 27th Cleveland, Ohio, 0.50 inch in 12 minutes: Detroit, 1,20 inches in 8 hours; Indianapolis, 2.27 inches; Chincoteague, Va., 1.43 inches in 8 hours. 31st, Denison, Tex., 1.10 inches in 4 hours.

Largest monthly rainfalls, including melted snow.—Point Pleasant, La., 13.16 inches; McPherson Barracks, Ga., 12.46 inches; Franklin, N. C., 12.40 inches; Chattanooga, Tenn., 12.16 inches; Highlands, N. C., 12.00 inches; Atlanta, Ga., 11.87 inches; Gainesville, Ga., 11.75 inches; Murphy, N. C., 11.70 inches; Vicksburg, Miss., 11.23 inches; Green Springs, Ala., 10.76 inches; Cape Henry, Va., 10.72 inches; Austin, Tenn., 10.38 inches; Forsyth, Ga., 10.14 inches; Statesville, N. C., 9.90 inches; Charlotte, N. C., 9.57 inches; Princeton, Cal., 9.50 inches; Mobile, Ala., 9.41 inches; Montgomery, Ala., 9.26 inches; New Ulm, Tex., 9.13 inches; Memphis, Tenn., 8.82 inches; Fayette, Miss., 8.60 inches; Knoxville, Tenn., 8.59 inches; Ashwood, Tenn., 8.50 inches; Nashville, Tenn., 8.16 inches.

Smallest monthly rainfalls, including melted snow.—Fort Abraham Lincoln, Dak., and Wickenburg, Ariz., trace; Fort Wallace, Kans., 0.02 inch; Punta Rassa, Fla., 0.03 inch; Dodge City, Kans., 0.04 inch; Cheyenne, Wyo., 0.06 inch; Fort Union, N. Mex., 0.08 inch; Prescott, Ariz., and Socorro, N. Mex., 0.11 inch; Pioche, Nev., 0.12 inch; Vail, Iowa, 0.14 inch; Stockton, Tex., Mammoth Tank, Cal., and Santa Fé, N. Mex., 0.15 inch; North Platte, Nebr., 0.18 inch; Whitewater, Cal., 0.20 inch; Fort Buford, Dak., and Denver, Colo., 0.21 inch; Tulare, Cal., 0.24 inch; Howard, Nebr., 0.26 inch; Browns, Cal., 0.27 inch; El Paso, Tex., and Fort Verde, Ariz., 0.30 inch; Clear Creek, Nebr., and Pembina, Dak., 0.32 inch; Umatilla, Oreg., and Fort Fetterman, Wyo., 0.35 inch; Fort Custer, Dak., 0.36 inch; Winnemucca, Nev., 0.37 inch; Fort Collins, Colo., 0.38 inch.

Rainy days.—The days on which rain or snow has fallen vary as follows: New England, 15 to 24; Middle Atlantic states, 14 to 20; South Atlantic states, 8 to 20; Eastern Gulf states, 4 to 16; Western Gulf states, 12 to 14; Lower Lake region, 13 to 22; Upper Lake region, 8 to 18; Ohio valley and Tennessee, 14 to 21; Upper Mississippi valley, 8 to 17; Missouri valley, 3 to 11; Red River of the North valley, 5 to 6; Eastern Rocky Mountain slope, 1 to 11; Texas, 2 to 16; Rocky Mountains, 2 to 10; Middle and Southern plateaux, 3 to 15; California, 5 to 9; Oregon, 17 to 19.

Cloudy days.—The number varies in New England from 9 to 17; Middle Atlantic states, 9 to 17; South Atlantic states, 3 to 19; Eastern Gulf states, 0 to 15; Western Gulf states, 13 to 17; Lower Lake region, 11 to 15; Upper Lake region, 6 to 15; Ohio valley and Tennessee, 12 to 17; Upper Mississippi valley, 6 to 11; Missouri valley, 2 to 11; Red River of the North valley, 9 to 12; Eastern Rocky Mountain slope, 3 to 13; Texas, 11 to 20; Rocky Mountains, 1 to 9; Middle plateau, 0 to 12; California, 2 to 6.

Hail.—California: Mount Saint Helena, 24th, 28th; Princeton, 24th; San Diego, 25th, size of pea; Sacramento, 3d; Red Bluff, 3d, 27th; Salinas, 3d; Visalia and Point San José, 3d, 25th; Camp Sheridan, Nebr., 5th. Illinois: Rockford, 4th; Mount Sterling, 4th, 5th. Indiana: Vevay, 5th, 25th; Logansport, 23d; Spiceland, 4th. Iowa: Nora Springs, 3d, 23d; Fort Madison and Independence, 25th; Monticello, 25th, 26th; Cresco and Fort Dodge, 31st. Kansas: Leavenworth, 26th; Yates Center, 7th; Holton, Lawrence, Independence, Cedar Vale, and Wellington, 26th; at latter place very large, some stones 1½ to 2 inches in diameter. Massachusetts: Fall River, 16th. Missouri: Oregon, 24th; Corning, 26th. Nebraska: De Soto, 25th. New

Jersey: Princeton, 28th. New York: Fort Niagara, 5th; Starkey, 11th. North Carolina: Weldon, 12th; False Cape, 30th. Ohio: North Lewisburg, 4th; Norwalk, 5th; Jacksonburg, 10th, 15th, 26th; Cincinnati, 11th; Bellefontaine, 4th, 27th; Wooster and Ringgold, 27th; at latter place covering ground, of all shapes and sizes. Pennsylvania: Dyberry, 25th. Vermont: Woodstock and Lunenburg, 5th. Virginia: Walnut Grove, 28th, 30th, 31st; Cape Henry and Norfolk, 28th. Idaho: Boise City, 11th. Oregon: Portland, 11th, 25th; Umatilla and Roseburg, 25th. Washington Territory: Dayton, 3d. Dakota: Fort Yates, 26th, 27th. Texas: Denison, 31st; Galveston, 21st. Vermont: Burlington, 5th. Wisconsin: La Crosse, 25th, 26th. Kentucky: Louisville, 5th. Georgia: Atlanta, 27th.

Snow fell frequently in the northern half of the country to the end of the month. At points of special interest it fell as follows: On summit of Mount Diablo, Cal., 4th, 5th; Fort Union, N. Mex., 1st to 21st; Portland, Oreg., 1st to 16th; Las Cruces, N. Mex., 15th to 18th; McKavett and Uvalde, Tex., 14th; False Cape, N. C., 30th; Augusta, Ga., 12th, light spits; Lynchburg, Va., 12th; Melissa and Mesquite, Tex., 15th.

Largest monthly snowfall in inches.—California: Summit, 89; Cisco, 76; Truckee, 46.5; San Gorgonio, 13.5; Mount Washington, N. H., 48.7; South Lee, Mass., 35; Pike's Peak, 27.9; Oswego, 25.9; Alta, Cal., and Newport, Vt., 19; Duluth, Mich., and Springfield, Mass., 18.3; Westborough, Mass., 17.5; Flushing, N. Y., and Dunbarton, N. H., 16; Somerset and Rowe, Mass., Freehold, N. J., 55; Southington and Grafton, N. H., 15; Fall River, Mass., and Escanaba, Mich., 14; Antrim, N. H., and Neillsville, Wis., 13.

Snow on ground at end of month.—On summit of Mount Washington, 24 to 36 inches; on summit of Pike's Peak, 4 inches; Westborough, Mass., 3 inches; Auburn, N. H., 1 inch.

Rain and snow from a cloudless sky.—Las Cruces, N. Mex., 18th, snow; Oswego, N. Y., 15th, snow; Woodstock, Vt., 6th, rain.

RELATIVE HUMIDITY.

The percentages of mean relative humidity for the month range as follows: New England, 62 to 84; Middle Atlantic states, 60 to 73; South Atlantic states, 63 to 78; Eastern Gulf states, 68 to 75; Western Gulf states, 67 to 84; Ohio valley and Tennessee, 57 to 74; Lower Lake region, 66 to 72; Upper Lake region, 61 to 76; Upper Mississippi valley, 59 to 70; Missouri valley, 60 to 82; Red River of the North valley, 90 and 91; Eastern Rocky Mountain slope, 46 to 64; Texas, 44 to 75; Western plateau, 36 to 62; California, 46 to 74; Oregon, 72 to 80. High stations report the following averages not corrected for altitude: Mount Washington, 87.8 per cent.; Cheyenne, 42.0; Denver, 40.4; Virginia City, 58.0; Santa Fé, 41.6; Pike's Peak, 65.5.

WINDS.

The prevailing direction of the winds for the month of March, 1880, is shown by arrows flying with the wind on chart No. II. The prevailing winds throughout the country east of the Rocky Mountains except in Texas and along the South Atlantic and Florida coasts were northwesterly. Along the Atlantic coast from Boston southward to Norfolk the prevailing direction at every station was northwest.

Total movements of the air.—The following are the largest total movements recorded in miles at the Signal Service stations during the month of March, 1880: Pike's Peak, 19,785; Delaware Breakwater, 15,269; Sandy Hook, 14,140; Cape Lookout, 13,715; Kittyhawk, 13,426; Thatcher's Island, 13,095; Indianola, 12,419; Barnegat, 12,344; Cape Henry, 12,187; Cape Hatteras, 11,996; Wood's Holl, 11,913; Portsmouth, N. C., 11,982. There is no report from Mount Washington, owing to frost interfering with the registering apparatus, but the velocities exceeding 50 miles were reported on 21 days. The following are the highest: 3d, 6th, 12th, 17th, and 24th, NW. 84 miles; 25th, N., 90; 22d, NW., 93; 5th, 14th, 26th, NW., 96; 7th, W., 102. The smallest movements are Nashville, 2,314; Deadwood, 2,337; Roseburg, Oreg., 2,883; Tucson, Ariz., 2,873; Uvalde, Tex., 2,939; Visalia, Cal., 3,034; La Mesilla, N. Mex., 3,218; Lynchburg, Va., 3,286; Fort Buford, Dak., 3,300; Los Angeles, Cal., 3,622.

Local storms.—Indianapolis, Ind., 4th, about 10.30 p. m. a severe tornado visited the city, passing through the northern section, in a direction from southwest to northeast. The storm cloud appeared as an immense dark mass with a long trunk extending downward toward the earth, and accompanied by a loud rumbling noise like an approaching train of cars. The cloud, during its progressive movement, pursued a zigzag course, alternately changing from NE. to SE., which was indicated by the *debris*. The destruction to property was estimated at $100,000. Alto, Ind., 4th, about 10 p. m. severe wind and rain storm, one house destroyed and its nine occupants injured—one fatally. La Fayette, Ind., 4th, about 10 p. m. heavy wind and rain storm, causing considerable damage. Spencer, Ind., 4th, about 10 p. m. heavy wind and rain storm, fences and out-buildings destroyed. Liberty, Ind., 5th, a very severe wind and rain storm from the west in the early morning, causing considerable damage. Toledo, 4th, 11.15 p. m. a severe tornado passed over the city from southwest to northeast, causing immense damage to property, killing two persons and injuring several others. At several points in the storm's path the rotary movement from right to left of the destructive winds—a characteristic feature of the tornado—was developed, as shown by the direction of the *débris*. Persons who were out during the storm reported vivid lightning and heavy thunder in the south and southwest. Shortly before the storm broke upon the city the barometer fell rapidly and the atmosphere was decidedly close and oppressive. Madison, Ind., 5th, at 2 a. m. a heavy wind and rain storm, causing great loss of property. Clayton, Bourbon County, Alabama, 15th, a very severe storm of wind and rain during the night delayed all railroad communication in the vicinity, and trees and fences were generally destroyed. One house was completely demolished, and others more or less damaged. Pike County, Alabama, 18th, a destructive tornado was reported to have passed across the southern portion of the county during the evening, causing great damage to timber and fencing, and blowing down and unroofing houses. The tornado struck about three miles west of Smilie's bridge on Corench River, and took an easterly course for a distance of ten miles, when it disappeared. The buildings and fences on fourteen plantations were scattered in ruins.

The following notes are of interest respecting the unusually heavy wind storms of the 26th and 27th: Las Cruces, N. Mex., 26th, very violent sand storm, filling the air with dust. Omaha, Nebr., 26th, very sudden and violent west wind, overturning buildings; 27th, heavy wind still continued, three houses blown down—many unroofed; dummy trains could not cross railroad bridge during the day. Leavenworth, Kans., 27th, blinding dust storm almost obscuring the sun at 10 a. m. Fort Gibson, Ind. T., 27th, violent wind storm, blowing down flag-staff at post and injuring buildings slightly; Fort Davis, Tex., violent sand storm; Corsicana, Tex., severe wind storm, doing considerable injury; Saint Louis, 27th, wind SW. 60 miles at 8 a. m., and several times during the day reached a velocity of 48 miles; Keokuk, Iowa, 27th, violent wind storms, SW. 37 miles; Davenport and Dubuque, Iowa, and Springfield, Ill., 27th, violent thunder storms with heavy wind, remarkable fall in the barometer; Milwaukee, Wis., 27th, wind 40 miles E. and barometer lowest on record; much damage to city property and shipping; Knoxville, Tenn., 27th, violent SW. wind, blowing down saw mill, killing one man; Morristown, Dak., 27th, high wind storm unroofing buildings; Louisville, Ill., 27th, most violent wind storm in many years; New Corydon, Ind., 27th, very violent gale, estimated velocity 60 miles; Muscatine, Iowa, 27th, worst storm of wind and rain that has ever visited this section, barometer remarkably low; Lawrence, Kans., 27th, violent wind storm, maximum velocity 70 miles, from 3 to 5 a. m.; Wellington, Kans., 27th, severe NW. gale, much damage to buildings; Cedar Vale, Kans., 26th and 27th, violent gale, much damage to fences, trees, and buildings; Ashley, Mo., 27th, high wind, blowing down trees and fences; Pierce City, Mo., 27th, 2 a. m., high wind from the NW., blowing down much fencing; Genoa, Nebr., 26th, violent wind storm from the west; Howard, Nebr., 27th, most violent wind storm for many years, dust gathered in drifts from 1 to 2½ feet in depth; Ringgold, Ohio, 27th, heavy wind and hail storm. Professor Nipher reports this storm as the "most remarkable phenomenon of the month. It covered the entire state, except the extreme southern part. The atmosphere was filled, during the whole day, with a fine grayish dust, which, in the western part of the state and in eastern Kansas, was so dense as to obscure the light of the sun and to render objects invisible at a distance of from 100 to 300 yards. The wind was very high, coming, in most cases, from the west and northwest."

Sand storms.—Fort Garland, Col., 12th (13th violent). Umatilla, Oreg., 5th, most violent; maximum velocity, 62 miles W. at 12 and 12.30 p. m., accompanied with electricity so intense that it was impossible to touch anemometer wire or battery without experiencing severe shock; 25th, very violent and accompanied with much electricity. Las Cruces, N. Mex., 26th; Davis, Tex., 27th; Fort Yuma, 7th, 25th.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily indications for March, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verifications to be 85.4 per cent. The percentages for the four elements are: Weather, 87.1; direction of the wind, 82.1; temperature, 86.0; barometer, 86.1 per cent. By geographical districts they are: for New England, 85.5; Middle states, 86.6; South Atlantic states, 87.0; Eastern Gulf states, 84.4; Western Gulf states, 79.4; Lower Lake region, 87.3; Upper Lake region, 87.1; Tennessee and the Ohio valley, 83.7; Upper Mississippi valley, 85.6; Lower Missouri valley, 87.2; Northern Pacific coast region, 77.5; Central Pacific coast region, 87.5; Southern Pacific coast region, 88.3. There were 14 omissions to predict out of 3,813, or 0.37 per cent. Of the

3,799 predictions that have been made, 137, or 3.60 per cent., are considered to have entirely failed; 109, or 2.87 per cent., were one-fourth verified; 443, or 11.66 per cent., were one-half verified; 463, or 12.19 per cent., were three-fourths verified; 2,647, or 69.68 per cent., were fully verified, so far as can be ascertained from the tri-daily weather maps.

Cautionary signals.—260 cautionary signals were displayed during the month, of which 225, or 86.5 per cent., were justified by winds of 25 miles per hour or over at or within a radius of 100 miles of the station. 94 off-shore signals were displayed, of which 85, or 90.4 per cent., were fully justified; 90, or 95.7 per cent., were justified as to direction; 86, or 91.5 per cent., as to velocity; and 3, or 3.2 per cent. were not justified either as to direction or velocity. 52 of the off-shore were changed from cautionary. 354 signals of both kinds were displayed, of which 310, or 87.6 per cent., were fully justified. The above does not include signals ordered for 50 display stations, where the velocity is only estimated. 67 cases of winds of 25 miles and over per hour, from scattering stations, were reported, and for which signals had not been ordered.

NAVIGATION.

In the table on the right-hand side of chart No. III are given the highest and lowest readings of the Signal Service river gauges for the month, with the dates of the same. The Red River at Shreveport rose gradually during the month from about 10 feet on the 1st to nearly 23 feet on the 31st. The Arkansas, at Little Rock, rose 4 feet from the 2d to the 11th, remained almost stationary until the 17th, then fell to the end of month. The Missouri varied but little throughout the month, the total range at the three stations Yankton, Omaha, and Leavenworth being from 3 to 4 feet; above Yankton it continued frozen until the latter part of the month—see notes on ice given below. The Mississippi remained closed at Saint Paul until the 29th; from La Crosse to Saint Paul the total range did not exceed 4 feet; at Cairo the water fell slowly from 1st to 6th, it then rose slowly, and passing the danger line (40 feet) on the 9th, reached 44 feet 7 inches from the 21st to the 25th, after which it fell slowly, and passing the danger line on the 30th, reached 38 feet 11 inches on the 31st; at Memphis the water continued almost stationery and within a few inches of danger-line (34 feet) from the 1st to the 18th, when it passed the danger-line and continued a few inches above that point to the end of the month, the total monthly range being only 17 inches; at Vicksburg the water rose slowly from the 2d, and passing the danger-line (41 feet) on the 11th, reached 42 feet 11 inches on the 31st; at New Orleans it rose slowly from the 18th, and passing the danger-line on the 10th, reached the maximum height, 13 inches above the danger-line, on the 28th. Notwithstanding the long-continued high stage of water from Cairo to New Orleans the amount of damage reported was comparatively small; the principal crevasses reported were (1) above Arkansas City, flooding town and adjoining plantations; (2) near Gaines' Landing, flooding the Yellow Bayou country; and (3) in Bayou La Fourche, near Lockport, causing little damage. The most damage probably occurred at Cairo, where one-fourth of the city grounds were overflowed 3 to 5 feet by "snipe" water. The Ohio, at Pittsburg, fell from 9 feet 5 inches on the 1st to 6 feet 9 inches on the 4th, rose to 14 feet on the 6th, fell to 6 feet 6 inches on the 14th, rose to 10 feet 9 inches on the 17th, fell to 5 feet on the 27th, rose to 9 feet 6 inches on the 29th, and fell to 8 feet 3 inches by the end of month; at Cincinnati the water continued almost stationary (at about 28 feet) until the 6th, when a rapid rise set in, reaching 44 feet 9 inches on the 10th; on the 12th the water commenced falling and reached 21 feet 11 inches on the 26th, after which it rose slowly to end of month; at Louisville a rise of 8 feet occurred from the 8th to 12th, and the water remained comparatively high until the 20th, after which it fell to 8 feet 8 inches on the 28th. The Tennessee, at Chattanooga, generally rose from the beginning of the month to the 18th, when the water reached 37 feet 7 inches, or 4 feet 7 inches above danger-line, after which it fell, passing the danger-line (33 feet) on the 20th and reaching 7 feet 2 inches on the 31st; on the 19th the low lands near the city were overflowed. The Cumberland, at Nashville, rose from 34 feet on the 1st to 40 feet on the 4th; fell to 32 feet on the 7th, after which it rose, and passing the danger-line (42 feet) on the 12th, reached 46 feet 6 inches on the 17th; it remained almost stationary at this high stage until the 20th, after which it fell rapidly, and on the 31st reached 11 feet; portions of the city were flooded and houses had to be vacated. The Savannah, at Augusta, remained almost stationary until the 9th, when a rapid rise set in; on the 17th the water reached the highest stage (28 feet 5 inches), after which it fell to 9 feet at end of month. The Alabama, at Montgomery, from the 15th to the 20th, overflowed low lands and the Chattahoochee, at Gainesville, Ga., on the 16th overflowed, causing much damage to crops, fences, and bridges. Since printing the table of heights of rivers on chart No. III the reports received from Portland, Oreg., give the height of water in the Columbia River; highest, 3d, 5 feet 6 inches; lowest, 22d and 23d, 1 foot 4 inches.

Ice in rivers and harbors.—The following notes on the breaking up of ice, &c., and opening of navigation are reported by observers: *Yellowstone River.*—Fort Keogh, Mont., 23d, ice broke up. Fort Buford, 24th, ditto. *Missouri River.*—At Fort Buford, Dak., the river below the mouth of the Yellowstone broke up on the 26th and above on the 28th. Fort Stevenson, ice broke up on the 29th, Bismarck, 30th, Fort Yates, 30th, 1.30 p. m. Omaha, ice disappeared on the 20th. Plattsmouth, river opened on the 2d, closed on the 14th, and open again on the 20th. *Dakota River.*—Morriston, ice disappeared on the 25th. *Mississippi River.*—Saint Paul, ice broke up on the 26th, but remained gorged until the 29th. La Crosse, 6th, river open; 14th to 18th, river frozen above city; 12th, first steamboat arrived from below. Davenport, 1st to 18th, floating ice. Keokuk, from 1st to 17th, floating ice. Burlington, 17th, river clear of ice. *Rock River.*—Rockford, Ill., 14th and 15th, river frozen over. *Des Moines Rapids canal.*—8th, open. *Lake Superior.*—Duluth, harbor closed entire month; 31st, the ice was 2 feet thick and extended out about 30 miles. Marquette, 24th, the ice in the bay over 2 feet thick. *Lake Huron.*—Alpena, 8th, steamer left port, but had to return, and was ice-bound until the 23d; river frozen until the 30th. Port Huron, 18th, first boat from Toledo. *Lake Michigan.*—At Escanaba, navigation closed; bay frozen throughout month. At Northport the bay continues low; navigation opened on the 31st. Milwaukee, 13th and 14th, ice around pier. *Detroit River.*—Detroit, first steamer left on the 9th; 13th to 19th, river full of floating ice. *Lake Erie.*—Toledo, coasting scows running on the 2d; first steamers and schooners left on the 13th. Buffalo, 19th, first vessels arrived. Sandusky, 8th, first vessel left port. Cleveland, 9th, first steamer arrived. *Lake Ontario.*—Rochester, 23d, first vessel arrived; Oswego, 21st, ditto. Catawissa, Pa., 17th, north branch of Pennsylvania canal opened for navigation. *Otsego Lake.*—Cooperstown, N. Y., lake open on the 5th, but closed again on the 9th. *Hudson River.*—Albany, 1st, river open to New York; 10th, first steamer left for New York. *Lake Champlain.*—Burlington, 6th, lake open; 23d, temporarily frozen over; 29th, Shelbourne Bay, south of city, still closed with heavy ice; 29th, first steamer left for Plattsmouth. *Lake Massabesic.*—Auburn, N. H., 31st, about half free of ice.

High tides.—Atlantic City, 29th; Portsmouth, N. C., 10th, 29th; Indianola, Tex., 21st, 22d.

Low tides.—Baltimore, 25th.

TEMPERATURE OF WATER.

The temperatures of water as observed in rivers and harbors, with average depth, at which observations were taken, is given in the table on the left side of chart No. II. At the following stations observations were not made on the dates indicated, on the account of ice: Duluth, Escanaba, and Marquette throughout the month; Alpena, 1st to 29th; Milwaukee, 13th and 14th; Detroit, 13th to 19th; Burlington, 1st to 7th and 9th to 28th. On account of breaking of thermometer no observations were made at Alpena on the 30th and 31st; at Eastport, from 10th to 31st; at Milwaukee, from 28th to 31st; at New York City, from 1st to 7th and 19th to 25th, and at San Francisco, from 1st to 13th.

ATMOSPHERIC ELECTRICITY.

Thunder-storms were reported in the various districts as follows: New England, 5th; Middle Atlantic states, 4th, 5th, 22d, 23d, 26th to 28th; South Atlantic states, 5th, 6th, 13th to 16th, 18th, 27th, 28th; Gulf states, 8th to 16th, 18th, 19th, 27th, 28th, 31st; Tennessee and the Ohio valley, 3d to 6th, 11th, 12th, 16th, 23d, 25th to 29th, 31st; Lake region, 3d to 5th, 27th; Upper Mississippi and Lower Missouri valleys, 2d to 6th, 25th to 27th, 31st; California, 3d at Sacramento and Visalia, 14th at San Diego.

Auroras.—Isolated cases of aurora are reported as follows: 1st, Pembina, Dak.; 3d, Oregon, Mo.; 8th, Nora Springs, Iowa; Manitowoc, Wis., 9th, 10th, dark segment with "merry dancers"; 9th and 21st, Frankfort, Mo.; 16th, Starkey, N. Y.; 10th, Orono, Me.; 15th, Fort Stevenson, Dak., ranging from 60° N. to 60° W.; the beams had a quick lateral motion and were most brilliant about 3 a. m. of the 16th; the beams displayed the greatest brilliancy and altitude when due north, sometimes reaching the zenith; 16th, aurora similar to the 15th though not so brilliant; Fort Sisseton, Dak., 21st, 8 to 11 p. m.; Williamstown, Mass., 30th. On the 12th at Burlington, Vt., 11.15 p. m., and Eastport, Me., 11.45 p. m.; color, pale yellow, few streamers, no dark segment. Starkey, N. Y., 8 p. m. On the 13th an aurora was observed from Eastport, Me., to Fort Sisseton, Dak., except where cloudy weather prevented observations. The following descriptions are reported: At Eastport, Me., faint, and of pale yellow color; it began at 11.45 p. m. of the 13th, and ended at 3 a. m. of the 14th. At Burlington, Vt., seen for a few minutes through a rift in clouds, and was observed to be faint. Pembina, Dak., "very brilliant aurora at 7 p. m. of the 13th, and continued into the night. The whole northern sky was more or less illumined and the light emitted was almost equal to the moon at the full. A broad arch of light, very bright but rather ill-defined, extended 170° to 270° azimuth, and sometimes reached the zenith. There was a good deal of movement, but it was rather slow and the eye had some difficulty in detecting it. There was also some striated lines of light crossing the arch, but nothing like the 'merry dancers.' A peculiarity of this aurora was a number of large whorls of nebulous light, like the large nebula in Canes Venatici, which appeared at several points along the arch and also beneath it. These whorls were constant as to duration, but not as to position, as they changed constantly, but were at no time entirely absent. There was very little variety of color, the only deviation from white being some faint traces of greenish yellow which occasionally appeared in the whorls." Fort Sisseton, 7 to 11 p. m., very bright. The display of the 17th is interesting from its unusual extent and brilliancy. It was observed from Eastport, Me., to Fort Benton, Dak., except in sections where cloudy weather prevailed. The most southerly station reporting was Somerville, N. J., where it was faint. The following are the other stations reporting it: in *Maine*, Orono, Bangor, and Gardiner; *New Hampshire*, Grafton; *Massachusetts*, Newburyport, Boston, Springfield, Williamstown, and Fall River; *Connecticut*, New Haven and New London; *New York*, Madison Barracks, North Volney, Palermo, Oswego, and Lima; *Pennsylvania*, Catawissa; *Ohio*, Toledo; *Michigan*, Detroit, Lansing, and Alpena; *Wisconsin*, Manitowoc; *Dakota*, Pembina. It is described as follows: Bangor, Me., from 11.05 till 3 a. m., greatest brilliancy at 12.30 a. m.; extent from 120° to 140° azimuth; greatest altitude, 37°; peculiarity, slender luminous beams, "merry dancers," and dark segment; color, brilliant yellow. Eastport, from 9 p. m. to 3 a. m. of the 18th, extending from NW. to NE.; altitude, 40°; peculiarities, an arch with six luminous beams shooting upwards; color, straw. Springfield, Mass., 9.30 to 10.30 p. m.; very brilliant, dark arch, altitude 18°, with "merry dancers" shooting up to altitude of 30°. New Haven, Conn., appeared at 8 p. m. It consisted of an arch of white light, measuring 12° of altitude and 40° of azimuth, with a dark-colored segment below the arch, the segment being so dark as at first to be mistaken for a cloud. Between 8 and 9 p. m. streamers of quivering white light shot upwards nearly to the zenith. The display lasted until daylight of the 18th, and would doubtless have been very brilliant but for the moon, which shone brightly during most of the time. Oswego, N. Y., from 11 p. m. till after midnight; azimuth, 50°; altitude, 5°; a luminous arch resting on dark segment; changes slight. Grafton, N. H., "first appeared at 7.20 p. m., continuing until 4 a. m. 18th. Streamers appeared at 9.30 p. m., reaching their greatest brilliancy at 10 p. m., having an altitude of 70° and a quick motion from east to west, bearing north. From 10 p. m. to 1.30 a. m., of diffuse white color, intermixed with patches of dark segments, reaching at latter hour an altitude of 40°, which was mainly the altitude of the aurora during the rest of the night. At 1.35 a. m. the aurora had a dancing motion, up and down, with the rapidity of lightning. From this time until the end, the aurora was mainly of a diffuse white, with patches of dark segment mixed in. The aurora was observed all around the horizon. The patches of dark segment had a slow lateral motion from W. to E. No dark clouds below the arch observed." Pembina, Dak., the aurora appeared at 7 p. m. It would probably have been brilliant but for the influence of the moonlight, but as it was, the display was rather pale. It extended from about 175° to 260° azimuth, and at times almost reached the zenith. There were three arches of light of very unequal brilliancy, the upper one being generally brilliant. Occasionally, rays of light started from the lower arch and reached across the upper one, and remained for a time with a tremulous motion. Those rays generally preceded the breaking up of the upper arch into hazy nebulous masses, which soon afterwards disappeared, while a new arch was developed beneath the others. After 10 p. m. there was only one arch visible, and at 11.30 p. m. it had nearly disappeared. North Volney, N. Y., streamers soon changing to striated mass. At 9. p. m., local time of the 17th, an aurora was seen at Edinburg, Scotland, lasting until 11 p. m.

Telegraphic communication interrupted by atmospheric electricity.—Socorro, N. Mex., 2d and 26th; Dodge City, Kans., 4th, severe electric storm; telegraphic instruments could be worked without battery at times; the air was filled with floating sand; Decatur, Tex., 26; Castroville, Tex., 11th and 21st; Mason, Tex., 2d, 7th, and 26th.

MISCELLANEOUS PHENOMENA.

Sunsets.—The characteristics of the sky at sunset as indicative of fair or foul weather for the succeeding twenty-four hours have been observed at all Signal Service stations. Reports from 135 stations show 4,108 observations to have been made, of which 23 were reported doubtful; of the remainder, 3,347, or 81.9 per cent., were followed by the expected weather.

Zodiacal light.—Southington, Conn., 5th, 8th, 10th, 30th. *Indiana*, New Corydon, 1st, 2d, 5th, 28th, 29th, 30th; Wabash, 1st, 5th, 8th, 29th. *Iowa*, Cresco, 5th, 9th, 11th; Monticello, 1st, 3d, 5th, 8th, 9th, 11th, 28th; Fort Dodge, 1st, 5th, 28th, 29th. *Kansas*, Cedar Vale, 1st, 3d, 4th, 7th, 10th, 27th, 30th; Yates Center, 1st, 7th, 28th, 30th, 31st. *Massachusetts*, Harvard College, Cambridge, 2d (4th at 8.30 p. m., Gamma Arietis and Zeta seemed to be on opposite borders of the light); 5th, 8th, 10th, distinct, perceptible on the 12th, other nights moonlight or cloudy; Rowe, 2d, 6th; Somerset, 1st, 2d, 4th, 5th, 6th, 8th, 10th, 30th, 31st. *Missouri*, Oregon, 1st to 4th, 7th to 10th, 28th to 31st. Clear Creek, Nebr., 1st, 8th, 28th. Freehold, N. J., 1st; Atco, N. J., 1st, 2d, 5th, 10th, 31st. Waterburg, N. Y., 2d, 4th (6th, bright), 8th, 11th (30th, bright), 31st; Ithaca, N. Y., 31st; Bellefontaine, Ohio, 1st, 2d, 30th, 31st; Dyberry, Pa., 10th; Coalville, Utah, 4th; Wytheville, Va., 2d, 4th, 5th, 9th, 29th, 31st; Dubuque, 11th; New Haven, Conn., 2d, 6th, 8th, 30th; Lynchburg, Va., 26th, 29th, 30th, 31st. Mr. Charles Hasselbrink, observer at Havana, Cuba, reports as follows: March 27th, visible from 7.15 to 7.50 p. m.; "light rises almost vertically and vanishes in the region about Omega Taurus; at beginning of observations noted a luminous band which extended horizontally as far as Cassiopeia"; 31st, visible from 7.15 p. m., not very bright or extensive. Pleiades 30° above the horizon formed the vertex of the triangle of the light. Intermittence in brightness less sensible than in former observations.

Meteors.—Corning, Mo., 3d, large as full moon and passed through zenith southwards to the horizon; Oregon, Mo., 3d, very brilliant; Fort Dodge, Iowa, 5th, 7.30 p. m., two small and very swift Perseides, moving from Algal to a point a few degrees below Capella, leaving behind two faint parallel tracks close together; 11th, a large and very slow meteor, dull yellow, size double of Jupiter when first seen, but rapidly diminishing, moved along nearly parallel to the horizon, and disappeared in four seconds.

Earthquakes.—Los Angeles, Cal., 21st, 6.25 a. m., most violent for many years, lasting about five seconds and felt within a radius of several miles; vibration from northeast to southwest, with a vertical impulse. San Gorgonia, Cal., 25th, 2.30 a. m., moderate, but sufficient to cause a perceptible vibration of the houses; duration about three seconds, and direction from southeast to northwest.

Sun spots.—The following record of observations, made by Dr. D. P. Todd, assistant, has been forwarded by Prof. S. Newcomb, U. S. Navy, superintendent Nautical Almanac Office, Washington, D. C.:

Date.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	
March, 1880.									
1st, 3 p. m...	0	1	0	0	0	0	2	3	
2d, 8 a. m...	0	2	0	0	0	0	2	5	Faculæ.
4th, 8 a. m...	0	0	1	4	0	0	1	1	Several groups of faculæ.
5th, 1 p. m...	1	1	1	1	0	0	1	1	Faculæ.
6th, 1 p. m...	0	1	0	0	0	0	1	2	
10th, 2 p. m...	2	4	1	2	0	0	2	4	Faculæ. Spots probably disappeared by solar rotation,
17th, 8 a. m...	2	2	....	....	....	....	2	2	
18th, 8 a. m...	0	0	0	0	0	0	2	2	
19th, 6 p. m...	0	0	1	1	0	0	1	1	
20th, 8 a. m...	0	0	0	0	0	0	1	1	
26th, 7 a. m...	1	2	0	0	0	0	1	2	
30th, 7 a. m...	1	6	0	0	....	....	2	8	Broad areas of faculæ.
31st, 9 a. m...	0	0	0	0	0	0	2	8	} Faculæ.
3 p. m...	1	2	0	0	0	0	3	10	

21st, 8 a. m., 22d, 9 a. m., 4 p. m., faculæ but no spots; 23d, 9 a. m., 24th, 8 a. m., 5 p. m., and 25th, 8 a. m., no spots or faculæ.

Mr. William Dawson, at Spiceland, Ind., reports: 1st, one large spot in SW. quadrant, 3 smaller spots near W. limb; 2d, group of small spots increased to 7; 9th, 5 spots in one group in NW. quadrant; 15th, 5 spots in one group near W. limb, 1 prominent spot near E. limb; 17th, 1 spot and faculæ near W. limb, 1 large spot near east of center; 23d, no spots; 29th, 1 large spot near E. limb, group of 10 small spots in SW. quadrant; 30th, 1 large spot near E. limb, and a group of 3 small spots 4′ W. of it; also a group of 10 small spots near W. edge; 31st, small spot just above the large one, 3 spots in group to W. of it, and only 5 spots in the western group.

The Signal Service observer at New Haven, Conn., reports: 4th, 1.30 p. m., small spot very near NW. limb; 8th, 1 p. m., group of 4 small spots NE. of center; 31st, 12.30 p. m., 1 large spot near center, and group of 3 in NE. center.

Mr. F. Hess, at Fort Dodge, Iowa, reports: 1st and 2d, 9 a. m., 1 spot in SW. quadrant and group of 3 in NW.; 5th, noon, 2 groups of brilliant faculæ near NE. limb; 6th, noon, 4 spots in SW.; 7th, noon, ditto, with faculæ, and a new group of 2 spots in

NW.; 8th, 8 a. m., 1 spot in SW. and 3 in NW.; 9th, noon, 3 small spots in NW.; 10th, 4 p. m., 1 large spot in NW.; 11th, 11 a. m., 1 large and 1 small spot in NW.; 14th, 10 a. m., 2 new groups, 1 very large double spot, with 3 or 4 smaller ones and faculæ in NW., and 1 large spot in faculæ in SE.; 15th, 9 a. m., ditto, and also a new brilliant white spot near SE. limb; 16th and 17th, the 2 groups still visible; 19th and 20th, 9 a. m., 1 spot in SW.; 22d to 28th, sun observed each day, but no spots or faculæ seen; 29th, noon, 2 groups, 1 of 5 spots in SW., and 1 large spot and faculæ near NE. limb; 31st, 1 large spot and faculæ, and 2 small spots surrounded by brilliant faculæ in NW. No observations on the 3d, 4th, 12th, 18th, and 30th.

Published by order of the Secretary of War.

ALBERT J. MYER,
Brigadier-General (Brevet Assigned), Chief Signal Officer, U. S. A.

PAPER 42.

MONTHLY WEATHER REVIEW, APRIL, 1880.

INTRODUCTION.

In preparing this review the following data, received up to May 13th, have been used, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 139 Signal Service stations and 14 Canadian stations, as telegraphed to this office; 138 monthly journals and 159 monthly means from the former, and 14 monthly means from the latter; reports from 27 sunset stations; 225 monthly registers from voluntary observers; 39 monthly registers from United States Army post surgeons; marine records; international simultaneous observations; monthly reports from voluntary observers in, and the local weather service of, Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

Barometric pressure.—As compared with the means for the preceding eight years, the pressure for April, 1880, east of the Rocky Mountains, shows a marked deficiency in Iowa, Minnesota, and the Upper Lake region, with a corresponding excess over the Middle Atlantic, South Atlantic and East Gulf states, Tennessee and along the coast of New England. The greatest excess is reported from Augusta, Ga., 0.12 inch above the mean, and the most marked deficiency prevailed at Saint Paul, Minn., .08 below the mean. On the Pacific coast as compared with the preceding three years a marked deficiency, ranging from .02 to .09, is reported from Oregon and Washington Territory, while in California an excess prevailed, ranging from .02 at Red Bluff to 0.11 at San Diego.

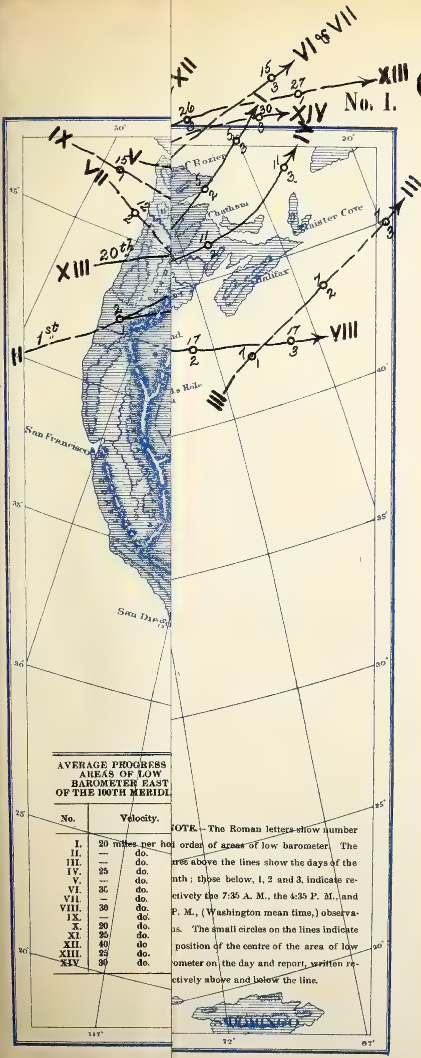
Local barometric ranges.—East of the Rocky Mountains the barometric ranges for April, 1880, increase gradually from the Florida Peninsula northwestward to the states of Nebraska, Iowa, Minnesota. Ranges exceeding one inch occurred in the Upper Lake region, the Upper Mississippi and Lower Missouri valleys, and the Eastern Rocky Mountain slope from central Texas northward to Dakota. The minimum ranges were 0.35 inch at Key West, 0.40 at Punta Rassa, and the maximum ranges 1.54 at North Platte and Marquette, 1.65 at Omaha and 1.89 at Duluth. On the Pacific coast the ranges regularly increased northward; maximum range 1.20 at Umatilla.

Areas of high pressure.—Eleven areas of high pressure have appeared during April within the limits of the Signal Service maps. Three areas only are of interest: No. II, which, in connection with low area No. II, produced the very heavy rains, from the 2d to the 4th, on the Pacific coast; No. IV, which was marked by the severe frost in the Southern States from the 9th to the 12th; No. VIII, which, developing on the Pacific coast, passed eastward to the Atlantic coast and was marked by the unusually cold weather from April 29 to May 1.

No. I.—This area, covering the Ohio valley and the Atlantic states during the 1st, withdrew slowly northeastward and dissipated during the 4th in the Canadian Maritime Provinces. The highest pressure was reported from Halifax the morning of the 3d; barometer 30.47, or 0.70 above the normal. During the 2d, brisk winds being reported, cautionary signals were ordered from Fort Macon northward to Sandy Hook. These signals were fully justified in connection with this area and were continued, in connection with low area No. I, until the 5th; maximum velocities: SW. 36 at Kittyhawk, Capes Lookout and Hatteras; S. 46 at Delaware Breakwater.

No. II.—During the 3d the pressure rose rapidly on the Pacific coast; midnight barometer at Los Angeles, 0.24 above the normal. The center of high pressure

No. 1.



AVERAGE PROGRESS
AREAS OF LOW
BAROMETER EAST
OF THE 100TH MERIDI

No.	Velocity.
I.	20 miles per ho
II.	— do.
III.	— do.
IV.	25 do.
V.	— do.
VI.	30 do.
VII.	— do.
VIII.	30 do.
IX.	— do.
X.	20 do.
XI.	25 do.
XII.	40 do
XIII.	25 do.
XIV.	30 do.

OTE.—The Roman letters show number
order of areas of low barometer. The
res above the lines show the days of the
nth; those below, 1, 2 and 3, indicate re-
ctively the 7:35 A. M., the 4:35 P. M., and
P. M., (Washington mean time,) observa-
s. The small circles on the lines indicate
position of the centre of the area of low
ometer on the day and report, written re-
ctively above and below the line.

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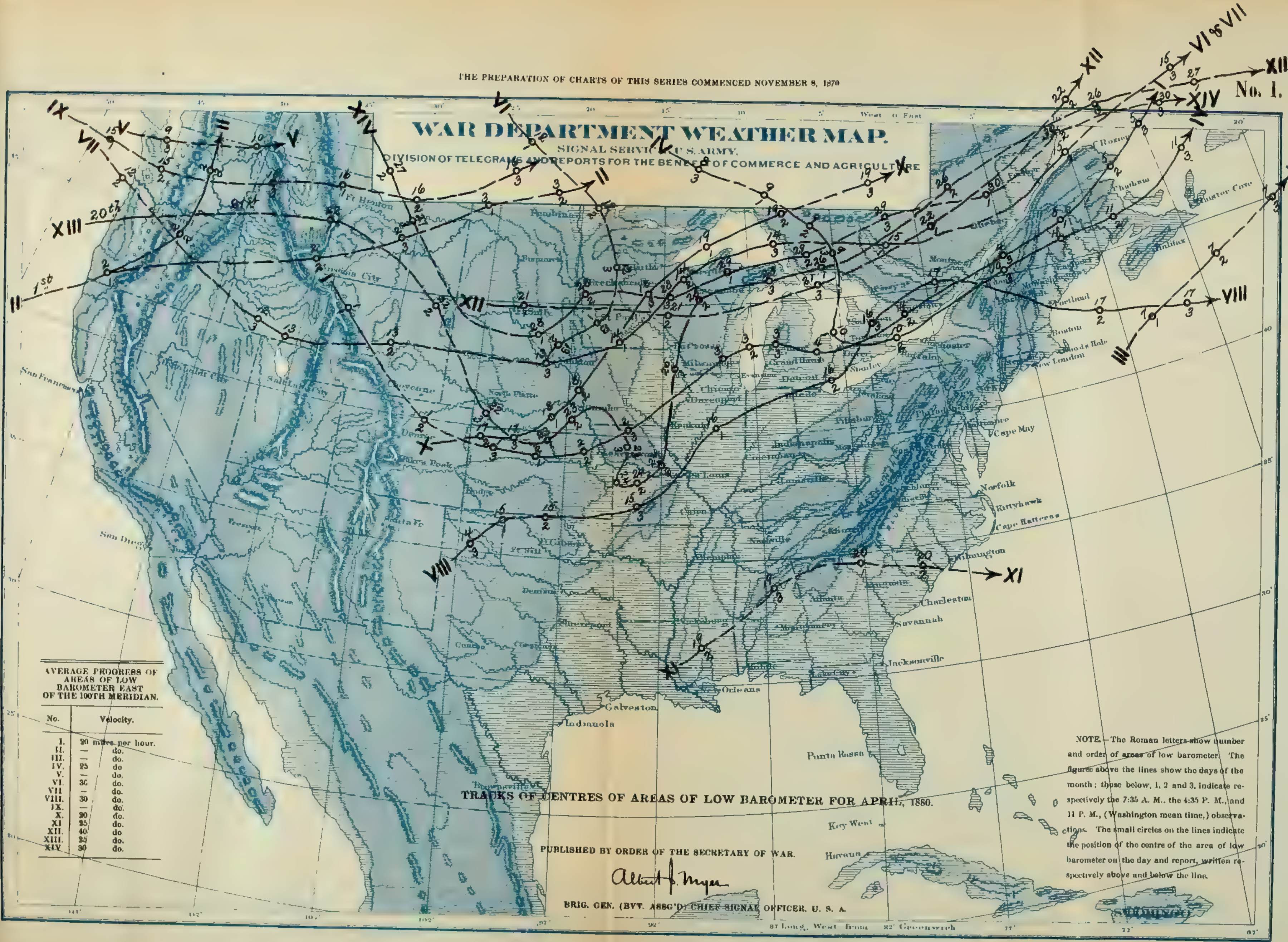
THE PREPARATION OF CHARTS OF THIS SERIES COMMENCED NOVEMBER 8, 1870

No. 1.



WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE

AVERAGE PROGRESS OF AREAS OF LOW BAROMETER EAST OF THE 100TH MERIDIAN.

No.	Velocity.
I.	20 miles per hour.
II.	— do.
III.	— do.
IV.	25 do
V.	— do.
VI.	30 do.
VII	— do.
VIII.	30 do.
IX.	— do.
X.	20 do.
XI	25 do.
XII.	40 do
XIII.	25 do.
XIV	30 do.

NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7:35 A. M., the 4:35 P. M., and 11 P. M., (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above and below the line.

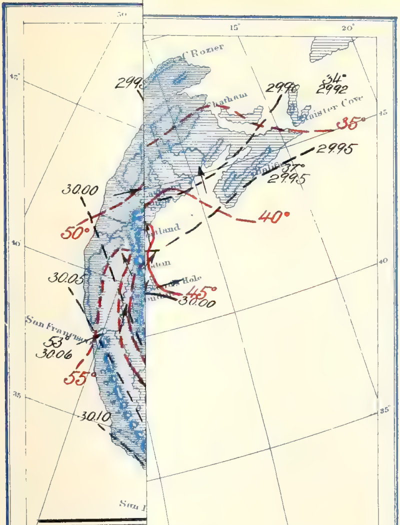
TRACKS OF CENTRES OF AREAS OF LOW BAROMETER FOR APRIL, 1880.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

No. II.



TEMPERATURE
APRIL

STATIONS.	Te a Ma
*Alpena	4
Augusta	7
Baltimore	5
Buffalo	5
Burlington, Vt.	3
Cedar Keys	
Charleston	7
Chicago	5
*Chincoteague	6
*Cleveland	5
Detroit	4
*Duluth	—
Del. Breakwater	5
Eastport	3
*Escanaba	4
Galveston	7
Grand Haven	5
Jacksonville	8
Key West	8
*Marquette	3
*Milwaukee	4
Mobile	7
New London	4
New York	4
Norfolk	6
Portland, Maine	4
Punta Rassa	—
Sandusky	—
*San Francisco	—
Savannah	7
Smithville	7
Toledo	5
Wilmington	7
Wood's Holl	4

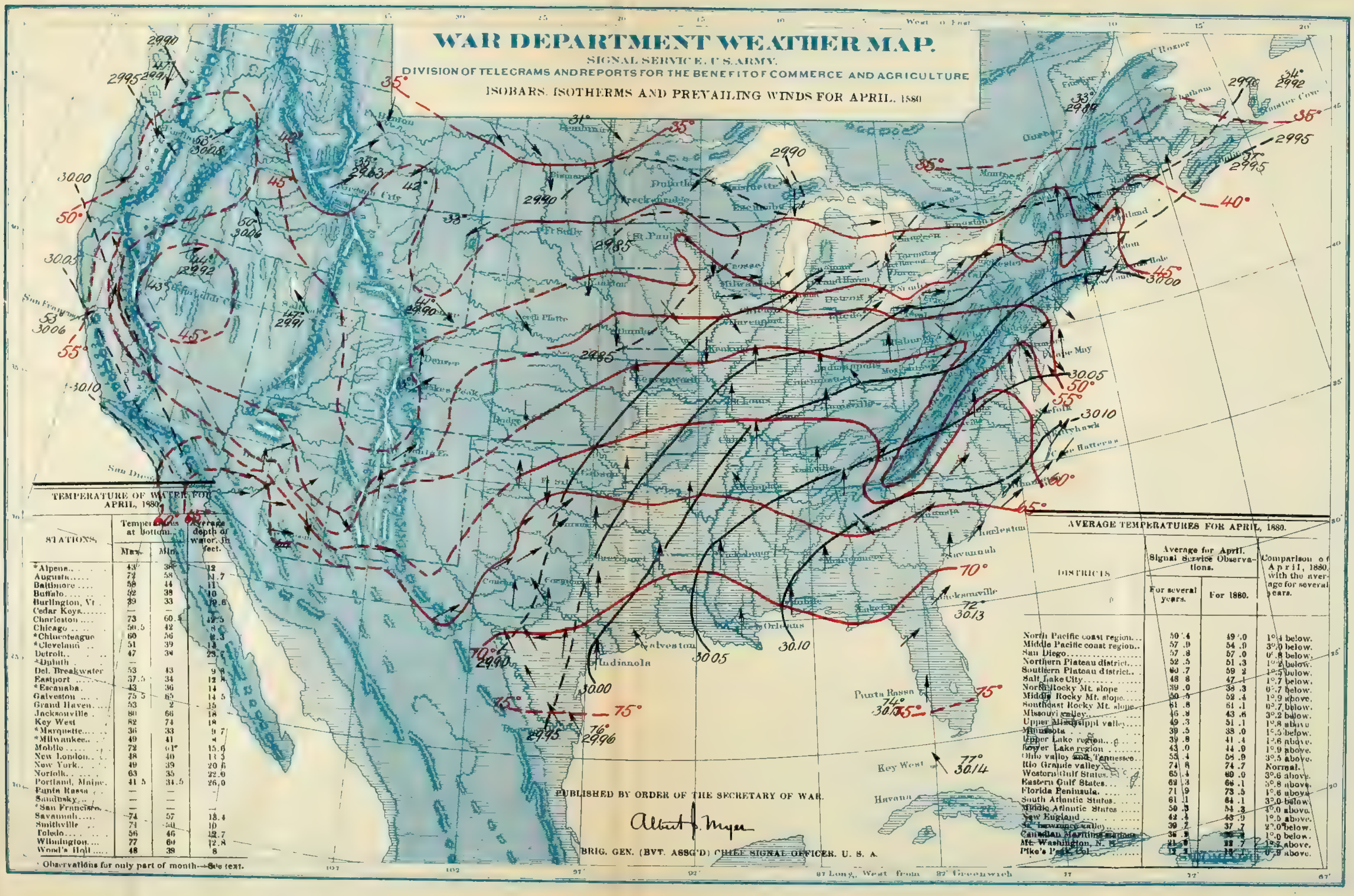
* Observations for only

TEMPERATURES FOR APRIL, 1880.

	Average for April. Signal Service Observations.		Comparison of April, 1880, with the average for several years.
	For several years.	For 1880.	
ion	50°.4	49°.0	1°.4 below.
gion	57 .9	54 .9	3°.0 below.
	57 .8	57 .0	0°.8 below.
ict	52 .5	51 .3	1°.2 below.
ict	60 .7	59 .2	1°.5 below.
	48 .8	47 .1	1°.7 below.
	39 .0	38 .3	0°.7 below.
pe	50 .5	52 .4	1°.9 above.
lope	61 .8	61 .1	0°.7 below.
	46 .8	43 .6	3°.2 below.
ey	49 .3	51 .1	1°.8 above.
	39 .5	38 .0	1°.5 below.
	39 .8	41 .4	1°.6 above.
	43 .0	44 .9	1°.9 above.
ssee	55 .4	58 .9	3°.5 above.
	74 .8	74 .7	Normal.
	65 .4	69 .0	3°.6 above.
	62 .3	66 .1	3°.8 above.
	71 .9	73 .5	1°.6 above.
	61 .1	64 .1	3°.0 below.
	50 .3	54 .3	4°.0 above.
	42 .4	43 .9	1°.5 above.
	39 .7	37 .7	2°.0 below.
tions	36 .2	[illegible]	1°.0 below.
	21 .0	22 .7	[illegible] above.
	12 .2	13 .1	[illegible] above.

72° 67°

No. II.



WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE

ISOBARS, ISOTHERMS AND PREVAILING WINDS FOR APRIL, 1880

TEMPERATURE OF WATER FOR APRIL, 1880.

STATIONS.	Temperatures at bottom.		Average depth of water, in feet.
	Max.	Min.	
*Alpena	43	38	12
Augusta	72	58	11.7
Baltimore	59	44	11
Buffalo	52	38	10
Burlington, Vt	39	33	10.6
Cedar Keys	—	—	
Charleston	73	60.5	12.5
Chicago	50.5	42	8
*Chincoteague	60	56	8.3
*Cleveland	51	39	14
Detroit	47	38	23.5
*Duluth	—		—
Del. Breakwater	53	43	9 8
Eastport	37.5	34	12
*Escanaba	43	36	14
Galveston	75 5	65	14 5
Grand Haven	53	2	15
Jacksonville	80	66	18
Key West	82	74	19
*Marquette	36	33	9 7
*Milwaukee	49	41	8
Mobile	72	61	15.6
New London	48	40	11 3
New York	49	39	20 6
Norfolk	63	35	22.0
Portland, Maine	41 5	34.5	26.0
Punta Rassa	—	—	—
Sandusky	—	—	
*San Francisco	—	—	—
Savannah	74	57	18.4
Smithville	74	50	10
Toledo	56	46	12.7
Wilmington	77	60	12.8
Wood's Holl	48	39	8

* Observations for only part of month—See text.

AVERAGE TEMPERATURES FOR APRIL, 1880.

DISTRICTS	Average for April. Signal Service Observations.		Comparison of April, 1880, with the average for several years.
	For several years.	For 1880.	
North Pacific coast region	50 .4	49 .0	1°.4 below.
Middle Pacific coast region	57 .0	54 .0	3°.0 below.
San Diego	57 .8	57 .0	0°.8 below.
Northern Plateau district	52 .5	51 .3	1°.2 below.
Southern Plateau district	60 .7	59 .2	1°.5 below.
Salt Lake City	48 .8	47 .1	1°.7 below.
North Rocky Mt. slope	39 .0	38 .3	0°.7 below.
Middle Rocky Mt. slope	50 .5	52 .4	1°.9 above.
Southeast Rocky Mt. slope	61 .8	61 .1	0°.7 below.
Missouri valley	46 .8	43 .6	3°.2 below.
Upper Mississippi valley	49 .3	51 .1	1°.8 above.
Minnesota	39 .5	38 .0	1°.5 below.
Upper Lake region	39 .8	41 .4	1°.6 above.
Lower Lake region	43 .0	44 .9	1°.9 above.
Ohio valley and Tennessee	55 .4	58 .9	3°.5 above.
Rio Grande valley	74 .6	74 .7	Normal.
Western Gulf States	65 .4	69 .0	3°.6 above.
Eastern Gulf States	62 .3	68 .1	5°.8 above.
Florida Peninsula	71 .9	73 .5	1°.6 above.
South Atlantic States	61 .1	64 .1	3°.0 below.
Middle Atlantic States	50 .3	54 .3	4°.0 above.
New England	42 .4	43 .9	1°.5 above.
St. Lawrence valley	39 .2	37 .7	2°.0 below.
Canadian Maritime stations	36 .2	[illegible]	1°.0 below.
Mt. Washington, N. H.	21 .0	22 .7	1°.7 above.
Pike's Peak, Col.	[illegible]	[illegible]	0°.9 above.

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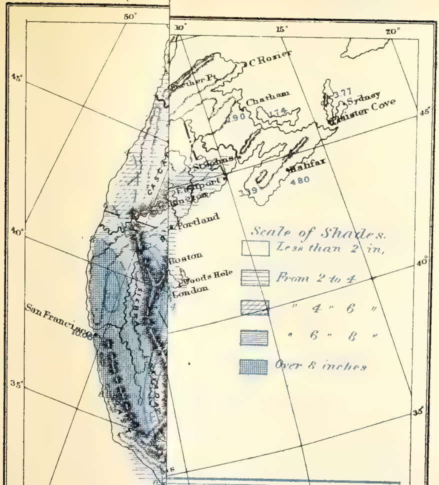
No. III.



ERS ABOVE LOW-WATER MARK, APRIL, 1880

Danger point on gauge.	HIGHEST WATER.		LOWEST WATER.	
	Date.	Height.	Date.	Height
ft. in.	Apr.	ft. in.	Apr.	ft. in
29 9	4	23 2	28	16 3
	9	8 1	16, 17	1 10
20 0	—	—	—	—
16 0	6	15 9	18	7 0
21 0	7	13 3	2	5 5
14 6	5, 6	7 3	1	5 4
18 0	9, 10	8 2	1	5 0
21 10	17, 18	12 2	1	5 10
15 0	29	9 11	1	4 2
14 6	25	11 1	1	5 8
30 0	11	17 5	6	13 6
40 0	1	37 8	16	29 8
34 0	1	33 11	30	24 5
41 0	8, 9	43 2	27	41 9
− 3 6	24	− 0 11	5, 11	− 1 8
20 0	27	14 6	23	3 1
50 0	29	45 4	24	13 8
24 0	30	19 6	24	7 10
42 0	20	27 2	15	9 8
31 0	5	16 11	15	6 6
28 0	26	19 4	19 to 22	5 9
29 0	27	14 6	23	3 1
	5	24 3	19	7 10

AVERAG

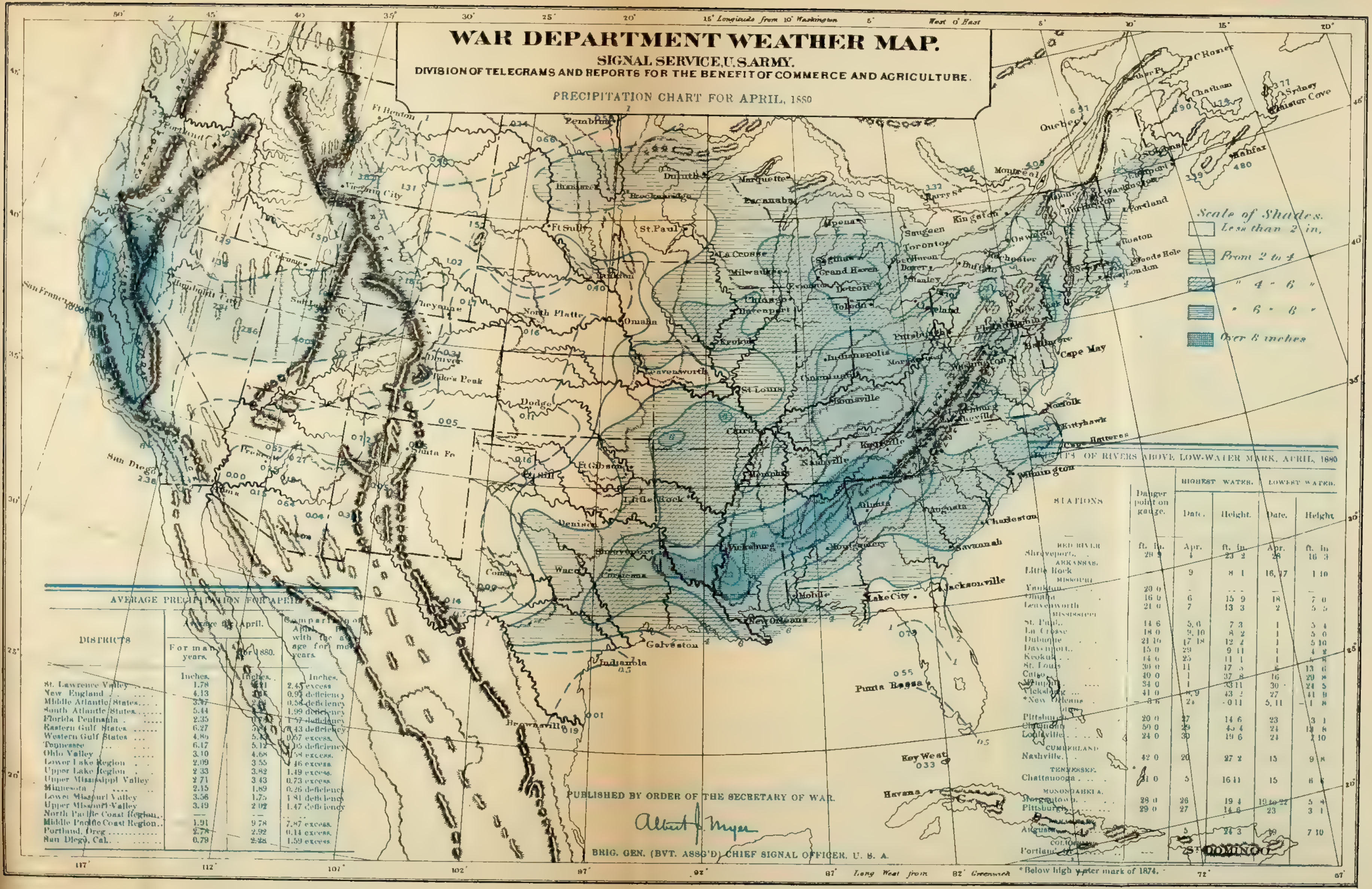
DISTRICTS.

St. Lawrence Valley....
New England..........
Middle Atlantic States...
South Atlantic States....
Florida Peninsula........
Eastern Gulf States......
Western Gulf States. ...
Tennessee...............
Ohio Valley...........
Lower Lake Region .....
Upper Lake Region. .....
Upper Mississippi Valley.
Minnesota.............
Lower Missouri Valley...
Upper Missouri Valley
North Pacific Coast Regio
Middle Pacific Coast Regio
Portland, Oreg ....
San Diego, Cal..........

25°
20°
117°
72°
67°
ST DOMINGO

k of 1874.

No. III.



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DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

PRECIPITATION CHART FOR APRIL, 1880

AVERAGE PRECIPITATION FOR APRIL.

DISTRICTS	Average for April.		Comparison of April, 1880, with the average for many years.
	For many years.	For 1880.	
	Inches.	Inches.	Inches.
St. Lawrence Valley	1.78	[illegible]	2.45 excess
New England	4.13	[illegible]	0.97 deficiency
Middle Atlantic States	3.47	[illegible]	0.56 deficiency
South Atlantic States	5.44	[illegible]	1.99 deficiency
Florida Peninsula	2.35	[illegible]	1.57 deficiency
Eastern Gulf States	6.27	[illegible]	0.43 deficiency
Western Gulf States	4.86	[illegible]	0.57 excess.
Tennessee	6.17	5.12	1.05 deficiency
Ohio Valley	3.10	4.68	1.58 excess.
Lower Lake Region	2.09	3.55	1.46 excess.
Upper Lake Region	2.33	3.82	1.49 excess.
Upper Mississippi Valley	2.71	3.43	0.73 excess.
Minnesota	2.15	1.89	0.26 deficiency
Lower Missouri Valley	3.56	1.75	1.81 deficiency
Upper Missouri Valley	3.49	2.02	1.47 deficiency
North Pacific Coast Region	—	—	....
Middle Pacific Coast Region	1.91	9.78	7.87 excess.
Portland, Oreg	2.78	2.92	0.14 excess.
San Diego, Cal.	0.79	2.28	1.59 excess.

HEIGHTS OF RIVERS ABOVE LOW-WATER MARK, APRIL, 1880

STATIONS	Danger point on gauge.	HIGHEST WATER.		LOWEST WATER.	
		Date.	Height.	Date.	Height.
	ft. in.	Apr.	ft. in.	Apr.	ft. in.
RED RIVER					
Shreveport	29 9	4	23 2	28	16 3
ARKANSAS.					
Little Rock	—	9	8 1	16, 17	1 10
MISSOURI					
Yankton	20 0	-	...	—	—
Omaha	16 0	6	15 9	18	7 0
Leavenworth	21 0	7	13 3	2	5 5
MISSISSIPPI					
St. Paul	14 6	5, 6	7 3	1	5 4
La Crosse	18 0	9, 10	8 2	1	5 0
Dubuque	21 10	17, 18	12 4	1	5 10
Davenport	15 0	29	9 11	1	4 2
Keokuk	14 6	25	11 1	1	6 8
St. Louis	30 0	11	17 5	6	13 6
Cairo	40 0	1	37 8	16	29 8
Memphis	34 0	1	33 11	30	24 5
Vicksburg	41 0	8, 9	43 2	27	41 9
*New Orleans	— 3 6	24	- 0 11	5, 11	— 1 8
OHIO					
Pittsburgh	20 0	27	14 6	23	3 1
Cincinnati	50 0	29	45 4	24	13 8
Louisville	24 0	30	19 6	24	7 10
CUMBERLAND					
Nashville	42 0	20	27 2	15	9 8
TENNESSEE.					
Chattanooga	31 0	5	16 11	15	8 6
MONONGAHELA.					
Morgantown	28 0	26	19 4	19 to 27	5 4
Pittsburgh	29 0	27	14 6	23	3 1
[illegible]					
Augusta		5	24 3	19	7 10
COLUMBIA					
Portland	---				

*Below high water mark of 1874.

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gradually moved northward, and on the afternoon of the 5th the highest pressure was reported from Umatilla, 0.47 above the normal. The highest pressure remained substantially unchanged over Oregon until the 7th, when it withdrew eastward over the Northern Plateau district and gradually dissipated on the 9th, in advance of low area No. V. In connection with this area and low area No. II, exceedingly heavy storms of rain on the coast and snow in the interior continued from the morning of the 1st until midnight of the 4th. During the 1st and 2d the rains were specially heavy, more than two inches within twenty-four hours being reported from many places in California.

No. III.—During the night of the 5th the pressure rose rapidly in the entire Missouri valley. By the afternoon of the 6th Bismarck barometer was 0.54 above the normal. Moving slowly southeastward, the highest pressure, the afternoon of the 7th, was at Leavenworth, and on the morning of the 8th at Fort Sill, where the barometer was 0.56 above the normal. At that time the entire country, except Sydney, C. B., was covered by a pressure above the normal. The afternoon of the 8th the highest pressure of the area was reported from Eagle Pass, 0.63 above the normal. The highest pressure remained unchanged in Southern Texas until the 11th, when it gradually dissipated. The signals in the Lake region, in connection with this area, are treated of in the description of low area No. I. The cautionary off-shore signals displayed on the Texas coast, from midnight of the 6th until the afternoon of the 8th, were fully justified by northerly winds of 36 miles at Galveston, and 49 at Indianola. A north wind of 26 miles is also reported from the Eastern Gulf, at Cedar Keys, on the 8th.

No. IV.—As low pressure No. IV moved eastward it was followed by this area. central in the Upper Missouri valley on the morning of the 10th, it moved slowly southeastward to the Ohio valley, where the highest pressure of the area was reported from Cairo, on the morning of the 12th, 0.48 above the normal. Moving thence nearly eastward it withdrew slowly, during the 14th, from the Carolina coast over the Atlantic ocean. On the morning of the 11th, the isotherm of 32° minimum temperature passed to the southward of the Lake region, the Ohio and the greater part of the Upper Mississippi and Lower Missouri valleys, and on the morning of the 12th passed to the southward of east Tennessee and the interior of North Corolina. Serious and numerous frosts were reported from the 9th to the 12th, as far south as parallel 33°. On the 13th the barometer at Havana, Cuba, read 30.30, the highest reading for seven years past. The minimum temperatures of the month were reported in connection with this area. The signals in the Upper Lake region, during the 10th, are treated in connection with low area No. IV. During that date cautionary off-shore signals were ordered from Smithville to Cape Lookout and the signals from Eastport to Cape Hatteras were changed to off-shore. These signals were lowered on the New England coast during the 11th, and on the New Jersey and North Carolina coasts during the 12th, having been fully justified; maximum velocities: Portland, NW. 26; Sandy Hook, NW. 40; Cape Henry, NW. 43; Delaware Breakwater, NW. 44.

No. V.—During the 15th an area of slight importance appeared over the province of Ontario, and by the morning of the 17th had withdrawn northeastward over the Gulf of Saint Lawrence. In the afternoon of the 15th cautionary off-shore signals were ordered from Sandy Hook southward to Chincoteague. These signals were partly justified by velocities of SW. 28 at Delaware Breakwater and SW. 32 at Chincoteague.

No. VI.—During the 18th and 19th an area covered a greater part of California, but dissipated on the latter date in advance of low area No. XII.

No. VII.—This area developing in the Ohio valley during the night of the 16th had moved northeastward to the lower Saint Lawrence by the afternoon of the 18th. Extending from Connecticut northeastward to Nova Scotia it remained substantially unchanged until the 20th, when it withdrew eastward over the Atlantic ocean. On the morning of the 17th the cautionary signals displayed in connection with low area No. VIII were changed along the Atlantic coast to off-shore, and were lowered that afternoon, having been fully justified; maximum velocities: NW. 36 at Sandy Hook and Chincoteague; NW. 38 at Delaware Breakwater.

No. VIII.—This area appeared in northern Texas the morning of the 19th, and moving eastward to the Middle Atlantic coast united with area No. VII on the 20th, and withdrew eastward over the Atlantic ocean on the 22d. Cautionary off-shore signals were ordered on the morning of the 19th for the Western Gulf and were lowered at midnight, having been justified by velocities of N. 27 at Galveston and N. 41 at Indianola. On the Atlantic coast, brisk winds having been reported, off-shore signals were ordered at noon of the 20th from Sandy Hook southward to Kittyhawk, and were lowered later in the day, having been but partly justified; maximum velocity: N. 32 at Delaware Breakwater.

N.o IX.—The pressure increasing on the Pacific coast during the 22d, the barometer at Olympia the afternoon of the 23d was 0.34 above the normal. The pressure remained unchanged until the 27th, when it withdrew eastward over the Northern Plateau district, where, on the afternoon of the 28th, the Virginia City barometer was 0.32 above the normal. On the morning of the 29th the highest pressure was at Deadwood, 0.35 above the normal. Its course thence was southward to Texas, where the highest pressure of the area prevailed during the 30th; Fort Sill barometer that afternoon 0.60 above the normal. At midnight of the 30th the area was gradually moving east, with diminishing pressure. The passage of this area was marked by unusually low temperatures for the season. On the morning of the 30th the isotherm of 32° minimum temperature passed to the southward of the greater part of the Upper Lake region, the Missouri valley, and the Rocky Mountain slope as far south as northwestern Texas; at midnight freezing temperatures were reported from the Lower Lake region and from the interior of New York and New England. On the morning of the 29th cautionary off-shore signals were displayed on the Texas coast and were lowered that afternoon, justified as to velocity, but not as to direction. During the 30th the cautionary signals from Cape Hatteras to Eastport were changed to off-shore. These signals were lowered on the 1st of May, having been justified, except on portions of the Maine and North Carolina coasts; maximum velocities: N. 28 at Cape Lookout; NW. 44 at Sandy Hook and Cape Henry; W. 32 at Boston.

No. X.—On the 22d this area appeared over the Upper Lake region. On the morning of the 23d the highest pressure was reported from Rockliffe—0.42 above the normal. This area remained over the Canadian Maritime Provinces from the 24th to the 25th, on which date it gradually dissipated. On the 22d cautionary signals were ordered for Lakes Erie and Ontario in the morning, and for the Upper Lake region in connection with advancing low area No. XIII, at midnight. The signals for the entire Lake region—generally justified—were continued until the 25th, and are discussed in the low area above mentioned. In the morning of the 23d cautionary signals were displayed from Eastport to Chincoteague, and during the afternoon southward to Fort Macon. These signals were lowered that afternoon in New England (not justified), but were continued on the Middle Atlantic and Carolina coast until the 25th, and were fully justified; maximum velocities: Delaware Breakwater, NE. 36; Kittyhawk, S. 36; Sandy Hook, E. 42.

No. XI.—This area appeared in Indian Territory the morning of the 26th, and moving northeastward prevailed in the Ohio valley during the 27th. Central on the Middle Atlantic coast during the 28th, it extended northward during the night, and on the morning of the 29th the highest pressure of the area prevailed at Halifax—barometer 0.67 above the normal. During the 30th it withdrew eastward or dissipated in advance of low area No. XV. On the morning of the 27th cautionary off-shore signals were ordered for the Texas coast and were lowered that afternoon, not justified. At midnight of the 26th off-shore signals were ordered from Cape Hatteras to Wood's Holl, and on the following morning thence northward to Portland. These signals were lowered during the 27th, having been fully justified; maximum velocities: Portland, NW. 26; Cape Hatteras, NW. 29; Sandy Hook and Delaware Breakwater, NW. 34.

Areas of low pressure.—During the month of April, 1880, fourteen areas have been charted on the Signal Service weather maps. Six of these first appeared on the Pacific coast north of California; four developed on the eastern slope of the Rocky Mountains; three came from Manitoba or Saskatchewan, and one developed in the Lower Mississippi valley. The areas of most marked interest are Nos. X and XIII. During the passage of No. X occurred the violent storms of the 18th, in Arkansas, Missouri, Iowa, and Illinois. In connection with area No. XIII occurred the violent rain and snow storms on the Pacific coast during the 20th and 21st, and the severe local storms of the 24th in Missouri and Illinois.

No. I.—This area, central in northwestern Wyoming the morning of the 2d, moving southeastward, reached western Kansas at midnight. Moving very slowly eastward, with still decreasing pressure, at midnight of the 2d it was in northern Missouri. During the 2d, in the Western Gulf States high temperatures and cloudy weather, with heavy rains, prevailed with brisk to high southerly winds on the Texas coast; maximum velocity, SW. 43 miles at Indianola. In the Upper Missouri and Mississippi valleys, cold northerly winds with heavy rains were reported. Destructive local storms, causing loss of life and property, occurred at Ottawa and Girard, Kans., and at Shreveport, La., which are elsewhere mentioned. Changing its course to the northeastward, the storm was central during the 3d in the vicinity of Lake Michigan. During the 4th it passed slowly northeastward over the Lower Lake region, down the Saint Lawrence valley, and by midnight of the 5th it reached the Gulf of Saint Lawrence. At midnight of the 2d a cautionary off-shore signal was ordered at Indianola, and cautionary signals for the entire Lake region. The signal at Indianola was lowered the morning of the 4th, justified as to velocity, but not as to direction. The signals in the Lake region were lowered on the morning of the 5th, having been justified on the 4th in connection with high area No. III, at scattering stations in the Lower Lake region, but at Duluth only in the Upper; maximum velocities: at Duluth, NW.

30; Sandusky, W. 34. The signals displayed in connection with high area No. I, from Fort Macon to Sandy Hook, were continued from the 3d to the morning of the 5th, when they were lowered, having been fully justified; maximum velocities: Chincoteague, SE. 44; Capes Hatteras and Lookout and Kittyhawk, SW. 36.

No. II.—The approach of this area was marked on the Middle Pacific coast by heavy rains on the 1st, which became general in California by the morning of the 1st, and extended to the Northern Pacific region during that day. The area, on the afternoon of the 2d, was central, with unusually low pressure, in southern Oregon. The area dividing, one portion moved northeastward, and passed into British Columbia by the morning of the 3d. In connection with this area and high area No. II, which moved northward along the Pacific coast, unusually heavy rains fell all along the entire Pacific coast from the 1st to the 3d, over two inches having been reported in that time from many stations. The second portion, moving nearly eastward, passed through Montana and Dakota into Manitoba during the 3d.

No. III.—This area moved northeastward over the Atlantic ocean during the 7th, at some distance from and nearly parallel with the coasts of New England and Nova Scotia. This area was possibly a southern offshoot of No. 1. No signals were displayed in connection with this area. Velocities of 27 miles NW. at Eastport and 28 NW. at Boston were reported.

No. IV.—This area was apparently central north of Lake Superior at midnight of the 8th. Moving slowly southeastward, on the morning of the 10th it was central, with greatly decreased pressure, over Lake Huron; Port Huron barometer 0.55 below the normal. Moving thence northeastward over the Lower Lakes, it reached the Saint Lawrence valley during the 11th, on which day the lowest pressure of the area was reported from Eastport in the afternoon—29.15, or 0.70 below the normal. On the morning of the 9th signals were ordered for the entire Lake region, except Duluth and Lake Ontario. During the afternoon they were ordered for Lake Ontario and the Atlantic coast, from Eastport southward to Chincoteague. These signals were lowered in the Lake region on the morning of the 11th, having been fully justified by unusually high winds during the 9th and 10th; maximum velocities: N. 40 at Escanaba and Grand Haven; NW. 48 at Sandusky; SW. 37 at Buffalo. In connection with advancing high area No. IV, the signals in the Upper Lake region were continued during the 10th, and along the Atlantic coast on that date they were changed to off-shore from Cape Hatteras northward to Eastport. The cautionary signals on the Atlantic coast were fully justified; maximum velocities: S. 34 at Boston and S. 40 at Delaware Breakwater.

No. V.—This area appeared on the North Pacific coast during the 9th, and moving northeastward through Washington Territory, passed into British Columbia by the morning of the 10th. Its passage was marked by moderate rains in the Central and North Pacific coast regions.

No. VI.—This area—possibly identical with area No. V—was central in Manitoba on the morning of the 12th. Moving southeastward, at midnight it was central in western Minnesota. It remained nearly stationary until midnight of the 13th, when it united with area No. VII in the Lower Missouri valley. On the afternoon of the 12th, brisk winds being reported from Lake Michigan and the Lower Lake region, cautionary signals were ordered for the entire Lake region. These signals—fully justified—are discussed in connection with low area No. VII.

No. VII.—At midnight of the 11th a sharp fall of pressure was reported from the Oregon coast. The area moving southeastward was central the morning of the 13th in Utah; Salt Lake barometer 0.42 below the normal. Moving rapidly eastward, at midnight it united with low area No. VI in the Lower Missouri valley; North Platte barometer 0.64, Yankton 0.65 below the normal. At that time a cloudless sky within a radius of 250 miles from the center of the depression was reported, and at no point within 500 miles had precipitation occurred within the preceding forty-eight hours. Changing its course to the northeast with decreasing pressure, the area was central in the afternoon of the 14th in northwestern Wisconsin; Duluth barometer 29.16 or 0.77 below the normal. Central at midnight of the 14th over the eastern end of Lake Superior, it moved rapidly eastward with increasing pressure, and by midnight of the 15th had reached the Gulf of Saint Lawrence. The signals displayed in the Lake region for low area No. VI on the 12th, and continued for this storm, were lowered during the morning and afternoon of the 15th. During the 13th and 14th, brisk to high southerly to westerly winds prevailed in the entire Lake region, fully justifying all signals displayed; maximum velocities: Buffalo, SW. 33; Escanaba, S. 36; Duluth, NE. 38, and Milwaukee S. 46. Signals for the Texas coast, ordered on the 13th and lowered on the 14th, were justified at Indianola, S. 30, but not at Galveston. On the 13th cautionary signals were ordered along the Atlantic coast from Fort Macon northward to Thatcher's Island. The signals north of New York were lowered at midnight of that date, and southward to include Kittyhawk, during the 14th, the signals from Fort Macon to Cape Hatteras remaining displayed until midnight of the 16th, in connection with low area No. VIII. These signals were all fully justified; maximum velocities: Boston and Kittyhawk, SW. 32; Newport, SW. 40; Sandy Hook, SW. 44; Wood's Holl, SW. 53.

No. VIII.—At midnight of the 14th a sharp barometric fall was reported from western Texas, and in the afternoon of the 15th, an area was evidently central in Indian Territory; Dodge City barometer 0.24 below the normal. Moving eastward with rapidly decreasing pressure its center at midnight was in southern Missouri. During the past eight hours the barometer had fallen sharply in the central Mississippi valley, where high temperatures, brisk southerly winds and thunder-storms, with heavy rains, prevailed; while from the Lower Missouri valley cold northerly winds, with rain, were reported. During the evening a severe local storm, seriously damaging property, swept over Natchez, Miss., and its immediate vicinity. On the morning of the 16th the area was central, with diminished pressure, in Illinois; in the afternoon over the western end of Lake Erie, and at midnight in Ontario. At 11 p. m. of the 16th, an abnormal barometric rise of 0.30 in the past eight hours was reported from the entire Ohio valley, with a marked fall of temperature in the southern half. During that time violent wind storms occurred throughout the eastern half of Ohio and the western parts of Pennsylvania, and West Virginia, the details of which are given under the heading of *Local storms.* Central the morning of the 17th in the province of Quebec, it passed southeastward through New England during the day over the Atlantic ocean. At midnight of the 15th signals were ordered, except at Duluth, for the entire Upper Lake region, and for Lake Erie, followed on the following morning by signals for Lake Ontario. These signals were lowered on the Upper Lakes at midnight of the 16th and on the Lower Lakes during the 17th. These signals were justified in connection with high area No. VII by gales of unusual severity, accompanied by rain or snow; maximum velocities: Alpena NE. 32; Buffalo, SW. 33; Milwaukee, NE. 36, and Cleveland, W. 50. During the 16th signals were displayed on the Atlantic coast at Eastport, where brisk winds had been reported, and from Sandy Hook southward to Kittyhawk. The signals on the North Carolina coast were lowered at midnight, and those on the New Jesey coast on the following day. These signals were fully justified; maximum velocities: Sandy Hook E. 31; Chincoteague, S. 41; Eastport, E. 48.

No. IX.—The pressure fell sharply on the North Pacific coast during the night of the 14th and on the morning of the 15th an area was central on the coast of Washington Territory; Olympia barometer 29.39 or 0.71 below the normal. Moving easterly on the morning of the 16th the area was central in western Montana; Virginia City barometer 0.50 below the normal, and by midnight had passed northeastward into Manitoba. In connection with the passage of this storm, exceedingly heavy rains occurred from the 14th to the 16th on the north half of the Pacific coast, and unusually heavy snow-storms prevailed on the Sierra Nevada Mountains. From the 14th to the 16th 4 inches of rainfall at Mendocino, Cal., and during the 15th 2 feet of snow fell at Truckee and Summit, and 4 feet at Cisco. Several snow slides occurred, and travel on the Central Pacific Railroad was seriously interfered with for several days.

No. X.—As area No. IX passed northeastward on the night of the 16th into Manitoba, a considerable fall was reported in the southern segment of that area from Kansas and Nebraska, which continued until morning of the 18th, at which time the area was central in southern Nebraska; Omaha barometer 0.66 below the normal. Moving slowly northeastward, at 3 p. m. of the 18th the area was central in the Missouri valley northwest of Omaha, from which station a S. wind of 42 miles was reported, with the unusually low pressure of 28.85, or 0.90 below the normal, and a temperature of 82°. From Bismarck, Dak., and North Platte, Nebr., high north winds of 40 and 48 miles, with temperatures below the freezing point, were reported. The report for that afternoon from Yankton has not yet been received. During the preceding eight hours an abnormal barometric fall, ranging from 0.20 to 0.30, had occurred over the greater part of the states of Iowa and Missouri, and over the eastern parts of Kansas and Nebraska. In the succeeding eight hours an abnormal barometric rise, ranging from 0.30 to 0.34, occurred in the Lower Missouri valley, with an average abnormal barometric fall of 0.16 in the Upper Missouri valley. From 3 p. m. to 11 p. m. of that date the temperature fell 52° at Omaha and 35° at Leavenworth, while in the Upper Mississippi valley the temperature remained stationary at La Crosse, rose 1° at Saint Paul, and fell but 1° at Davenport. At 11 p. m. the area was central in the Upper Mississippi valley; Saint Paul barometer 28.89 or 0.97 below the normal. Thunder-storms, with high temperatures and brisk southerly winds, then prevailed in the Upper Mississippi valley, while cold north to west winds, ranging from fresh to high, were reported from the Missouri valley. During the evening of that day occurred violent tornadoes in Arkansas, Missouri, Iowa, and Illinois. These violent storms, by which nearly one hundred persons were killed and several hundred wounded, and during the passage of which immense damage was done to property throughout these states, are as fully described as is possible at this date, under the head of *Local Storms.*

The area, central the morning of the 19th over the western end of Lake Superior—Duluth barometer 28.77 or 1.07 below the normal—passed northeastward during the day into British Columbia. Its course over the Lake region was marked by unusually high winds in the Lake region, where the signals displayed during the 18th, and lowered on the 19th, were fully justified; maximum velocities: Escanaba, S. 33; Toledo and Grand Haven, SW. 40; Alpena and Port Huron, SW. 44; Milwaukee, SW. 48; and Sandusky, NW. 52. Cautionary signals were displayed during the 18th and 19th from Wood's Holl southward to Fort Macon, and were generally lowered the morning of the 20th. These signals were generally justified; maximum velocities: Barnegat, NE. 28; Wood's Holl, S. 38; Delaware Breakwater, S. 43.

No. XI.—This area, of but slight energy and minor importance, developed during the 19th in Mississippi. Its course was generally easterly, and it passed off the Carolina coast during the night of the 20th. No signals were displayed during its passage.

No. XII.— This area, appearing in Dakota on the morning of the 21st, moved eastward during the day through Minnesota and the Upper Lake region, and during the 22d passed northeastward over Canada to the north of Saint Lawrence valley. No signals were ordered for the Lake region in connection with this area. Brisk winds were reported from the Upper Lake region during the 21st, with a maximum velocity of 36 miles SW. at Milwaukee. On the morning of the 22d cautionary signals were displayed on the New Jersey and Virginia coasts, which were lowered the next morning, having been fully justified; maximum velocities: SW. 27 miles at Chincoteague, and SE. 38 at Delaware Breakwater.

No. XIII.—This area appeared on the North Pacific coast during the night of the 19th, and moving eastward through Oregon and Idaho was central in western Montana on the morning of the 22d. Its passage through the North Pacific coast region was marked by exceedingly heavy rains during the 20th and 21st in the northern half of California; rain falls, ranging during that time from 3 inches to 9.73, being reported. The valleys in the central and northern portions of the State suffered severely from inundations, which damaged crops, washed out railways, carried away bridges, &c. Heavy and violent snow storms generally prevailed in the Sierra Nevadas, which caused frequent snow-slides and interrupted travel for several days on the Central Pacific Railroad. Pursuing a southeasterly course from Montana, it was central the afternoon of the 23d in eastern Nebraska; Omaha barometer 29.10 or 0.65 below the normal. The storm remained central with gradually increasing pressure in the valley of the Lower Missouri until midnight of the 24th, when it was in central Missouri. During the 23d remarkable differences of temperature prevailed between the northwestern and southeastern sides of the area, the difference amounting in some cases to over 30° in a distance of 200 miles. These remarkable differences of temperature continued until the morning of the 25th. About 7 p. m. of the 23d a severe cyclone occurred in Adams County, Illinois, doing much damage in the towns of Lorraine, Lima, and Keene, and injuring many persons. At 5 p. m. of the 24th, a severe tornado occurred in Jasper County, Missouri, and at 7 p. m. in Christian County, Illinois, killing and injuring persons and doing great damage to property. Violent thunder-storms also occurred at various other points in Illinois and Missouri. Details are to be found under the head of *Local Storms*. The area moving due northward during the night was central the morning of the 25th in Iowa and that afternoon in Wisconsin. Changing its course to the northeast it passed over the Upper Lake region during that night, and on the 26th moved down the valley of the Saint Lawrence. The signals displayed in the Lake region on the 22d for high area No. X were continued for this storm until the afternoon of the 25th, and were then lowered, having been fully justified, as shown elsewhere.

No. XV.— This area advanced southeastward from Saskatchewan during the 27th, reaching Dakota the morning of the 28th. Thence, by a nearly northeast course, it passed during the 29th through the Upper Lake region, and on the 30th down the valley of the Saint Lawrence. Its passage through the Lake region was marked by brisk winds, which justified, except at scattered stations, the signals displayed during 29th and part of the 30th; maximum velocities: Grand Haven, E. 28; Rochester, W. 32; Milwaukee, NW. 36; and Sandusky, NW. 42. On the Atlantic coast cautionary signals were displayed during the 29th at all stations except Jacksonville. These signals were lowered during the 30th on the South Atlantic coast, but were continued on the New England and Middle Atlantic coasts until the morning of May 1. During the 29th violent southerly gales, with heavy rain squalls, prevailed along the entire Atlantic coast, followed, in connection with advancing high area No. IX, by heavy westerly gales from Maine to Delaware; maximum velocities: Boston SW. 37; Eastport, S. 39; Barnegat, S.43; Kittyhawk, S.46; Delaware Breakwater, S. 52; Wood's Holl, S. 56. This storm was generally reported to have been one of the severest experienced for years along the New England and Middle Atlantic coasts.

INTERNATIONAL METEOROLOGY.

Two international charts, Nos. IV and VI, accompany the present review. They are for the months of September, 1877, and March, 1880. The charts of mean pressure,

&c., for September, 1878, have been delayed to permit the compilation of chart for September, 1877, which completes the series for the autumn months of that year.

No. IV indicates the probable course of six of the principal storm areas (No. I, II, IV, VI, IX, and XI) occurring over the north Atlantic ocean during the month of March, 1880. This month was generally characterized by a rapid succession of high and low pressure areas and consequent stormy weather over the United States, Canada, and that portion of the north Atlantic ocean to the north of a line running from the Bermudas to 50° N. 25° W., while over northwestern Europe high pressures and, in general, clear, dry weather were prevalent, except during the regime of low areas Nos. I, III, XI. Area No. I was, on the 1st, 2d, and 3d, central to the north of the British Isles and North Sea, whilst the trough of low pressure extended far to the westward over the Atlantic. Severe westerly gales prevailed from the English Channel to 40° W., and from this meridian to the American coast cold northwesterly winds, accompanied by occasional violent snow and hail squalls, in advance of an area of high pressure (No. I, March Review) central over the United States. On the 3d the highest pressure of the month (about 30.47 in., or 774.0^{mm}) was recorded at the Bermudas, and from the 4th to the 7th this high pressure moved slowly eastward to the region of the Azores. During these days, namely, from the 4th to the 7th, two areas of low pressure (the last of which is shown on chart No. IV as area No. II) left the American coast and, passing eastward over the Banks of Newfoundland, curved towards the northeast, about 50° W.; hard to violent winds, from S. to W., accompanied by severe rain squalls, were experienced from 40° to 50° N. and from 30° to 50° W. During the 7th the pressure rose rapidly over western Europe, and on the morning of the 8th an area of quite high pressure covered the region included between 15° W. and 25° E. and 35° to 60° N. From the latter date to the 29th the pressure remained high over the greater part of this region, and apparently formed a barrier to the passage eastward of low pressure areas from the Atlantic. On the 9th only moderate winds were reported over the Atlantic, except that S. S. Amerika, in 48° 29′ N. 31° 10′ W., had an ENE. wind, force 8, with barometer down to 29.52, or 749.8. This appears to have been due to a small area which passed northward on the 10th, followed by NW. gales about 50° N. 30° W. Area No. IV (No. V, March Review) passed off the American coast during the morning of the 9th, and on the 10th passed eastward to the north of the Bermudas, where the wind increased to WSW., force 6, with threatening weather. Brigantine George, (10th), in 32° 25′ N. 68° 35′ W., had a WSW. moderate gale, with low barometer, showers, and rough sea. High pressures (area No. IV, March Review) and cold weather prevailed in the vicinity of Newfoundland. On the 11th and 12th low area No. IV moved rapidly northeastward; and severe gales from SE. to NW, were reported in 41° N. 60° W., 42° N. 53° W., 43° N. 47° W., 47° N. 40° W., and continued southerly gales thence eastward. S. S. Amerika (11th in 45° N. 43° W.) reported barometer, at 7.35 a m., Washington mean time, 29.30, or 744.2, wind SW., force 11, very heavy sea; "had a heavy gale from SE. to NNW. and back to W." Bark Silver Cloud, from New Brunswick to Great Britain, on the 11th had a severe SE. gale, with terrific squalls, veering at 5 p. m. to SSE., and on the 12th severe gale from NNW.—vessel abandoned on the 12th in 45° N. 42° W. After the morning of the 12th, the progressive motion of this area appears to have lessened decidedly, and the area to have curved toward the east. S. S. Hibernian reports 12th, in about 50° 39′ N. 33° 17′ W., lowest barometer 29.25, or 743.0, strong gale from SE. by S., with heavy rain; 13th, 52° 17′ N. 27° 14′ W., lowest barometer 29.26 or 743.2, wind SE. by E., violent gale of hurricane force, and heavy rain of short duration. On the 14th, S. S. Ohio reports, in 49° 49′ N. 26° 55′ W., barometer 29.35 or 745.5, wind WSW. 6, with hail. From the 15th to the 18th, low pressure, with hard gales and high seas, continued to prevail over the eastern portion of the Atlantic (between 45° and 55° N.), and from the 16th to the 19th a low pressure area (No. X, March Review) moved rapidly northeastward from the American coast, crossing the Banks of Newfoundland on the 17th, to about 55° N. 30° W. on the 19th. On the 19th and 20th, low area No. VI (No. XI of the March Review) passed rapidly eastward as a severe hurricane, from the American coast, between Nova Scotia and the Bermudas, to about 50° W. S. S. Celtic, 20th, in 40° N. 63° W., 7.35 a. m., Washington mean time, reports barometer 28.53 or 724.6, wind N. by W., force 12, and also adds, "from 10 a. m. until 4 p. m. terrific gale from N., with hurricane force at times, compelled to steer ship before the sea to avoid damage, the wind having veered from E. to N., with a tremendously high confused sea." S. S. Ohio reports 19th, 43° N. 54° W., barometer 30.14, NW. 3, snow; 20th, 42° N. 58° W., barometer 28.82., NW. 11, thick snow storm; and 21st, 40° N. 66° W., 29.84, SE. 2, snow; and adds, "from midnight (19th and 20th) to 4 p. m., 20th, violent gale, commencing at ESE. and backing to N., with very heavy squalls and thick snow, barometer falling rapidly—kept ship before the sea until 7 p. m." As instances of the unsettled condition of the weather prevalent over this portion of the Atlantic during the latter half of March, the following may be noted: the S. S. Ohio reported snow or hail on each day from the 14th, in 50° N. 27° W., to the 21st, in 40° N. 66° W., the barometer observations showing low pressures on the 14th, 16th, 18th, and 20th; the S. S. Nederland, from the 17th, in 48° N. 19° W., to the 29th, in 40° N. 73° W., reported "much rain" for the 24 hours preceding the reports of the 17th, 19th, 21st, 22d, 23d, and 28th, "rain" on 25th, "showers" on 20th, and "snow" on the 24th, 27th, and 29th; had low pressures on the 17th, 19th, 22d, 25th, and 28th. During the hurricane of the 19th, 20th, and 21st many disasters to shipping occurred, among which the following may be noted: brig Rescue abandoned in 39° N. 70° W.; brig Victor abandoned in 37° N. 58° W.; bark Memphis abandoned in 39° N. 59° W.; ship Wassenaar abandoned in 44° N. 39° W.; bark May Queen lost two men overboard; bark Queen of Hearts, in 38° N. 62° W., lost three men overboard; while numerous vessels had decks swept of everything movable. From 22d to the 26th this storm moved very slowly northeastward with diminished energy near the center, but followed by northwest gales, high seas, rain, sleet, or snow from 35° to 55° W. Low area No. IX (No. XIV March Review) passed off the New England coast on the 24th, and moved east and northeastward off the coasts of Nova Scotia and Newfoundland during the 25th and 26th, accompanied by very low pressures and followed by northwesterly gales and high seas. On the morning of the 28th, while low area No. XV was yet central over the United States, a second center had formed off the Middle Atlantic coast, which rapidly developed into a severe storm (see No. XI present Review). During the 28th, 29th, and 30th it moved rapidly east and northeastward, and was encountered by the following vessels: schr. Addie Fuller on the 26th, in 32° N. 80° W., 28th, in 35° N. 75° W., and 30th in 35° N. 73° W., reports: "26th, at sunset, weather threatening; midnight, gale commenced with S. wind, which lasted until morning of the 28th; it veered gradually to WSW.; had occasionally terrific squalls during the gale, with velocities of 40 or 50 miles; 27th, midnight, the barometer was at its lowest (29.50 as read off); 28th, fine weather and nearly calm all day, barometer continuing low; at 8 p. m. gale commenced with wind from NNW., increasing in force from 20 to 50 miles, and continued until morning of the 31st, with severe squalls of hail and rain." S. S. Scythia reports: "28th, 43° N. 55° W., barometer 29.70 or 754.4, wind S., heavy rain; 29th, 42° N. 59° W., 29.33 or 745.0, NW. by W., force 4, cloudy, rough sea; and adds, 'Sunday. March 28, from 3 p. m. to Monday 29, 4 a. m., storm with wind veering from SW. to W'ly and N'ly, with very high sea, barometer 29.28.,' S. S Hibernian, 29th, in 53° N. 26° W., and 30th, in 52° N. 31° W.: "29th, heavy gale from S., with torrents of rain and heavy sea; 30th, strong gale from WSW., with heavy sea, lowest barometer 29.22 or 742.2." On the 30th the barometer fell rapidly over northwestern Europe, thereby ending the period of high pressures which had continued since the 8th over this region. During the 31st the low area No. XI passed eastward over the British isles and ushered in a period of unsettled weather, which continued over these isles until the 6th of April. By afternoon of the 28th low area No. XV of the March Review, referred to above, had passed off the American coast; during the 29th and 30th it moved slowly eastward between the Bermudas and Nova Scotia, and on the 31st was central some distance south of Newfoundland. The lowest pressures of the month, accompanied by thunder, lightning, rain, and moderate gale, were experienced at the Bermudas on the 29th and 30th.

TEMPERATURE OF THE AIR.

The mean temperatures for April, 1880, are shown on chart No. II. The table of average temperatures on that chart shows that the temperature was above the normal from Texas and the Mississippi valley eastward to the Atlantic, except in the lower Saint Lawrence valley, and the Canadian Maritime Provinces. Over the entire country westward of Texas and the Mississippi valley deficiencies were reported, except from the middle Rocky Mountain slope. The greatest excess of temperature prevailed in the Middle, South Atlantic, Gulf states, Tennessee, and the Ohio valley, ranging from 3°.0 to 4°.0 above the normal. The deficiency of 3°.2 reported from the Missouri valley, covers the entire valley; if divided an access of 2°.7 would have been credited to the lower valley, and a deficiency of about 9°.0 to the upper valley. On the Pacific coast the greatest deficiency is reported from the central region, 3°.0.

Maximum and minimum temperatures.—Maine: *Cornish, 70°: Portland, 65°; Eastport, 17°; *Orono, 14°. *New Hampshire:* *Contocookville, 76°: Mount Washington, 40°; *Dunbarton, 18°; Mount Washington,—12°. *Vermont:* *Windsor, 74°; Burlington, 69°; Burlington, 16°; *Lunenburg and *Newport, 14°. *Massachusetts:* *Springfield Armory, 79°; Springfield, 77°; Thatcher's Island, 20°; *South Lee and *Somerset, 18°. *Rhode Island:* *Fort Adams, 64° and 24°; Newport, 63° and 26°. *Connecticut:* *Southington, 78°; New Haven, 75°; New London, 24°; *Southington, 19°. *New York:* *Ardenia, 81°; New York City, 76°; Rochester and Buffalo, 20°; *Schroon Lake and *Plattsburg Barracks, 16°. *New Jersey:* *Dodge Mine, 87°; Barnegat, 79°; Atlantic City, 24°; *New Lisbon and *Vineland, 22°. *Pennsylvania:* Pittsburgh, 84°; Erie, 26°; *Franklin, 15°. *Delaware:* Delaware Breakwater, 79° and 32°; *Dover, 32°. *Maryland:* *Sandy Springs, 85°; Baltimore, 80° and 30°; *Woodstock, 23°. *District of Columbia:* Washington, 82° and 28°. *Virginia:* *Accotink, 90°; Norfolk, 84° and

27°; *Wytheville, 23°. *West Virginia:* *Helvetia, 82° and 15°; Morgantown, 81° and 28°. *North Carolina:* Wilmington and *Weldon, 90°; Charlotte and Kittyhawk, 33°; *Sulphur Springs, 25°. *South Carolina:* Charleston, 85° and 33°. *Georgia:* *Gainesville, 92°; Augusta and Savannah, 88°; Atlanta and Augusta, 36°; *McPherson Barracks, 29°. *Florida:* *Houston, 96°; Jacksonville, 91° and 42°; *Saint Augustine, 41°. *Alabama:* Montgomery, 90° and 40°. *Louisiana:* *Okalooska, 94° and 35°; Shreveport, 93° and 40°. *Arkansas:* *Mount Ida, 95° and 32°; Little Rock, 94° and 43°. *Texas:* Eagle Pass and Rio Grande City, 105°; Fort Elliott, 26°; *Fort Concho, 25°. *Tennessee:* *Ashwood, 89°; Chattanooga, 88°; Knoxville and *Ashwood, 30°. *Kentucky:* Louisville, 87° and 31°; *Bowling Green, 30°. *Ohio:* *Cincinnati, 87°; Cincinnati, 83°; Cleveland, 27°; *Wooster and *Westerville, 22°. *Indiana:* *Laconia, 87°; Indianapolis 83° and 27°; *Vevay, 24°. *Illinois:* *Mount Sterling, 86°; Cairo, 83°; Chicago, 27°; *Riley, 20°. *Michigan:* *Hudson, 80°; Port Huron, 73°; Alpena, 14°; Fort Brady, 4°. *Wisconsin:* *Beloit, 80°; Madison, 78° and 23°; *Neillsville, 18°. *Missouri:* *Corning, 94°; Saint Louis, 86° and 30°; *Pierce City, 26°. *Iowa:* *Glenwood, 92°; Des Moines, 84°; Dubuque and Des Moines, 26°; *Logan, 15°. *Minnesota:* Breckinridge, 80° and 13°. *Indian Territory:* Fort Sill, 96°; Fort Gibson, 34°. *Kansas:* *Holton and *Cedar Vale, 94°; Dodge City, 92° and 24°. *Nebraska:* *Howard, 97°; North Platte, 90° and 20°; *Camp Sheridan, 15°. *Dakota:* *Fort Hale, 90°; Yankton, 82°; Pembina, —3°. *New Mexico:* Socorro, 80°; Santa Fé, 17°; *Fort Union, 14°. *Colorado:* Denver, 77° and 20°; *Fort Garland, 10°; Pike's Peak, 32° and —9°. *Wyoming:* *Fort Fetterman, 77°; Cheyenne, 73° and 15°; *Fort Fred Steele, 10°. *Montana:* Fort Benton, 81°; Fort Assiniboine, —20°. *Idaho:* Boise City, 79° and 30°; *Fort Hall, 10°. *Utah:* Salt Lake City, 75° and 27°; *Camp Douglas, 75° and 23°. *Nevada:* *Fort McDermit, 80°; Winnemucca, 74° and 22°. *California:* *Fort Yuma, 96°; Red Bluff, 88°; Campo, 24°. *Oregon:* Umatilla, 89° and 29°; Roseburg, 29. *Arizona:* Yuma, 94°; Fort Apache, 20°. *Washington Territory:* Olympia, 82° and 28°.

Ranges of temperatures at Signal Service stations.—The monthly ranges will appear from the maxima and minima just given. The greatest daily ranges vary in New England from 19° at Wood's Holl to 35° at Boston; Middle Atlantic states, 19° at Cape May to 41° at Albany; South Atlantic states, 17° at Cape Lookout to 34° at Augusta and Wilmington; Eastern Gulf states, 13° at Key West and 24° at Pensacola to 32° at Montgomery; Western Gulf states, 21° at Galveston to 35° at Corsicana; Tennessee and Ohio valley, 24° at Cairo to 48° at Pittsburgh; Lower Lake region, 29° at Oswego to 41° at Cleveland; Upper Lake region, 24° at Grand Haven to 39° at Milwaukee; Upper Mississippi valley, 30° at La Crosse to 43° at Des Moines; Red River of the North valley, 42° at Pembina and 50° at Breckinridge; Missouri valley, 30° at Leavenworth to 51° at Fort Buford, and 53° at Omaha; Rio Grande valley, 31° at Rio Grande City to 45° at Eagle Pass; Eastern Rocky Mountain slope, 33° at Virginia City to 53° at North Platte, and 54° at Fort Elliott; Plateau districts, 33° at Boise City and Salt Lake City, 42° at Santa Fé; Pacific slope, 19° at San Francisco to 36° at Red Bluff.

Frosts.—Freezing temperatures were occasionally reported from Signal Service stations as follows: North Pacific coast region, till 8th; Plateau districts, except southern Arizona, till 29th; along central and northern Rocky Mountain slope, and, north of forty-second parallel, eastward to the Atlantic ocean, throughout month; east of Mississippi valley and north of thirty-third parallel, till 12th; northern Ohio and Pennsylvania, till 30th. The following cases of interest are noted: *Alabama:* Heavy frost, 11th to 14th, killing vegetables, injuring fruit, corn, wheat, and cotton at Troy, Greensborough, Blountsville, Wetumpka, and other places. *Delaware:* 11th, general and severe throughout peninsula, seriously damaging peach blossoms. *Georgia:* 9th to 12th, severe, killing fruit and vegetables and damaging much cotton in northern half of state. *Kentucky and Tennessee:* 9th to 12th, severe, killing fruit and vegetables and injuring wheat. *Louisiana:* Okalooska, 9th. *Mississippi:* Vicksburg and Fayette, 9th and 10th. *Ohio:* 30th, damaging gardens and fruit somewhat. *Texas:* 8th and 9th, general in interior of State as far south as Castroville and Uvalde. *Arizona:* Burkes, 19th. *California:* near Mount Saint Helena, 18th, destroying peach crop first time in sixteen years.

Ice was general north of parallel 40°. The following cases are noted as of interest: *Georgia:* Forsyth, 13th; Augusta, 10th, thin, in country near. *North Carolina:* Weldon and Wilmington, 12th; Charlotte, Statesville and Lenoir, 12th and 13th. *Indiana:* Logansport 30th. *Tennessee:* Ashwood, 9th. *Virginia:* Walnut Grove, Johnsontown and Mount Solon, 12th. *New Jersey:* Newark, 30th. *Kansas:* Holton, 27th.

PRECIPITATION.

The general distribution of the rainfall, including melted snow, for April, 1880, is illustrated upon chart No. III, as accurately as possible, from about 500 reports. On

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*Those marked with a star (*) are reported by United States Army post surgeons or voluntary observers.

the chart is given average precipitation for April. As will appear from that table slight deficiencies are reported from Minnesota, the Eastern Gulf and Middle Atlantic states, and a slight excess from the Western Gulf states. Deficiencies of from one to two inches are reported from New England, Tennessee, the South Atlantic states, Florida, and the Missouri valley. An excess of one and a half inch is reported from the Lake region and the Ohio valley, and of two and a half inches from the Saint Lawrence valley. On the Pacific coast the rainfall has been excessive in California, particularly in the central valleys. Over the Middle Pacific coast region the precipitation was five times the amount of the April mean, being 7.86 above the normal.

Specially heavy rains.—1st, New Ulm, Tex., 1.12 in 4 hours, 15 minutes; Brackettsville, Tex., 1.61 in 2 hours, 20 minutes. 1st and 2d, Auburn, Cal., 2.10; Shasta, Cal., 2.70. 2d and 3d, San Buenaventura, Cal., 1.95 in 36 hours; Highlands, N. C., 3 in 29 hours. 3d, Chattanooga, Tenn., 3.09 in 16 hours; Point Pleasant, La., 2 in 5 hours; Decatur, Ala., 2. 3d and 4th, Gainesville, Ga., 2.30; Ellsworth, N. C., 2.50 in 25 hours; Thatcher's Island, 2.66 in 13 hours. 4th, Wellsborough, Pa., 1.35 in 2 hours, 40 minutes. 7th, Corsicana, 2.79, of which 2.35 in 8 hours. 7th and 8th, Vicksburg, 3.09 in 24 hours; Point Pleasant, La., 3.01. 14th to 16th, Mendocino, Cal., 4; Point Arenas, Cal., 3. 15th and 16th, Evansville, Ind., 3.30; 16th, Fort Barrancas, Fla., 2.24 in 4 hours. 15th, San Francisco, Cal., 1.33; Louisville, Ky., 2.28, of which 1.84 fell in 2 hours and 45 minutes. 14th and 15th, New Harmony, Ind., 2.40; Point Pleasant, La., 4.01 in 8 hours; Fayette, Miss., 15th and 16th, 9 in 8 hours. 16th, Louisville, Ky., 1.78 in 6 hours; Vevay, Ind., 1.25 in 4 hours; Bowling Green, Ky., 2.04; Saint Meinrad, Ind., 1.95 in 6 hours; Pensacola, Fla., 2.30 in 8 hours; Mount Auburn, Ohio, 1.63 in 2 hours; Wellsborough, Pa., 1.10 in 1 hour and 50 minutes. 18th, Madison, Wis., 2.15 in 6 hours. 19th, Memphis, 1.79 in 2 hours; Fort Smith, Ark., 2.18; Little Rock, 1.23 in 4 hours; Princeton, Cal., 19th and 20th, 3.63; Red Bluff, 19th to 21st, 4.47. 20th, Kittyhawk, N. C., 2.15 in 6 hours; Corsicana, 1.30 in 3 hours; 19th and 20th, Green Springs, Ala., 3.82 in 9 hours; New Orleans, 3.18 in 24 hours. 20th and 21st, San Francisco, 3.20; Mount Saint Helena, Cal., 14.70; Sacramento, Cal., 8.37, of which 6.35 in 16 hours; Healdsburg, Cal., 973 in 48 hours; Santa Rosa, Cal., 6.70 in 48 hours; San Luis Obispo, Cal., 3.00 in 36 hours; Grass Valley, Cal., 4.50 in 18 hours; Georgetown, Cal., 4 in 24 hours; Nevada City, Cal., 5.20 in 24 hours, and "April to date 22.98 inches, being six times the average for April"; Forest City, Cal., 6.54 in 48 hours; Modesto, Cal., 7 in 48 hours; Tomales, Cal., 5.02 in 40 hours; 23d, Georgetown, Col., "April to date 25.50 inches." 23d, North Lewisburg, Ohio, 3.10 in 3½ hours; New Corydon, Ind., 3.79 in 11 hours. 23d and 24th, Norwalk, Ohio, 2.51; Bellefontaine, Ohio, 3.50; Augusta, Ga., 1 in 1 hour; Newton, Iowa, over 4 inches. 24th, Keokuk, 2.45 in 8½ hours; Vevay, Ind., 1.10 in 1 hour; Pierce City, Mo., 1.00 in 1 hour. 24th to 26th, Wellsborough, Pa., 4.82. 24th and 25th, Indianapolis, 3.03, of which 1.17 fell in 5 hours; Bethel, Ohio, 2.75. 25th, Vevay, Ind., 2.20 in 12 hours; Ringgold, Ohio, 0.80 in 12 minutes. 26th, Point Pleasant, La., 2.01 in 10 hours; 25th and 26th, Mount Auburn, Ohio, 2.07. 28th, Shreveport, 2.05 in 8 hours; Brackettsville, Tex., 2.05 in 6 hours; San Antonio, Tex., 2.79 in 1½ hours; Castroville, Tex., 1.73 in 3½ hours; Mesquite, Tex., 2.00; Mount Ida, Ark., 28th and 29th, 2.05 in 25 hours; Highlands, N. C., 28th and 29th, 2.60 in 15 hours; Charlotte, N. C., 2.19; Washington, D. C., 2.05. 29th, Lynchburg, 2.20; Ellsworth, N. C., 3.50 in 12 hours; Point Pleasant, La., 2.00 in 2 hours.

Largest monthly rainfalls, including melted snow.—Georgetown, Cal., 25.50 inches; Shasta and Healdsburg, Cal., over 18 inches; Sacramento, Cal., 14.20 inches; Fayette, Miss., 13.40 inches; Cincinnati (College Hill), 10.50 inches; Chattanooga, Tenn., 10.37 inches; Green Springs, Ala., 10.15 inches; Murphy, N. C., 9.30 inches; New Corydon, Ind., 9.08 inches; Kalamazoo, Mich., 8 inches.

Smallest monthly rainfalls, including melted snow.—Fort Yuma., Cal., 0.00; Yuma, Ariz., and Fort Union, N. Mex., trace; Brownsville, Tex., 0.01; Tucson and Camp Grant, Ariz., 0.04 inches; Socorro and Santa Fé, N. Mex., 0.05 inches; El Paso, Tex., 0.10 inches; Dodge City, Dak., 0.11 inches; Fort Davis, Tex., 0.14 inches; Phœnix and Burkes, Ariz., 0.15 inches; North Platte and Fort Elliott, Tex., 0.16 inches; Cheyenne, W. T., 0.17 inches; Edinburg, Tex., 0.19 inches; Wickenburg, Ariz., 0.25 inches; Camp Verde, Ariz., 0.27 inches; Olivet, Dak., and Denver, Colo., 0.31 inches; Key West, Fla., 0.33 inches; Vail, Iowa, 0.32 inches; Yankton, Dak., 0.40 inches.

Rainy days.—The number of days on which rain or snow has fallen varies as follows: New England, 2 to 23; Middle Atlantic states, 8 to 20; South Atlantic states, 9 to 15; Eastern Gulf states, 4 to 13; Western Gulf states, 8 to 13; Lower Lake region, 17 to 21; Upper Lake region, 12 to 20; Ohio valley and Tennessee, 10 to 17; Upper Mississippi valley, 7 to 12; Missouri valley, 4 to 9; Red River of the North valley, 5 to 12; Eastern Rocky Mountain slope, 1 to 10; Texas, 0 to 9; Rocky Mountains, 2 to 11; Middle Plateau, 1 to 14; California, 16 to 18; Oregon, 15 to 18.

Cloudy days.—The number varies in New England from 6 to 16: Middle Atlantic states, 4 to 11; South Atlantic states, 4 to 13; Eastern Gulf states, 0 to 16; Western Gulf states 5 to 16; Lower Lake region, 10 to 16; Upper Lake region, 8 to 15; Ohio valley and Tennessee, 5 to 13; Upper Mississippi valley, 4 to 10; Missouri valley, 4 to 10; Red River of the North Valley, 10; Eastern Rocky Mountain slope, 3 to 9; Texas, 4 to 14; Rocky Mountains, 3 to 11; Middle Plateau, 0 to 15; California, 9 to 13.

Droughts prevailed in central and western Kansas and in the interior of Texas, until ended by the heavy rains of the 27th to 30th.

Floods.—The following notes have been gathered regarding damage in lower Mississippi valley from high water during latter part of March and during April. March 23rd: Much land overflowed in Crittenden County, Ark. Many cattle drowned or starved. Many houses uninhabitable. Along White River much land overflowed as far up as Saint Charles; a large amount of stock drowned. Levee at O. K. landing broke March 27th; crevasse 40 feet wide. The Sharp crevasse, 4 miles above Gretna, La., occurred April 1st; enlarged by 2d to 70 feet wide with central depth of 15 feet. On 2d 5,000 acres under water. Two culverts on Morgan Railway, 8 miles from Algiers, washed out, interrupting travel. Main crevasse closed on 7th; but slight breaks occurred on 9th and frequently to 30th. 10th. Water from Morganzia crevasse, in West Baton Rouge Parish, Louisiana, slowly encroaching on rear lands. Northern Texas Railway continues inundated; between Vicksburg and Munroe, 40 miles, is traversed by skiffs, rest by rail; regular through trains not expected before May 1st. 16th. Crevasse on left bank of Bayou La Fourche, one mile below Thibodeau, La. Night 16th and 17th, levee broke on Tensas River near Stanton's plantation, submerging entire Black and Tensas River country. 17th. Frogmore, Concordia Parish, Louisiana: "water has commenced falling; levees on Cross Bayou above and below here have given away at several places. Moro and Dunbarton levees on Tensas River have given way, flooding the country for miles." Mineola, Tex., 1st, during previous night very heavy rain and remarkable rise in Sabine River; wash-outs on railway between Mineola and Tyler. 3d. Toccoa Falls, Ga., heaviest rain for years; about 12 miles Air Line Railway track washed out and bridge over Tugalo River carried away. 18th. Freshet in Bogue Chilto, submerging 6 miles track of Jackson Railway and interrupting travel between Brookhaven and Coon City, Miss. 25th Farmer City, Ill., creeks higher than ever before known. Princeton, Cal., 22d, Sacramento River, 23 feet 1 inch above zero of gauge, highest water ever known. 23d. Much damage in Sacramento, San Joaquin, Santa Clara, Napa, and other valleys in central and western California, from very heavy rains, 20th–23d. 21st. Yolo levee, near Sacramento, broke. Peoria, Ill., 24th, city flooded, many buildings damaged; numerous wash-outs and land-slides, interrupting railway travel. Litchfield, Mich., 30th, Saint Joseph River highest for 25 years. Fayette, Miss., 16th, streams highest ever seen; crops, bridges, and stock swept away; damage very great.

Hail.—Hail storms have been especially frequent and cannot be enumerated in detail. The following storms were unusually severe or interesting from the size of the hailstones. March 31st, very violent in parts of Cowen and Dallas Counties, Texas; near Plano the hail zone was 200 yards wide; the stones were as large as hickory nuts, and covered the ground like snow drifts. April 1st, Fort Ewell, Tex., violent, stones pierced tents and knocked shingles from roofs. 4th, Knoxville, Tenn., very severe, stones as large as partridge eggs fell in great quantities. 6th, Spartansburg, S. C., "terrific, the severest since memorable storm of June, 1840. Some stones 6 inches in circumference. Much damage to glass, and to fruit trees." Denny's Cross Roads, S. C., "worst ever known in this section; lasting 20 minutes; stones from size of partridge to hen's eggs." 7th, Maxey's, Ga., several stones 12 inches in circumference; hail fell for 15 minutes, much like snow, a calm prevailing. Bairdstown, Ga., one stone weighed 2 pounds. 16th, Merced, Cal., heaviest for years. 17th, Fayetteville, Tenn., stones size of hen's eggs, weighing 4 to 6 ounces. 18th, Mentor, Ohio, stones as large as marbles. 22d, Tama, Iowa, stones as large as English walnuts. 26th, Oakville, Ont., violent. Montgomery, N. Y., 6th, violent, doing much damage to buildings. 29th, Columbia, S. C., stones as large as hen's eggs. Gainesville, Ga., 4th, stones one inch in diameter; 6th, "size of chestnuts." Nora Springs, Iowa, 24th, of one to two inches in diameter, "soft, snowy texture." Fort Madison, Iowa, 24th, size of quail's eggs. Point Pleasant, La., half-inch in diameter. Hudson, Mich., 3d, "very severe, stones as large as walnuts. Twenty-four picked up half-hour after falling weighed 72 ounces. Fowls killed and farm houses damaged." Pierce City, Mo., 24th, stones 1.5 by 1.2 inches in diameter. Newark, N. J., 5th, one-half to three-fourths inch in diameter. Franklin, Pa., 4th, large, breaking much glass. Wytheville, Va., 25th, average diameter, one-half inch, of some one-fourth inch. Red Bluff, 20th, three-eighths inch in diameter, covering ground. Fort Sill, 17th, one-half inch in diameter. Castroville, Tex., 28th and Mason, Tex., 6th, "size of hen's eggs." Near Mount Airy, Ga., 3d, "reported as large as a man's fist." Savannah, Ga., 4th, some 1¼ inch in diameter; much glass broken in city; gardens seriously damaged. Augusta, 6th, size of partridge's eggs, covered the ground; "this hail storm is reported to have killed young stock in Orangeburg County, South Carolina."

RELATIVE HUMIDITY.

The percentages of mean relative humidity for the month range as follows: New England, from 57.6 to 85.5; Middle Atlantic states, 47.2 to 84.1; South Atlantic states, 60.4 to 79.2; Eastern Gulf states, 67.6 to 77.6; Western Gulf states, 59.3 to 79.5; Ohio valley and Tennessee, 53.6 to 70.0; Lower Lake region, 61.9 to 66.6; Upper Lake region, 62.9 to 72.6; Upper Mississippi valley, 53.7 to 62.0; Missouri valley, 45.9 to 68.4; Red River of the North valley, 72.8 to 75.0; Eastern Rocky Mountain slope, 23.0 to 72; Western Plateau, 19.0 to 54.8; California, 67.5 to 78.9; Oregon, 52.0 to 70. *High stations* report the following averages not corrected for altitude: Pike's Peak, 68.9; Mount Washington, 85.0 per cent.

WINDS.

Total movements of the air.—The following are among the *largest* total movements in various sections of the country: Pike's Peak, 16,279; Portsmouth, N. C., 13,560; Delaware Breakwater, 13,958 miles; Wood's Holl, 12,491; North Platte, 11,948; Indianola, 11,845; Fort Elliott, Tex., 11,050; Grand Haven, 10,875; Bismarck, 10,575; Saint Louis, 9,499; Erie, 9,491; Red Bluff, 8,621; Cairo, 7,671; Punta Rassa, 7,889. Frost-work prevented a complete record on Mount Washington. The *smallest in various districts are:* El Paso, 2,546; Roseburg, 2,569; Augusta, 2,787; Uvalde, 3,167; Tucson, 3,448; Lynchburg, 3,794; Toledo, 4,083; Nashville, 4,140; Montgomery, 4,733; Little Rock, 5,118; Springfield, Mass., 5,163; Baltimore, 5,398; Dubuque, 6,203; Escanaba, 6,804.

Local storms.—Violent local storms, in unusual numbers, occurred during April. Tornadoes, causing loss of life or doing serious injury to property, were reported from Kansas and Louisiana on the 2d; from Georgia on the 3d, 4th, and 24th; from Missouri, Arkansas, Iowa, Illinois, and Wisconsin on the 18th and 24th; from Illinois on the 23d; from Illinois and Missouri on the 24th, and from Mississippi on the 25th, 29th, 30th. The following details have been gathered from reports made by Signal Service and voluntary observers and other sources more or less reliable. Ottawa, Kans., 2d, about 6 p. m., severe tornado, destroying much property, injuring 15 persons and killing several. Just before the storm dark and angry looking clouds formed suddenly in the W. and NW., and as they drew near, seven houses were first demolished. The cloud, then bouncing over a space of 400 feet, unroofed a freight depot and overturned two railway cars, injuring seriously several passengers. The path of the storm was narrow; the direction from SW. to NE. Girard, Kans., 2d, 7 p. m., tornado apparently developed seven miles to the southwest and moved northeastward to within one mile of the town, where its course was changed to east, moving thence directly to the Missouri line; track 3 to 50 rods wide; 3 persons killed, many others badly hurt, and 17 houses destroyed. Shreveport, La., 2d, p. m., violent thunder-storm and tornado; 3 persons injured and 15 buildings destroyed; path one mile long and one-fourth mile wide; shape, parabolic curve. Loud roaring preceded storm. *Débris* on S. side fell to W., on N. side to E. Dalton, Whitefield County, Georgia, 3d, p. m., tornado passed 6 miles north of town, extending across Connasauga River into Murray County; 2 persons killed, many injured, and 18 houses completely demolished; path about one mile wide; two opposing currents of wind were observable during the progress of the storm, one from the west, the other and the most violent from the east. This tornado crossed Grass Mountain near the point at which a similar storm passed in 1878. 3d, near midnight, tornado and waterspout between Mount Airy and Toccoa, Ga. It passed through Murray County, reaching Cherokee, 100 miles distant, about 2 a. m. Hail reported as large as a man's fist. The county is sparsely settled, yet 50 dwellings of all kinds were leveled, 3 persons killed, and many badly injured. A hog was found 40 feet from the ground in the fork of a tree. Length of path unknown; average width about one mile. Remarkable amount of rain reported, but no figures given. Elbert County, Georgia, 3d, tornado passed through north part of county, blowing down many houses and the largest trees. Its passage resembled a cloud of smoke and fire rolling on the ground. Washington County, Georgia, 4th, during afternoon, tornado passed through southwestern portion of county, demolishing many buildings; track one-half mile wide; direction SW. to NE. Edgefield, S. C., 6th, 5 p. m., "most terrible storm of wind ever remembered." Trees and houses were swept away; several persons slightly and one seriously injured. Through one large forest, trees were twisted off or uprooted "that had stood for ages." In Mississippi, 15th, p. m., a severe storm swept over Natchez and vicinity, unroofing buildings, uprooting trees, and demolishing fences and outhouses. The rain fell in torrents, sweeping away bridges, &c. All telegraphic communication was interrupted for three days. Wheeling, W. Va., 16th, high storm, culminating in a violent due E. wind at 5 p. m. Two freight depots unroofed and several other buildings seriously damaged. High winds were felt through entire central and southern parts of Ohio At Newark, New Philadelphia, Canal Dover, Milford Center, Springfield, Snyder's Mills, Taylorsville, Columbus, Cincinnati, Martinsville, Bellaire, and Lebanon, buildings were unroofed or blown down and much damage was done to other property. Corwin Center, Bradford, and Oil City, Pa., 16th, destructive wind storm, demolishing derricks and unroofing buildings; two men seriously injured. Buffalo, N. Y., 16th, violent wind storm from SW.; several buildings damaged; heavy weather on Lake Erie; several vessels injured, one sunk. Harrisburg, Pa., 16th, violent wind storm; covered bridge over the Susquehanna River blown in; several buildings more or less damaged. Beloit, Wis., 18th, about 5 p. m., severe tornado swept over the city from SW. to NE.; houses and other buildings destroyed; many persons injured and several killed. Loss to property estimated at $75,000. Stiles, Davis County, Iowa, 18th, tornado passed from SW. to NE. through the town and adjoining country, causing great destruction to property; path 20 miles long and from 50 to 300 yards wide; accompanied by heavy hail and floods of water. Bloomfield, Iowa, 18th, during afternoon a tornado, causing great destruction to buildings, fences, &c., passed 4 miles north of town in a direction from SW. to NE.; no lives were lost. Greenville, Bond County, Illinois, 18th, furious tornado; almost every portion of the city was more or less injured; numerous houses, &c., were demolished and torn to pieces; several persons seriously injured, but none killed. In and near Decatur, Macon County, Illinois, 18th, violent wind storm, blowing down trees and buildings. Wenona, Marshall County, Warren, Jo Daviess Peoria County, Illinois, 18th, violent wind and rain storm; many buildings demolished; no lives lost. Champaign, Ill., 18th, old university building badly wrecked and many other buildings partially demolished. Ottawa, La Salle County, Illinois, 18th, during the evening a violent storm of wind and rain, causing much destruction. Peoria, Peoria County, Illinois, 18th, heaviest storm of wind and rain experienced for many years; many buildings damaged. Summerfield, Saint Clair County, Illinois, 18th, very violent storm of wind, rain, and hail; much damage to trees and buildings. Jacksonville, Morgan County, Illinois, 18th, terrible storm of wind and rain; the roof of county poor house blown off, large ice house torn to pieces, and the bridge across Big Sandy River swept away. Tuscola, Douglas County, Illinois, 19th, about 2 a. m., "a most terrific wind and rain storm," with vivid lightning. Many buildings demolished. Lyndon, Ill., 18th, violent tornado moved NE. from extreme west part of Whitesides County, demolishing 6 buildings; surface wind of SE. 30 miles prevailed. A funnel-shaped cloud hung downward and inclined to rear; sometimes absorbed by surrounding clouds, it would again descend, destroying everything in its path. On April 18th, 1869, a tornado passed over almost the same ground. Clinton, De Witt County, Illinois, 18th, about midnight a very violent wind storm caused considerable damage to buildings. Collinsville, Madison County, Illinois, 18th, violent wind storm accompanied by heavy thunder and vivid lightning; railroad depot completely destroyed. Chester, Randolph County, Illinois, 18th, several houses unroofed and much other property badly damaged. One person seriously injured. Davenport, Iowa, 18th, "wind blew terrific gale," making it unsafe to swing the draw of the government bridge; ferry boats could not cross the river. Much damage to buildings and other property. The following data relative to the remarkably violent storms in connection with low area No. X, that prevailed throughout the Lower Missouri and Central Mississippi valleys on the afternoon and night of the 18th, have been compiled from various sources: In *Missouri* the following places were more or less devastated by a series of separate tornadoes the paths of which ran from SW. to NE., and were distributed over a narrow strip of country, having an average width of about 80 miles. The most destructive, or what is known as the Marshfield tornado, was first *reported* as appearing in Barry County, Missouri, near the Arkansas line, where ten persons were killed in the Crow Creek settlement and six on Flat Creek. It moved thence northeastward, passed six miles south of Springfield, Green County, reaching Marshfield, Webster County, about 6 p. m. All of the buildings, brick and frame, in this city of nearly 2,000 inhabitants, were demolished except half a dozen, the ruins taking fire during the prevalence of the storm; 65 persons were killed and about 200 wounded. In the vicinity of the town the violence of the storm was such that trees 3 feet in diameter were for a space of several hundred yards wide lifted entirely out of the ground, limbs twisted off and split into kindling wood, and the bark of trees peeled off as if struck by lightning. Loss of property in these two counties estimated at over $1,000,000. After leaving Marshfield the tornado struck the Saint Louis and Santa Fé Railroad 10 miles east, with greatly diminished force, and at about 8 p. m. reached Frank's Station 110 miles ENE. of Springfield, where, after crossing the Gasconade River, it continued only as a heavy storm of wind and rain. At Conway, Laclede County, one house blown down and two children killed. In Panther Valley, Webster County, seven persons reported killed and a large amount of property destroyed by a tornado which passed northeastward about 20 minutes later than the Marshfield storm. At Licking, Texas County, the entire town was destroyed, except three houses; 300 persons were left homeless; one person killed and 17 wounded, 5 of them seriously. The loss to property is estimated at $50,000. At Cuba, Crawford County, the town and surrounding country were nearly laid waste. In the vicinity of Jefferson City, about 60 miles NW. of the line of the Marshfield tornado, another series of violent storms devastated portions of Morgan, Cole, Moniteau, and Callaway counties, on the night of the 18th. At New Bloomfield, Callaway County, 10 houses and one church were destroyed, several persons injured, and one killed. The town of Barnettsville, Morgan County, was nearly torn to pieces; several persons killed and many wounded. The surrounding country was strewn with fragments of demolished buildings. At Russellville, Cole County, great destruction to property occurred; several persons killed and many injured. One of the tornadoes crossed the Missouri Pacific Railroad, near Scott's Station, causing considerable destruction to property; 10 persons were seriously injured. Ten miles SW. of Fulton, Callaway County, the tornado made great havoc among the farm houses in the line of the storm; 2 persons were killed and 8 wounded. At Carrington, Callaway County, several houses were unroofed and other property destroyed. The tornado moved nearly due north in this vicinity for three or four miles, demolishing everything in its course. Those who were near describe the appearance of the clouds as "terrible," and the noise as the sound of "10,000 express trains." Regarding the storms in that State the Missouri Weather Service says: "The average width of its (Finley Creek valley storm) destructive path for a distance of 100 miles would be at least 3,000 feet." "The destructive path of this (Marshfield) storm was about 45 miles long and on the average 1,500 feet wide." The area covered by these three storms will not fall short of 80 square miles. Not less than 100 persons lost their lives. In *Kansas* the violent local storms of the 18th were confined to the eastern tier of counties, and occurred between 3 and 4 p. m. At Leavenworth several buildings were unroofed; one person was seriously injured. At Lawrence the worst wind storm ever known, the measured wind velocity at the State University from 3.30 to 3.45 p. m. reaching a maximum of 80 miles per hour. The roof of the university building was damaged; large number of buildings unroofed or blown over. At Shawnee Mission, Johnson County, a violent wind storm prevailed between 4 and 5 p. m., demolishing several buildings and injuring 5 persons. In *Arkansas* the storms of the 18th only visited the northern half of the State. At Fayetteville, Washington County, the tornado struck about 8.30 p. m., passing through the town from SW. to NE.; the track was about 100 yards wide, and not a single building in its course escaped destruction or injury. Buildings, fences, and trees were leveled to the ground and the fragments scattered in every direction. Over 100 buildings destroyed, two persons killed, and 20 to 30 injured, many of them seriously. The loss to property is reported to be over $100,000. Goshen, 12 miles northeast of Fayetteville, was struck later by the tornado and almost entirely swept away. At Eureka Springs, 20 miles northeast of Fayetteville, 18 houses were demolished, one person killed, and several injured. In Franklin County, near Ozark, a violent storm of wind, rain, and hail prevailed from 6.40 to 7 p. m.; the roar of the storm was dreadful and its destruction complete. The damage among the farming community was very great. El Paso, White County, was struck by a violent tornado at 8 p. m.; ten persons were killed and twenty injured. The path of the storm was about one-fourth mile in width and passed from SW. to NE.; the devastation, throughout its entire course, was complete. The town of Dardanelles, in the northeastern portion of Yell County, was partly destroyed, about 8 p. m., by a violent storm. 18th, severe wind and rain storm in Chester, Eaton County, demolishing several buildings and killing live stock. Track of storm one-fourth mile wide. In *Indiana* violent local wind storms were experienced, but the time of their occurrence was early on the moring of the 19th. At Richmond, Wayne County, the wind was exceedingly violent; several houses were blown down and unroofed; great damage was caused to buildings and telegraph lines throughout the Whitewater valley. A violent wind storm reached Wabash about 4 a. m., causing considerable damage to buildings, fences, &c. Along the southern boundary of *Wisconsin* the violent tornadoes of the 18th were experienced about 5 p. m. At Shopiere, Rock County, 23 buildings were unroofed or destroyed, stock killed, and several persons injured. The path of the storm was quite narrow and its direction from SW. to NE. In the vicinity of Turtleville, Rock County, the tornado was equally severe. Those who witnessed its approach from the SW. said that it appeared much like a "turbulent mass or wall of clouds, in color varying from gray to black, and moving somewhat in the form of eddies or small whirlwinds, some rising, some falling, the whole moving at a rapid pace, gathering up all loose rubbish, hurling it in every direction. There was a steady ominous roar unlike anything ever heard before, resembling both the screech of a bomb-shell and the rumble of many heavy-laden railroad trains." At Rockton, just across the Illinois line, the tornado was severely felt. The premonitions of an unusual storm were clearly evident in the huge masses of dark clouds piling up in the W. and NW., together with the rapid shifting of the conflicting air currents. Clouds were seen to "whirl, twist, and fly in all directions, some chasing swift toward the NW. in solid masses, lighter ones curling gracefully up toward the zenith, working back and forth across the face of the heavier masses, while others swept toward the NE. and E., causing an intermingling of the wildest confusion." Portions of the path of this storm appeared to disclose a zigzag course of the storm cloud, as if in its progressive movement it swung from side to side. The general direction was from SW. to NE., and varied in width from one-quarter to one-half mile. On the 24th, at about 7.30 p. m., a violent tornado entered Lima Township, Adams County, Illinois, from Lewis County, Missouri, passing northeastward through the northern portions of Keene and Houston townships. The The storm cloud was very black, funnel-shaped, and moved with great velocity, like a screw propeller; path one-half mile wide, everything swept before it; 5 persons seriously injured. Taylorville, Christian County, Illinois, 7 p. m., storm passed from SW. to NE. First observed as a funnel-shaped cloud gradually approaching the earth, which struck near Sharpsburg, where it demolished everything in its path for a distance of 8 miles; width of track one-eighth to one-half mile; 6 persons killed and 20 injured. Hundreds of horses and cattle killed or seriously injured, and 25 farm houses destroyed. Carlinville, Macoupin County, Illinois, 24th, about 6.30 p. m., "terrific" wind storm passed 2 miles north, crossing the Chicago and Alton Railroad, demolishing houses, barns, fences, and orchards. Joplin City, Jasper County, Missouri, 24th, about 5 p. m., terrible tornado; barns, hoisters, engine rooms, and buildings through the mines all demolished; 12 houses blown down and several persons injured. Webb City, 5 miles north, was completely wrecked. Macon, Miss., 25th, 8.30 p. m., terrible tornado, demolishing 22 houses and other buildings, including all railroad shops and depots; 16 box cars were blown from the track, many of them turned bottom side up; 22 persons were killed and 72 injured. The damage to property was estimated at $100,000. One house near the center of the storm was whirled around and its front changed in exactly the opposite direction. A pair of car trucks weighing 8,000 pounds were lifted 200 yards from the track. The first approach of the storm was indicated by "peculiar black clouds in the SW. and NE. rushing toward each other, and when nearly together two balls of fire appeared to leave them and unite with a terrible roar, when the storm burst." It did not seem to come from across the country, but suddenly shot downward from the air, devastating the city in about three minutes. Paint Rock, Jackson County, Alabama, 25th, many houses and barns destroyed, and three children killed; width of track 75 yards. Giles County, Tennessee, 25th, great damage done to buildings and stock. Dalton, Whitefield County, Georgia, 25th, about sundown, several houses unroofed, and much damage to other property; width of track one-quarter to one-half mile. Mayersville, Issaquena County, Mississippi, 22d, about 1.30 a. m., very violent wind and rain storm continued for 10 to 15 minutes, blowing down houses, fences, stables, and trees. Near Griffin, Spaulding County, Georgia, 20th, between 7 and 8 a. m., violent tornado, accompanied with a dull roaring noise and funnel-shaped cloud, passed from SW. to NE., destroying fences and unroofing trees over a path about 50 yards wide and 2 miles in length. In some places the cloud rose from the ground, and skimmed along over the tops of trees, twisting off only the upper limbs. Grassy Cove, Cumberland County, Tennessee, 25th, 7.30 p. m., destroying several buildings, uprooting trees, and demolishing fences. In a large forest to the rear of the town hundreds of the stoutest trees were torn up by the roots or twisted off near the ground with the greatest violence. Dawson, Sangamon County, Illinois, 24th, 10 p. m., several buildings destroyed and much fencing blown down. In many instances fences running north and south were, at points, first thrown to the east, and then at a short distance to the north, almost the same length of fencing thrown to the west, showing a marked characteristic of the tornado. Fences running east and west were alternately thrown north and south. Direction of storm N. 70° E. At Medova, Rockbridge, Chesterfield, and Anderson Switch, Macoupin County; Rochester, Sangamon County; Tuscola, Douglass County; Ashland, Cass County; Farmer City, DeWitt County; and Kankakee, Kankakee County, very violent wind and rain storms occurred during the evening of the 24th, causing immense damage to property and stock. Oskalooska, La., 28th, high wind, blowing down several houses (some old) in Jackson, Winn, and Ouachita parishes. Columbia, S. C., 29th, 4 p. m., terrific tornado, several persons injured and many buildings blown down. Track a few hundred yards in width, direction from SW. to NE. At Plano, Kinney, Melissa, Brenhan, Granville, and Davilla, Tex., 29th, violent wind storms, blowing down houses, destroying much property, and injuring several persons. Yazoo City, Miss., violent wind storm, demolishing buildings, trees, and fences; track very narrow, SW. to NE.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daly indications for March with the telegraphic reports for the succeeding twenty-four hours shows the general percentage of verifications to be 82.3 per cent. The percentages for the four elements are: weather, 87.8; direction of the wind, 78.0; temperature, 79.9; barometer, 82.9 per cent. By geograpical districts they are: for New England, 81.6; Middle states, 84.7; South Atlantic states, 83.5; Eastern Gulf states, 83.9; Western Gulf states, 81.8; Lower Lake region, 84.5; Upper Lake region, 79.9; Tennessee and the Ohio valley, 84.9; Upper Mississippi valley, 80.9; Lower Missouri valley, 76.8; Northern Pacific coast region, 86.1; Central Pacific coast region, 83.9; Southern Pacific coast region, 83.9. There were 20 omissions to predict out of 3,790, or 0.54 per cent. Of the 3,670 predictions that have been made 89, or 2.42 per cent., are considered to have entirely failed; 169, or 4.60 per cent., were one-fourth verified; 544, or 14.82 per cent., were one-half verified; 647, or 17.63 per cent., were three-fourths verified; 2,221, or 62.51 per cent., were fully verified, so far as can be ascertained from the tri-daily weather maps.

Cautionary signals.—292 cautionary signals were displayed during the month, of which 254, or 87.0 per cent., were justified by winds of 25 miles per hour or over at or within a radius of 100 miles of the station. 104 off-shore signals were displayed, of which 91, or 87.5 per cent., were fully justified; 96, or 92.3 per cent., were justified as to velocity; 94, or 90.4 per cent., as to direction; and 5, or 4.8 per cent., were not justified either as to direction or velocity. 45 of the off-shore were changed from cautionary. 396 signals of both kinds were displayed, of which 345, or 87.1 per cent., were fully justified. The above does not include signals ordered for 50 display stations where the velocity is only estimated. 89 cases of winds of 25 miles and over per hour from scattering stations were reported, and for which signals had not been ordered.

NAVIGATION.

In the table on the right-hand side of chart No. III are given the highest and lowest readings of the Signal Service river gauges for the month, with the dates of the same. The *Red River* at Shreveport fell slowly throughout the month. The *Arkansas* at Little Rock remained comparatively low throughout the month, the highest water occurring on the 9th; at Fort Gibson, on the 3d, Grand River was higher than for 2 years past. In the *Missouri* the highest water occurred at Omaha on the 6th and Leavenworth on the 7th; the water fell about 7 feet at former and 5 feet at latter station during the following week, and remained almost stationary to end of month. The *Mississippi*, from Saint Paul to Keokuk, had its lowest water on the 1st, after which it rose somewhat, but did not present any very high water throughout the month; the observer at Dubuque, however, reports the water on the 17th and 18th the highest since 1875; at Cairo the water fell from the 1st to the 16th; remained almost stationary to the 29th, when a rapid rise set in from the Ohio; at Memphis it fell throughout the month; at Vicksburg and New Orleans the water continued very high and above the danger line throughout the entire month, and much damage occurred, which is noted under "Floods." The *Ohio* at Pittsburgh, Cincinnati, and Louisville fell slowly from 1st to 23d or 24th; after which a rapid rise occurred, reaching the maximum at Pittsburgh on the 27th, Cincinnati on the 29th, and Louisville on the 30th. The *Cumberland* at Nashville generally fell until the 15th, rose to its highest point by the 20th, and fell to end. The *Tennessee* at Chattanooga had the highest water on the 5th, fell to the 15th, and after a slight rise remained almost stationary to end.

Ice in rivers and harbors, &c.—The following notes on the breaking up of ice and opening of navigation are reported by observers: *Missouri.*—Fort Hale, Dak., 9th, first steamboat. Omaha, 5th, navigation opened; 23d, first steamer up. Leavenworth, 6th, first steamer. *Mississippi.*—Saint Paul, 14th, first steamboat arrived. *Red River of the North.*—Pembina, 16th, ice moved, and on 23d went out, and navigation opened. 27th, first steamboat. *Lake Superior.*—Duluth, 15th, ice broke up in lake, but on 22d the harbor was again filled with ice. Marquette, 11th, ice broke around docks; steamers and barges arrived on the 28th. *Lake Michigan.*—Escanaba, 13th, the first steamers broke their way through the ice. *Lake Huron.*—On the 6th the first fleet of vessels coming through Mackinac Straits arrived at Port Huron. *Erie Canal.*—Opened at Rochester on the 17th, and Albany on the 19th. At Buffalo canal navigation opened on the 20th. *Otsego Lake.*—Cooperstown, N. Y., 7th, lake open. *Lake Champlain.*—Burlington, floating ice in lake and harbor to the 8th. *Kennebec River.*—Gardiner, Me., open on 3d; first steamer on 5th. Closed 110 days. *Lake Massabesic.*—Auburn, N. H., 9th, free of ice.

High tides.—Baltimore, 30th, very high. At Buffalo, N. Y., on the 10th, the water in Lake Erie rose 6 feet, and was higher than for 20 years past.

Low tides.—New River, N. C., 15th, very low.

TEMPERATURE OF WATER.

The temperature of water as observed in rivers and harbors, with average depth at which observations were taken, is given in the table on the left-hand side of chart No. II. At the following stations observations were not made, either on account of ice or loss of thermometer, on the dates indicated: Alpena, 1st to 15th; Escanaba, 1st to 19th; Marquette, 1st to 10th, 16th and 17th; San Francisco, 2d to 30th. Lake too rough for observation at Cleveland, 10th and 11th. At Chincoteague, Va., observations were commenced on the 14th. The March temperatures for Punta Rassa are: max., 80°; min., 68°; average depth, 13 feet.

ATMOSPHERIC ELECTRICITY.

Thunder-storms were of remarkable frequency during the month, but lack of space prevents their enumeration in detail.

Auroras.—During April, 1880, two general displays occurred—on the 1st and 28th—in each case extending from Eastport, Me., to Bismarck, Dak.; New Haven was the most southerly station reporting on either day. On the 1st the display generally prevailed from 9 p. m., Washington mean time, till after midnight. Eastport, Me., bright yellow; arch, 40° altitude. Grafton, N. H., faint white. Windsor, Vt., faint diffuse light, changing to arch 18° high, with segment. Burlington, Vt., bright diffuse arch of light, pale straw color. New Haven, arch of pale white light 10° altitude, 30° azimuth. Newburyport, Mass., bright segment, 15° azimuth, with quivering motion, rays shooting upward to 20° altitude. Waterburg, N. Y., 10° altitude. North Volney and Argyle, N. Y., diffuse light. Oswego, diffuse yellow light. Buffalo, faint motionless light above a dark segment of 20° altitude, 6° breadth and from 160° to 200° azimuth; beams brighter near midnight. Marquette, Mich., faint. Pembina, Dak., broad band of brilliant white light from 170° to 270° azimuth, altitude, 30°. Sometimes a second arch formed 10° under the first; at such time the upper arch faded while the second rose with increasing brillance, occasionally sending rays of short duration upward across the first arch. Bismarck, segment of nebulous light, 15° altitude, with few streamers. 28th.—The display generally prevailed from 8 p. m., Washington mean time till after midnight. Eastport, Me., arch from N. W., to N. E.; altitude 35°. Gardiner, Me., faint, without beams, 60° azimuth. Cambridge, Mass., suspected. Grafton, N. H., very bright. Burlington, Vt., pale emerald green light of marked intensity; a dark segment and bright arch with frequent streamers changing near midnight to steady light. New Haven, well defined dark segment almost black, with no arch or crown; color delicate rose; streamers of steady light with variable brightness and altitude occasionally shooting up to 30°. Ardenia, Waterburg and Argyle, N. Y., faint and diffuse. Pembina, from 170° to 260° azimuth, pale diffuse light with no distinct outlines; light being brightest at its summit, 40°. Light brillant enough to cast a faint shadow. Bismarck, Dak., faint altitude 10°; one stationary beam in NNE. section. On the 2d a display was visible at Eastport, Me., pale yellow. Grafton, N. H., and Burlington, Vt., bright arch with few streamers, but no dark segment. 4th, at Pembina, Dak., faint. The following reports for March were received too late for publication in the Review for that mouth: Eola, Oreg., 6th, very faint. Fort Assiniboine, Mont., 12th, 9.15 p. m., extending from E. to W. Three parallel arches, two upper very distinct, lowest faint. Twelve luminous beams shot upward from the highest arch. One beam resembled a bluish flame, and continued with great splendor for 45 minutes. 17th, 10 p. m., lasting 40 minutes, auroral arch of irregular and sinuous bands of variable curves, with a rapid undulatory motion from E. to W. Bright beams shot upward from arch, lasting but a few moments. Thornville, Mich., 17th, 9 to 10 p. m., few beams, no dark segment. In connection with the extensive display (from Maine to Montana) of March 17th it is noted as of interest that at 9 p. m. an aurora was seen at Edinburgh, Scotland. It was a low arch of quiescent light, breaking up at 11 p. m. into bright pellets, which sent upwards fainter rays, and then gradually disappeared.

Atmospheric Electricity.—Pembina, Dak., 3d, during a snow storm a constant band of flame accompanied by a loud buzzing sound, continued for nearly an hour between the points of the lightning arrester. Omaha, 13th, telegraph wire highly charged with electricity for whole day during a violent dust storm. Mount Washington, N. H., 10th, strong shocks of electricity felt from anemometer through two pair mittens, one of buckskin.

MISCELLANEOUS PHENOMENA.

Sunsets.—The characteristics of the sky at sunset as indicative of fair or foul weather for the succeeding twenty-four hours have been observed at all Signal Service stations. Reports from 133 stations show 3,901 observations to have been made, of which 30 were reported doubtful; of the remainder, 3,265, or 84.3 per cent., were followed by the expected weather.

Zodiacal light.—Harvard College, Cambridge, Mass., looked for daily; distinct, 5th, 8th; visible, 7th, 10th; suspected, 26th. Wytheville, Va., 4th, 5th; very bright, broad cone, 8th. Mr. Charles Hasselbrink, observer, at Havana, Cuba, reports: April 1st, 8 p. m., visible about 20° above horizon, of irregular elliptical shape, with large axis, inclined to north; 8.15 p. m., diminished and, at 9 p. m., disappeared. 3d, light glare of triangular shape, from 8.30 to 9.20 p. m. 6th, light, fairly visible, about 7.25 p. m.—stands about 27° high—without determined shape, and inclined (2° to 3°) to north; after 8.15 p. m., indifferent glare till disappearance. The following are a number of conclusions arrived at by Mr. Hasselbrink. (1) The zodiacal light is visible at Havana whenever the circumstances are favorable, that is, when there is neither cloudiness nor moonshine; (2) it presents a translucent, reddish, yellowish veil, which partly or feebly masks the sky, and when it decreases in brightness various stars become visible; (3) the intermittence in its intensity is characteristic, can be noted always, and is generally surprisingly sudden—every increase of light seems a rapid effluvium; (4) the extension and form vary; sometimes it stands about 40° above horizon, and has somewhat the shape of an isosceles triangle, at other times it does not rise above 30°, widening at the base and approaching equilateral triangle;

(5) the light generally exceeds in brightness that of the milky way, and has a different character, being more uniform; (6) the duration is from 1½ to 2 hours; (7) direction of axis of light not yet determined—it appears at times inclined towards the north, at times has the same inclination towards the south, and sometimes appears perpendicular.

Meteors.—Woodstock, Md., 28th, 8.40 p. m., greenish color, large nucleus; exploded, but no noise heard. Cape Henry, Va., 1st, 10 p. m., lighting up entire heavens; course from SE. to N., visible 8 seconds; color pale blue, leaving train of bright yellow; exploded 35° above horizon; no noise heard.

Solar and lunar halos were reported in too large a number during April to permit of their enumeration in detail.

Prairie and forest fires.—In the vicinity of Lincoln, Sussex County, Delaware, 13th, 5,000 acres burned over the first day. Pike and Monroe Counties Pennsylvania, 14th, assumed alarming proportions; 25th, broke out afresh, causing great destruction of timber. In Monroe County nearly 2,000 acres burned over. Ocean County, New Jersey, 14th, most extensive for years, area burnt over estimated at 60 square miles, extending from Bricksburg to Manchester; 18th, broke out again; Cape May and Cumberland Counties, 19th, disastrous fires broke out at Millville, Belle Plain and Mount Pleasant; fires still burning vigorously in Cape May, Cumberland and Atlantic Counties. Norfolk, Va., 15th, extensive fires in Dismal Swamp; enveloped Lake Drummond, preventing steamers from passing through the canal. Petersburg, Va., 15th, fires uncontrolable; in Prince George County very destructive. Dinwiddie, Chesterfield and Sussex Counties, 18th, reported beyond all control; losses very great; three persons burned to death. Port Jefferson, L. I., 21st, terrible forrest fire swept away nearly the whole north portion of the town of Brookhaven, burning over 1,000 acres in the adjacent country.

Sun spots.—The following record of observations, made by Mr. D. P. Todd, Assistant, has been forwarded by Prof. S. Newcomb, U. S. Navy, superintendent National Almanac Office, Washington, D. C.:

Date.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	
April 1880.									
1st, 8 a.m.	0	0	0	0	0	0	3	10	Faculæ.
2d, 8 a.m.	0	7	1	5	0	0	2	12	
4th, 2 p.m.	0	14†	0	0	0	0	2	26†	Faculæ. Many of the spots small.
5th, 8 a.m.	0	0	0	0	0	0	2	16†	
7th, 9 a.m.	0	0	....	....	0	0	1	3	Faculæ. Spots probably disappeared by solar rotation.
8th, 9 a.m.	0	0	0	0	0	0	1	3	
9th, 8 a.m.	1	2	0	0	0	0	2	5	Faculæ.
10th, 8 a.m.	1	5	0	0	0	0	3	10	Faculæ.
11th, 9 a.m.	0	0	1	3	0	0	1	10	
12th, 7 a.m.	0	0	0	0	0	0	1	10	
13th, 8 a.m.	0	0	0	0	0	0	1	10	
14th, 8 a.m.	1	3	0	0	1	3	2	13	Faculæ.
15th, 8 a.m.	0	0	0	0	0	0	2	13	Faculæ.
17th, 7 a.m.	0	0	1	10	0	0	1	3	Spots small.
18th, 8 a.m.	0	0	0	0	0	0	1	3	Broad areas of faculæ.
20th, 5 p.m.	1	1	0	0	0	0	2	4	Faculæ.
21st, 6 p.m.	0	2	0	0	0	0	2	6	
22d, 4 p.m.	0	0	0	0	0	0	2	6	
23d, 3 p.m.	0	0	0	0	0	0	0	0	
26th, 3 p.m.	1	8	0	0	0	0	1	8	
27th, 8 a.m.	0	10	0	0	0	0	1	18†	Faculæ.
28th, 7 a.m.	0	7	0	0	0	0	1	25†	Faculæ. Many of spots small.
30th, 8 a.m.	0	0	0	0	0	0	1	2†	Many of the spots small.

†Approximated.

NOTES AND ABSTRACTS.

Referring to the United States Signal Service, meteorological charts, showing the mean pressure and temperature for July, 1878, Nature, of April 15th, says: "Thus, then, the meteorology of the globe for July, 1878, stands out as a singular phenomenon, characterized by these broad features, viz: (1) a greatly reduced pressure over a large portion of the Southern Hemisphere as compared with what usually obtains there in the winter month of July; (2) a much greater diminution of the pressure than usually takes place in the summer month of July over the land of the Northern Hemisphere, over North America, over central and eastern Europe, western and central Siberia; and (3) a much larger increase of pressure than usually occurs in the Northern Hemisphere over the great oceans in July, the area of unusually high pressure being extended, as regards the Atlantic to the northeast as far as Christiansund, and as regards the Pacific to westward over central and southern Asia, as far as the Arabian Sea. It may be worth remarking that this increased pressure over the oceans and diminished pressure over the land of the Northern Hemisphere is in accordance with what might be expected to result from an increased solar radiation; whilst on the other hand the increased pressure over southern and central Asia, and diminished pressure in the Southern Hemisphere, is not in direct accordance with this supposition. The point here referred to will however receive an illustration from subsequent number of the weather maps, by which it is probable that different results as regards the states of the atmosphere will appear, with the varying states of the sun from year to year. The future maps of this international series will be eagerly scanned in connection with many of the larger questions of atmospheric physics, as well as those directly practical questions of climate with which we have been almost exclusively concerned in this article. It is plain that we need not hope to succeed in dealing with most of the larger problems proposed by meteorology without the help of the data laid before us in so full and convenient a form by the international weather maps of General Myer. It is only thus that we can trace to their proximate causes such climatal phenomena as the recurring droughts of India and the cold, sunless summer of the British Isles in 1879, and show their true relations to the great movements of the atmosphere."

Published by order of the Secretary of War.

ALBERT J. MYER,
Brigadier General (Brevet Assigned), Chief Signal Officer, U. S. A.

PAPER 43.

MONTHLY WEATHER REVIEW, MAY, 1880.

INTRODUCTION.

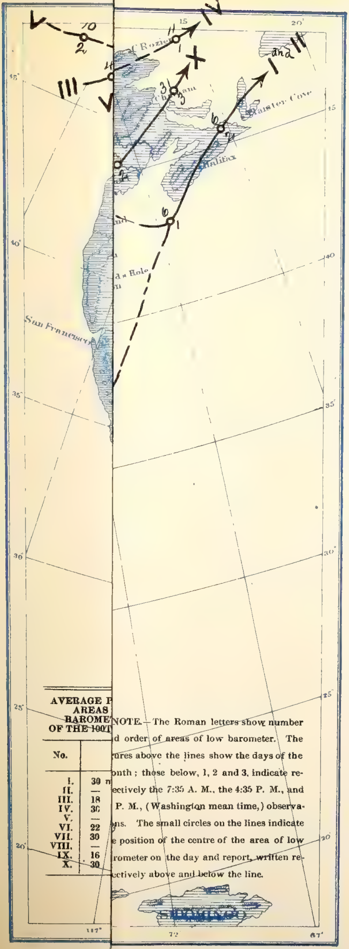
In preparing this review the following data, received up to June 15th, have been used, viz: The regular tri-daily weather charts, containing the data of simultaneous observations taken at 139 Signal Service stations and 13 Canadian stations, as telegraphed to this office; 147 monthly journals and 153 monthly means from the former, and 13 monthly means from the latter; reports from 27 sunset stations; 209 monthly registers from voluntary observers; 28 monthly registers from United States Army post surgeons; marine records; international simultaneous observations; monthly reports from voluntary observers in, and the local weather service of, Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

The general distribution of the atmospheric pressure for the month of May, 1880, over the United States and Canada is shown by isobaric lines on chart No. II. At a few outlying stations the barometric means are given in figures (English inches). The regions of highest pressure are found to cover the Middle and South Atlantic states and North Pacific coast region, the maximum means being reported from stations along the immediate coast of North Carolina. The region of lowest pressure covers the Red River of the North valley, the minimum mean for the whole country being reported from Pembina, Dak.

Departures from the normal values for the month.—By comparison with the average of the means for the months of May for the past eight years, those for the present month (May, 1880) show a decided excess of pressure over the region of highest barometer along the Atlantic coast, and a large deficiency over Dakota, Minnesota, and northern Wisconsin, or the region of lowest barometer. The deviations have ranged about as follows: An excess of from 0.04 inch at Jacksonville to 0.11 inch at Cape Hatteras in the South Atlantic states: from 0.07 to 0.02 from New England and the Middle states to the Ohio valley and Eastern Gulf states; and from 0.01 at Portland, Oreg., and San Diego to 0.07 at San Francisco. Elsewhere a general deficiency has occurred,

No. 1.



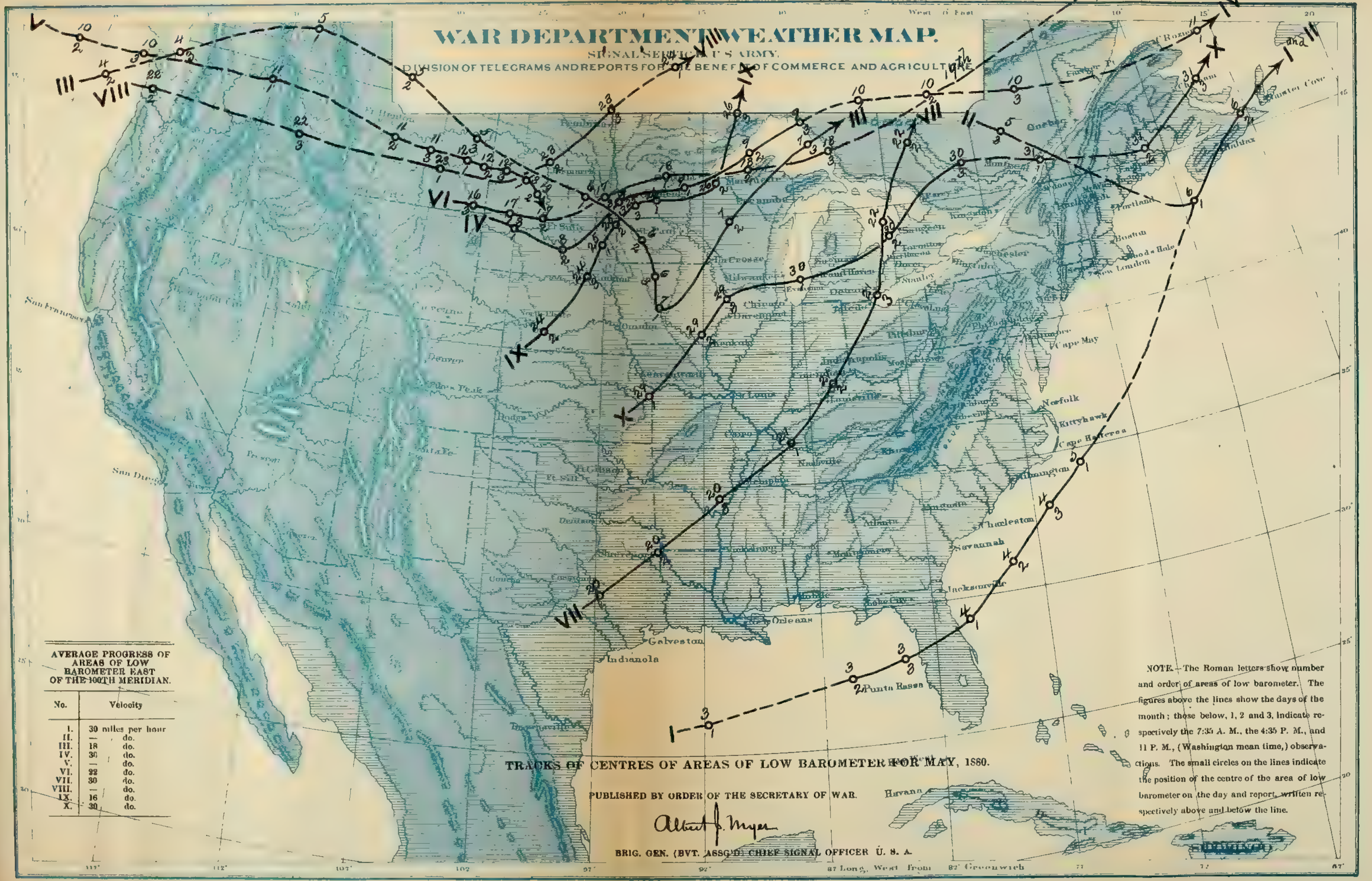
AVERAGE P
AREAS
BAROME
OF THE 100T

No.	
I.	30 n
II.	—
III.	18
IV.	30
V.	—
VI.	22
VII.	30
VIII.	—
IX.	16
X.	30

NOTE.—The Roman letters show number d order of areas of low barometer. The ures above the lines show the days of the onth; those below, 1, 2 and 3, indicate re- ectively the 7:35 A. M., the 4:35 P. M., and P. M., (Washington mean time,) observa- ns. The small circles on the lines indicate e position of the centre of the area of low rometer on the day and report, written re- ectively above and below the line.

No. 1.

THE PREPARATION OF CHARTS OF THIS SERIES COMMENCED NOVEMBER 8, 1870



WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE U. S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

AVERAGE PROGRESS OF AREAS OF LOW BAROMETER EAST OF THE 100TH MERIDIAN.

No.	Velocity	
I.	30	miles per hour
II.	—	do.
III.	18	do.
IV.	30	do.
V.	—	do.
VI.	22	do.
VII.	30	do.
VIII.	—	do.
IX.	16	do.
X.	30	do.

NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7:35 A. M., the 4:35 P. M., and 11 P. M., (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above and below the line.

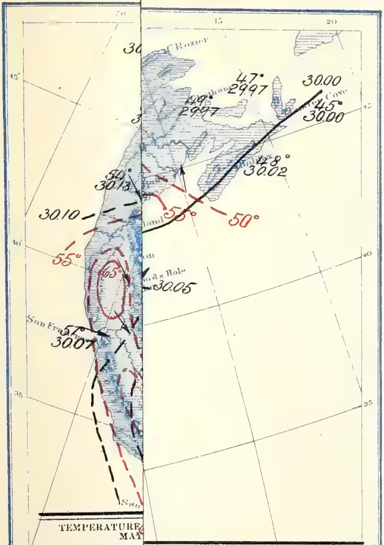
TRACKS OF CENTRES OF AREAS OF LOW BAROMETER FOR MAY, 1880.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER U. S. A.

No. II.



TEMPERATURE
MAY

STATIONS.	Te a M
Alpena	
Augusta	
Baltimore	
Buffalo	
Burlington, Vt.	
Cedar Keys	
Charleston	
Chicago	
Chincoteague	
Cleveland	
Detroit	
*Duluth	
Del. Breakwater	
Eastport	
Escanaba	
Galveston	
Grand Haven	
Jacksonville	
Key West	
Marquette	
Milwaukee	
Mobile	
New London	
New York	
Norfolk	
Portland, Maine	
Punta Rassa	
Sandusky	
*San Francisco	
Savannah	
Smithville	
Toledo	
Wilmington	
Wood's Holl	

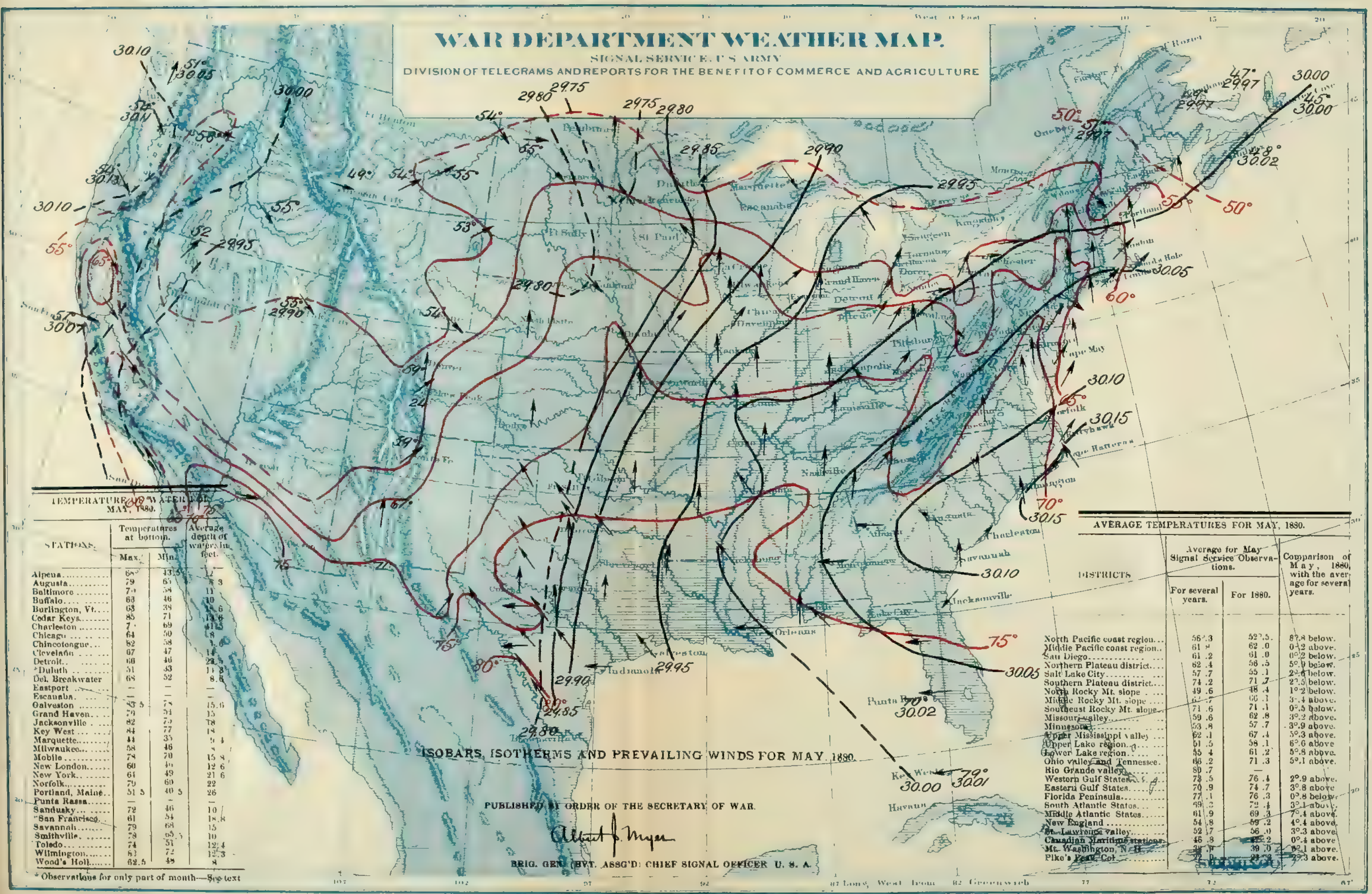
* Observations for only

TEMPERATURES FOR MAY, 1880.

	Average for May. Signal Service Observations.		Comparison of May, 1880, with the average for several years.
	For several years.	For 1880.	
on...	56°.3	52°.5	8°.8 below.
on..	61 .8	62 .0	0°.2 above.
	61 .2	61 .0	0°.2 below.
st...	62 .4	56 .5	5°.9 below.
	57 .7	55 .1	2°.6 below.
ct...	74 .2	71 .7	2°.5 below.
	49 .6	48 .4	1°.2 below.
	62 .7	66 .1	3°.4 above.
pe..	71 .6	71 .1	0°.5 below.
	59 .6	62 .8	3°.2 above.
	53 .8	57 .7	3°.9 above.
	62 .1	67 .4	5°.3 above.
	51 .5	58 .1	6°.6 above.
	55 .4	61 .2	5°.8 above.
see..	66 .2	71 .3	5°.1 above.
	80 .7	—	
	73 .5	76 .4	2°.9 above.
	70 .9	74 .7	3°.8 above.
	77 .1	76 .3	0°.8 below.
	69 .3	72 .4	3°.1 above.
	61 .9	69 .3	7°.4 above.
	54 .8	59 .2	4°.4 above.
	52 .7	56 .0	3°.3 above.
ions.	46 .8	47 .2	0°.4 above.
	32 .9	39 .0	6°.1 above.
	22 .9	24 .2	2°.3 above.

72° 67°

No. II.



WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE

ISOBARS, ISOTHERMS AND PREVAILING WINDS FOR MAY, 1880.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER U. S. A.

TEMPERATURE OF WATER FOR MAY, 1880.

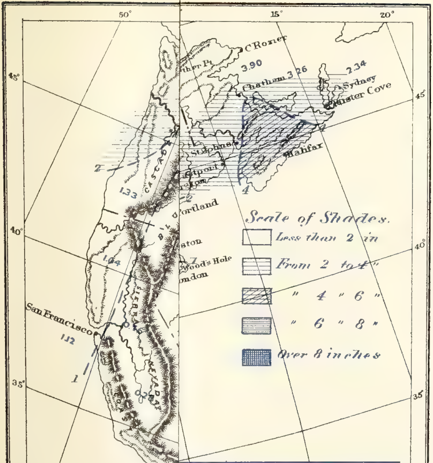
STATIONS.	Temperatures at bottom.		Average depth of water in feet.
	Max.	Min.	
Alpena	68	43.5	12
Augusta	79	65	8.3
Baltimore	79	58	11
Buffalo	68	46	10
Burlington, Vt.	63	38	18.6
Cedar Keys	85	71	14.6
Charleston	79	69	11.5
Chicago	64	50	8
Chincoteague	82	58	3.6
Cleveland	67	47	14
Detroit	66	46	23.5
*Duluth	51	33	11.8
Del. Breakwater	68	52	8.6
Eastport	—	—	—
Escanaba	—	—	—
Galveston	83.5	78	15.6
Grand Haven	79	54	15
Jacksonville	82	75	18
Key West	84	77	18
Marquette	44	35	9.4
Milwaukee	58	46	8
Mobile	78	70	15.8
New London	60	46	12.6
New York	64	49	21.6
Norfolk	79	60	22
Portland, Maine	51.5	40.5	26
Punta Rassa	—	—	—
Sandusky	72	46	10
*San Francisco	61	54	18.8
Savannah	79	68	15
Smithville	78	65.5	10
Toledo	74	51	12.4
Wilmington	83	72	12.3
Wood's Holl	62.5	48	8

* Observations for only part of month—See text

AVERAGE TEMPERATURES FOR MAY, 1880.

DISTRICTS	Average for May Signal Service Observations.		Comparison of May, 1880, with the average for several years.
	For several years.	For 1880.	
North Pacific coast region	56°.3	52°.5	3°.8 below.
Middle Pacific coast region	61 .8	62 .0	0°.2 above.
San Diego	61 .2	61 .0	0°.2 below.
Northern Plateau district	62 .4	56 .5	5°.9 below.
Salt Lake City	57 .7	55 .1	2°.6 below.
Southern Plateau district	74 .2	71 .7	2°.5 below.
North Rocky Mt. slope	49 .6	48 .4	1°.2 below.
Middle Rocky Mt. slope	62 .7	66 .1	3°.4 above.
Southeast Rocky Mt. slope	71 .6	71 .1	0°.5 below.
Missouri valley	59 .6	62 .8	3°.2 above.
Minnesota	53 .8	57 .7	3°.9 above.
Upper Mississippi valley	62 .1	67 .4	5°.3 above.
Upper Lake region	51 .5	58 .1	6°.6 above
Lower Lake region	55 .4	61 .2	5°.8 above.
Ohio valley and Tennessee	66 .2	71 .3	5°.1 above.
Rio Grande valley	80 .7	—	
Western Gulf States	73 .5	76 .4	2°.9 above.
Eastern Gulf States	70 .9	74 .7	3°.8 above
Florida Peninsula	77 .1	76 .3	0°.8 below.
South Atlantic States	69 .3	72 .4	3°.1 above.
Middle Atlantic States	61 .9	69 .3	7°.4 above.
New England	54 .8	59 .2	4°.4 above.
St. Lawrence valley	52 .7	56 .0	3°.3 above.
Canadian Maritime stations	46 .8	47 .2	0°.4 above
Mt. Washington, N. H.	[illegible]	39 .0	2°.1 above.
Pike's Peak, Col	[illegible]	[illegible]	2°.3 above.

No. III.



S ABOVE LOW-WATER MARK, MAY, 1880.

Danger point on gauge.	HIGHEST WATER. Date.	HIGHEST WATER. Height.	LOWEST WATER. Date.	LOWEST WATER. Height.
ft. in.	May.	ft. in.	May.	ft. in
29 9	1	17 7	31	9 6
—	1	4 3	30	— 1 8
20 0	1	7 6	19	2 3
16 0	27	9 7	22	7 0
21 0	30	9 3	20, 21	6 3
14 6	15	7 1	26	5 10
18 0	17	8 0	31	5 6
21 10	2, 3	12 2	31	10 3
15 0	1	9 7	18	8 0
14 6	1	10 10	24. 25	8 7
30 0	12	18 3	26, 27	15 0
40 0	6	38 2	28	18 6
34 0	11	29 9	31	14 3
41 0	1	41 8	31	25 1
— 2 6	1	1 5	31	— 4 10
20 0	1	8 3	20, 29	1 0
50 0	1	42 0	28	6 8
24 0	1	19 4	29	4 11
42 0	1	16 2	28	4 0
21 0	1, 2	14 6	19 to 21	4 2
28 0	1	9 0	24	5 8
29 0	22	8 3	20, 29	1 0
—	1	18 5	21	6 3
— —				— —

ST DOMINGO

ark of 1874.

AVERAGE

DISTRICTS.

St. Lawrence Valley
New England
Middle Atlantic States
South Atlantic States
Florida Peninsula
Eastern Gulf States
Western Gulf States
Tennessee
Ohio Valley
Lower Lake Region
Upper Lake Region
Upper Mississippi Valley
Minnesota
Lower Missouri Valley
Upper Missouri Valley
North Pacific Coast Region
Middle Pacific Coast Region
Portland, Oreg
San Diego, Cal

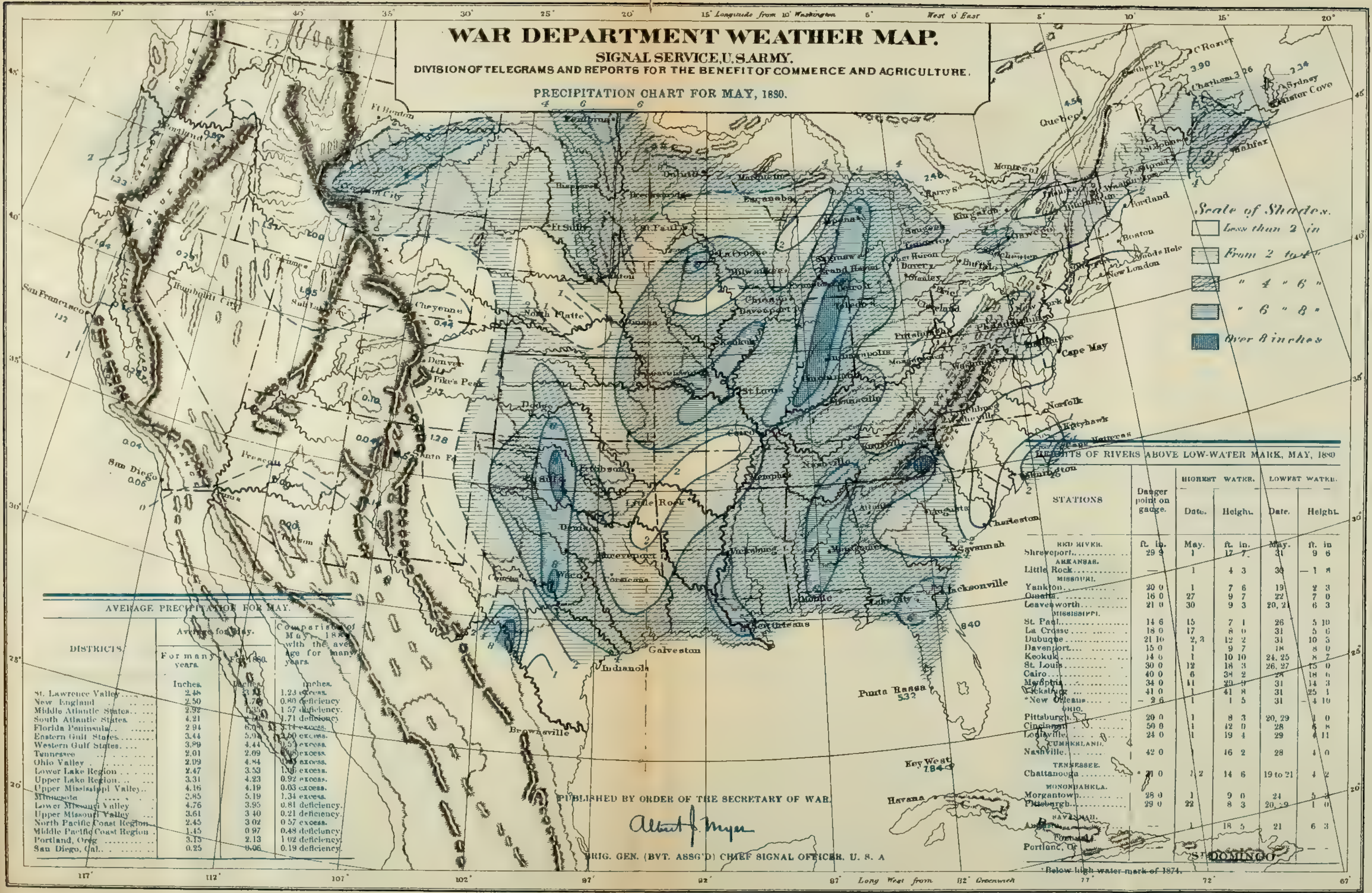
No. III.

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

PRECIPITATION CHART FOR MAY, 1880.



PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

AVERAGE PRECIPITATION FOR MAY.

DISTRICTS.	Average for May.		Comparison of May, 1880, with the average for many years.
	For many years.	For 1880.	
	Inches.	Inches.	Inches.
St. Lawrence Valley	2.48	[illegible]	1.23 excess.
New England	2.50	1.70	0.80 deficiency.
Middle Atlantic States	2.92	1.35	1.57 deficiency.
South Atlantic States	4.21	[illegible]	1.71 deficiency.
Florida Peninsula	2.94	[illegible]	3.14 excess.
Eastern Gulf States	3.44	[illegible]	2.50 excess.
Western Gulf States	3.89	4.44	0.55 excess.
Tennessee	2.01	2.09	[illegible] excess.
Ohio Valley	2.09	4.84	[illegible] excess.
Lower Lake Region	2.47	3.53	1.06 excess.
Upper Lake Region	3.31	4.23	0.92 excess.
Upper Mississippi Valley	4.16	4.19	0.03 excess.
Minnesota	3.85	5.19	1.34 excess.
Lower Missouri Valley	4.76	3.95	0.81 deficiency.
Upper Missouri Valley	3.61	3.40	0.21 deficiency.
North Pacific Coast Region	2.45	3.02	0.57 excess.
Middle Pacific Coast Region	1.45	0.97	0.48 deficiency.
Portland, Oreg	3.15	2.13	1.02 deficiency.
San Diego, Cal	0.25	0.06	0.19 deficiency.

HEIGHTS OF RIVERS ABOVE LOW-WATER MARK, MAY, 1880

STATIONS	Danger point on gauge.	HIGHEST WATER.		LOWEST WATER.	
		Date.	Height.	Date.	Height.
RED RIVER.	ft. in.	May.	ft. in.	May.	ft. in.
Shreveport	29 9	1	17 7	31	9 6
ARKANSAS.					
Little Rock	—	1	4 3	30	—1 8
MISSOURI.					
Yankton	20 0	1	7 6	19	2 3
Omaha	16 0	27	9 7	22	7 0
Leavenworth	21 0	30	9 3	20, 21	6 3
MISSISSIPPI.					
St. Paul	14 6	15	7 1	26	5 10
La Crosse	18 0	17	8 0	31	5 6
Dubuque	21 10	2, 3	12 2	31	10 5
Davenport	15 0	1	9 7	18	8 0
Keokuk	14 6	1	10 10	24, 25	8 7
St. Louis	30 0	12	18 3	26, 27	15 0
Cairo	40 0	6	38 2	28	18 6
Memphis	34 0	11	29 9	31	14 3
Vicksburg	41 0	1	41 8	31	25 1
*New Orleans	— 2 6	1	1 5	31	— 4 10
OHIO.					
Pittsburgh	20 0	1	8 3	20, 29	1 0
Cincinnati	50 0	1	42 0	28	6 8
Louisville	24 0	1	19 4	29	4 11
CUMBERLAND.					
Nashville	42 0	1	16 2	28	4 0
TENNESSEE.					
Chattanooga	[illegible] 0	1, 2	14 6	19 to 21	4 2
MONONGAHELA.					
Morgantown	28 0	1	9 0	24	5 8
Pittsburgh	29 0	22	8 3	20, 29	1 0
SAVANNAH.					
Augusta	— —	1	18 5	21	6 3
COLUMBIA.					
Portland, Or	— —				— —

*Below high water mark of 1874.

amounting to about 0.04 in the Southwest, along the eastern slope of the Rocky Mountains and in the Upper Lake region, and which gradually increases towards the region of lowest pressure until it reaches 0.13 at Breckinridge and 0.18 at Pembina.

Barometric ranges.—As reduced to sea-level the total monthly range of the barometer gradually increases from south to north. It amounts to 0.40 inch at Key West and Indianola and 0.38 at Santa Fé, N. Mex., and Los Angeles, Cal.; 0.55 on the North Carolina coast, 0.78 at Cairo, 0.68 at Denver, and 0.47 at San Francisco; 0.66 at New York, 1.00 at Chicago, and 0.86 at Roseburg, Oreg.; and 0.84 at Eastport, 1.05 at Alpena, 0.92 at Breckinridge, and 0.98 at Olympia.

Areas of high pressure.—Only five high areas of any importance have appeared during the month of May within the limits of the Signal Service maps. The most important area was No. III, which first developing in the Upper Lake region on the 10th, remained over the lakes, Tennessee, Ohio valley, Middle and South Atlantic states until the 17th.

No. I.—On the 1st a high area was central in the Southern states, the pressure being in general 0.3 above the normal. The minimum temperatures for the month for all the country east of the Mississippi river occurred this day. On the 2d, with slowly diminishing pressure, this high area moved slowly eastward to the Carolina coast. On the 3d and 4th it was dissipated by the advance of low area No. I, then moving in a northeasterly track along the Atlantic coast. Cautionary signals were ordered on the 1st at Indianola and Galveston, in connection with this high area and a depression near the Mexican coast; they were justified by the following maximum velocities: Indianola, E. 51; Galveston, NE. 41.

No. II.—On the 5th there was a very rapid rise of pressure on the Pacific coast in rear of low barometer No. III. The high area, slowly diminishing in pressure, remained nearly stationary in position until the 9th, when it became dissipated in advance of low area No. V, then approaching the coast from the Pacific ocean. Considerable rain fell in Washington Territory and Oregon, and occasional rain in northern California.

No. III.—On the 10th there was a great rise in pressure in the Northwest in rear of low area No. IV, the highest barometer being central in the Upper Mississippi valley. 11th, the high pressure moved slowly to the eastward, central over Lake Michigan. 12th, the highest barometer was transferred to the Lake Superior region. 13th, slightly increasing in pressure, the high area remained central over the Upper Lakes, the barometer being generally 0.3 above the normal. 14th, still slowly increasing in pressure the center of high barometer was transferred to the region of Lake Huron; Alpena barometer at the afternoon report being 0.49 above the normal. On the morning of the 15th the isobar of 30.40 included nearly all the Lake region and extended into Ohio, West Virginia, and Pennsylvania. During the day there was a general diminution in pressure over this area. On the 16th it was transferred to the South Atlantic states. 17th, it was dissipated as a high pressure in advance of low area No. IV, then central in Dakota. This high area was remarkable for the persistence with which it remained in the Lake region. During its continuance the weather within the limits of the isobars of high barometer was unusually clear and pleasant. High winds are reported in connection with this area from Thatcher's Island north, to Cape Hatteras south. Cautionary off-shore signals were ordered on the 13th from Chincoteague to Eastport, which were justified by the following maximum velocities: Chincoteague, NW. 30; Delaware Breakwater, N. 32; Cape May, NW. 27; Sandy Hook, NW. 46; New Haven, N. 25; Thatcher's Island, NE. 47. Also cautionary signals were ordered from Cape Henry to Wilmington. The following maximum velocities were reported: Cape Henry, N. 35; Kittyhawk, NE. 44; Cape Hatteras, NE. 32; Cape Lookout, NE. 36. The temperature within the limits of high barometer was below the mean.

No. IV.—On the 23d there was a rapid rise of pressure on the Pacific coast in rear of depression No. VIII. Alternately slowly falling or rising, the barometer remained above the normal in this region until the end of the month. During its continuance the weather within the limits of the isobars of high barometer remained fair and cool. Brisk northerly winds prevailed in California.

No. V.—On the 28th a high barometer extended over the Lower Lake region and the Middle states. On the 29th the high pressure was transferred to New England, and on the 30th to the Maritime Provinces of Canada. On the 31st it disappeared beyond Nova Scotia in advance of low area No. X.

Areas of low pressure.—Ten areas of low barometer are charted for the month. Of these, three (Nos. III, V, VIII), first appeared on the Pacific coast, and are charted across the Rocky Mountains, but no depression crossed the entire continent within the limits of the charts of the Signal Service. The most remarkable low area is No. I, whose track is charted farther to the south than any depression in the month of May since the organization of this service.

No. I.—On the 1st and 2d, the circulation of the winds in Texas showed the development of a storm center near the mouth of the Rio Grande. On the 3d, the low area apparently moved in an easterly track over the Gulf of Mexico; that night the center of the depression crossed Florida, between Punta Rassa and Cedar Keys, as shown in chart No. I. On the 4th, the storm center moved in a northeasterly track near the South Atlantic coast. At the morning report of the 5th, the winds show that the center of the storm was a short distance off the North Carolina coast. Its track on that day is too indefinite to locate the center of the depression at the hours of simultaneous observations, but, as charted, the low area continued a northeasterly track until the morning of the 6th, when the center was located south of Nova Scotia and east of Maine. In its passage over Nova Scotia on the 6th, the storm developed great energy. Cautionary signals were ordered in advance of this storm from Port Eads to Cedar Keys on the 2d; from Savannah to Cape May on the 4th, and at Eastport on the 6th. The following maximum velocities are reported: Cedar Keys, SE. 25; Charleston, NE. 25; Macon, SE. 32; Cape Lookout, SE. 40; Cape Hatteras, SE. 47; Kittyhawk, NE. 38; Chincoteague, NE. 39; Eastport, N. 27. The storm track, except in Florida and in Nova Scotia, is charted at sea. The following are marine reports referring to this storm: Brig Sisters at New York, May 9th, from Pernambuco, reports heavy SE. gale on May 4th, lasting ten hours. Ship Niagara, May 5th, off Hatteras, stove bulwarks, &c., during NE. gale. Bark Windermere, at New York, May 7th, from Colombo, January 31st, had revolving hurricane May 5th, lasting seven hours, during which, stove bulwarks, &c. Brig Edith Hall, at New York, May 10th, from Bahia, reports May 5th terrific SE. gale and tremendous sea. Steamer Totaze, at New York, May 8th, from Barrow, had hurricane, May 6th, from SE. to W., lasting several hours, with terrific sea, sweeping decks. Bark Elinor, in 37° N. 70° W., May 6th, (?) had hurricane from NE. to SW., lasting twenty-four hours, during which she lost topmast, &c. The progress of this depression over the Gulf and along the bordering states saw marked by abundant rain near the line of coast.

No. II.—On the 5th, a slight depression moved in a southeasterly track over the Province of Quebec. During the night it crossed New England, uniting on the morning of 6th with the low area No. I. After this junction, Nos. I and II showed a greatly-increased development in energy.

No. III.—On the 4th, there was a rapid fall in pressure on the coast of Washington Territory and Oregon; the barometer at Roseburg, 0.43 below the normal; at Portland, 0.42 below the normal. On the 5th, the depression advancing rapidly to the east crossed the Rocky Mountains and was central at the 11 p. m. report in Montana and Nebraska; the barometer being below the normal at Fort Buford, 0.65; at Fort Stevenson, 0.63. On the 6th, the storm area moved with diminishing energy in a southeasterly track into Iowa, the barometer slowly rising at the center of the depression. At the end of this day, the lowest reading of the barometer was at Omaha, Nebr., 29.45, only 0.41 below the normal. The 7th, in the morning, the center of depression was located near Des Moines, Iowa. That day the storm center pursued a northeasterly track over Wisconsin and the Lake Superior region, beyond the limits of the map. Cautionary signals were ordered in advance of this storm on the a. m. report of the 7th for all ports in the Lake region. These signals were justified as to Lakes Michigan and Huron by the following maximum velocities: Grand Haven, SE. 30; Milwaukee, S. 35; Escanaba, S. 30; Alpena, SE. 30. On the North Pacific coast, this storm was specially severe. Twenty five fishermen are reported drowned and some ten or fifteen of their boats lost.

No. IV.—On the 8th a depression developing east of the Rocky Mountains moved in an easterly track over Dakota; during its passage heavy rains fell in the Northwest. On the 9th the center of the depression passed over Minnesota and Lake Superior, and the rain extended over the Upper Lake region and Ohio valley. On the 10th the low area is charted as moving in an easterly track north of the Lower Lakes. Cautionary signals were ordered for this storm on the morning of the 9th, for the Upper Lake region and on Lake Erie, to include Sandusky; on the morning of the 10th to include the remaining ports in the Lower Lakes; maximum wind velocities are reported as follows: Chicago, NW. 28; Grand Haven, SE. 39; Milwaukee, SW. 36; Marquette, W. 28; Alpena, SW. 32; Sandusky, W. 40; Cleveland, W. 30; Buffalo, W. 28.

No. V.—On the 10th the barometer had a sharp fall on the North Pacific coast, accompanied by unusually heavy rains for the season, as far south as San Francisco. The rainfall extended on the following day southward to San Diego. On the 11th the barometer read at Portland 0.53 below the normal; during the day the low area moved in an easterly track over Washington Territory and Montana. On the 12th and 13th the depression progressed slowly eastward into Dakota; the barometer continued to rise at the center of the low area, and its track is not charted after the midnight report of the 13th.

No. VI.—On the 16th a depression developed in Montana and Wyoming. On the 17th it moved slowly over Dakota; the barometer at Breckinridge at the 11 p. m. report, 29.40, being 0.4 below the normal. 18th, the low area moved moved over Minnesota and Lake Superior. 19th, it crossed the Province of Ontario beyond the limits of the observing stations. The rainfall accompanying this depression was in general confined to the north of the track of the storm center. Cautionary signals were ordered on the 18th in advance of this storm on Lakes Michigan, Huron, and Erie, to include Sandusky. These were justified at the following stations by reported maximum velocities: Grand Haven, S. 28; Port Huron, W. 31; Toledo, SW. 25.

No. VII.—At the morning report of the 20th a slight depression was developed in Texas, accompanied with general rains. During the day it moved slowly in a northeasterly track into Arkansas, with rain extending over the Gulf states. On the 21st, rapidly developing in energy, the storm center moved up the Ohio Valley and became central near Toledo. This day heavy and general rains were reported from Tennessee, Ohio valley, and Lower Lake region. On the 22d the depression advanced in a northerly track over Lake Huron, beyond the limits of the chart. Cautionary signals were ordered on the 21st for the Lower Lakes and Lake Huron. The following maximum velocities are reported: Buffalo, W. 25; Cleveland, SW. 32; Sandusky, S. 28; Toledo, SW. 32; Detroit, S. 25; Alpena, W. 28.

No. VIII.—At the morning report of the 22d there was a sharp fall in pressure on the coast of Washington Territory and Oregon. During the day the center of depression moved in an easterly track. On the 23d, crossing the Rocky Mountains, it advanced over Montana and Dakota, and entered Manitoba. On the 24th it passed beyond the limits of the map. At the morning report of this day the barometer at Fort Garry was 0.62 below the normal. The depression was accompanied by abundant rain.

No. IX.—On the afternoon of the 24th the barometer fell decidedly in Nebraska; the pressure at North Platte being 0.34 below the normal. Moving slowly in a northeasterly course the storm center at the midnight report of the 25th was near Breckinridge. On the 26th the low area advanced beyond Lake Superior. The most abundant rain fell north of the center of depression during the passage of the low area. South of the track precipitation did not, in general, occur until the shifting of the wind to southwest or northwest. It was during the passage of this storm center that the maximum temperatures for the month occurred in Missouri, Illinois, Tennessee and the Ohio valley. The warm wave gradually extended eastward and southward, giving unusually high temperatures for May over the entire country east of the Mississippi river.

No. X.—At the morning report of the 29th there was a sharp fall in pressure in Kansas and Missouri, accompanied by rain, extending to the West Gulf coast. During the day the storm, rapidly increasing in energy, moved in a northeasterly track into northern Illinois. On the 30th it moved over Lakes Michigan and Huron into the Province of Ontario. At the morning reports the barometers at Chicago, Grand Haven, and Milwaukee were more than 0.5 below the normal. Its passage was marked by abundant rainfall, which extended over all the United States east of the Mississippi river. Cautionary signals were ordered for this storm for all the lakes except Superior. The following maximum velocities are reported: Milwaukee, NW. 28; Grand Haven, E. 26; Alpena, E. 28; Toledo, SW. 32; Sandusky, SW. 36; Cleveland, W. 28; Erie, SE. 28; Buffalo, SW. 29; Rochester, W. 26. On the 31st the low area moved over New England into the Maritime Provinces of Canada with diminished energy. Signals were ordered on the 30th in advance of this storm from Cape Henry to Eastport. The following are the reported maximum velocities: Cape Henry, S. 25; Chincoteague, SE. 37; Breakwater, S. 34; Atlantic City, SE. 25; Barnegat, S. 30; Sandy Hook, SE. 26; Wood's Holl, SW. 40; Boston, S. 28.

INTERNATIONAL METEOROLOGY.

Three international charts, Nos. IV, V, and VI, accompany the present Review. They are for the months of April, 1880, and September, 1878. In the introduction to International Meteorology, in the April Review, the numbers "IV and VI" should read "IV and V", and "March, 1878" should read "March, 1880."

Chart No. IV indicates the probable course of the principal storm areas occurring over that portion of the north Atlantic ocean, lying between the parallels of 35° and 60° N., during the month of April, 1880. The characteristic features of the weather for this month, over the region under consideration, are the long continued period of good weather and—if we except the northwesterly gales from the 2d to the 6th between the British Isles and 30° W., attending area No. I, and the gales from the 13th to the 21st, attending areas Nos. III, IV, and VI—a remarkable freedom from severe storms. Area No. I is a continuation of low area No. XV of the March Review. On the morning of the 1st it had passed to the east of Newfoundland, and was encountered in about 46° N. 40° W. by steamers Braunschweig and Hibernian; during the day it moved rapidly northeastward, and was followed over the western Atlantic by an extensive area of high pressure (see high area No. 1, March Review.) During the 2d, 3d, 4th and 5th, it slowly approached the British Isles as an extensive area of very low pressure; the S. S. Sardinian, on the morning of the 4th, in 54° N. 17° W., reported barometer

29.14, or 740.1, while the British Isles were included by the isobar 29.35, or 745.4. On the morning of the 5th the pressure at Stornoway fell to 28.79, or 731.3, and during the day the wind at this station veered from S. to W., with slowly rising barometer. Except during the régime of the two storms of minor importance, described as low areas Nos. I and II of the April Review, and which passed to the north of Newfoundland on the 7th and 8th respectively, high pressures and good weather generally prevailed over the western portion of the Atlantic from the 2d to the 10th, and over the eastern portion from the 7th to the 11th. S. S. Adriatic, from New York on the 1st to Liverpool on the 12th reported high pressures (except 29.97 on the 6th) and clear or fair weather throughout voyage. During the 10th, as the area of high pressure moved eastward over the British Isles, the barometer fell over the Atlantic to the westward, and on the morning of the 11th low area No. IV appeared to be central about 50° N. 25° W. S. S. Celtic, in 50° N. 23° W. reported barometer 29.70, or 754.4, wind SSW. force 4, and rain squalls; S. S. Strassburg, in 49° N. 16° W., 29.89, or 759.2, SE. 2, light rain. On the west side of the center, S. S. Nederland, in 46° N. 29° W., reported barometer 29.85, or 758.1, wind NNE. 3, much rain, and S. S. Indiana, in 48° N. 31° W., 29.97, or 761.2, N. 7, hard rain. On the morning of the 12th, the Celtic and Indiana, sailing westward, had passed into the area of high pressures, then over mid-ocean and which had moved eastward since the morning of the 8th, from the coast of the United States, while the Strassburg, in 49° N. 22° W. reported 29.86, or 758.4, E. 4, cloudy, and the Nederland, sailing eastward, in 47° N. 25° W., 29.71, or 754.6, rain, high sea, and squally. Bark Woodlands, in 39° N. 20° W., lost boat, &c., during a SW. to W. gale, lasting 48 hours, and SW. to SE. winds, force 3 to 5, had become fully established at the Madeiras and over the Spanish peninsula. During the 12th, 13th, 14th, and 15th, this area of low pressure moved slowly east and northward from the neighborhood of the Madeiras to the coast of Ireland as a somewhat severe storm; Bark Angelo Madre, on the 14th, about 200 miles north of the Madeiras, experienced a heavy gale, during which she had her decks swept, and four men washed overboard and drowned. On the 15th S. S. Nederland in 49° N. 9° W., reported barometer 29.46, or 748.3, wind NNE. 5, much rain and squally. Area No. III passed very slowly eastward to the north of Newfoundland on the morning of the 13th, being preceded by southerly winds, force 4 to 9, between 30° and 45° W., and followed by cold northwest gales, snow and hail. S. S. Celtic, in 46° 39° W., reported barometer 29.76, or 755.9, SSW. 6, and S. S. Indiana, in 42° N. 44° W., 29.74, or 755.4, SSW. 9, hard rain. On the morning of the 14th the pressure still continued quite low, but rising slowly, over Newfoundland, while the winds between 30° and 50° W. had veered to westerly. On the morning of the 15th, the center had moved eastward to 30° W.; S. S. Ohio in 50° N. 25° W., reported barometer 29.88, or 758.0, S. by W. 5; S. S. Strassburg, 46° N. 37° W., 29.58, or 751.3, NW. 9, rain and hail showers, high seas, much water on deck; Bark Syringa, 46° N. 36° W., 29.80, or 756.9, WNW., fresh gale, constant showers, and cross sea. On the morning of the 16th it was central about 20° W.; S. S. Ohio, 51° N. 17° W., reported barometer 29.25, or 743.0, SW. 5, while severe NW. to westerly gales and very high seas prevailed from 25° to 40° W.; S. S. Strassburg, 45° N. 40° W., barometer 29.65, or 753.1, W. to NW., 9 to 10. Area No. V passed rapidly eastward over Newfoundland on the morning of the 16th. By the morning of the 17th, the center had passed eastward to 30° W. and by the morning of the 18th to 20° W. Bark Syringa reported, 17th, 46° N. 29° W., 29.20, or 741.7, W. gale, frequent heavy showers, and S. S. Britannic, 18th, 51° N. 33° W., 28.87, or 733.3, NW. 6, squally. Area No. VI moved eastward to the south of Nova Scotia and Newfoundland during the 18th, and by morning of the 19th was central to the southeast of the latter; S. S. Strassburg, in 43° N. 51° W., reported barometer 29.67, or 753.6, S. 2. By morning of the 20th, this area had moved rapidly northeastward and was followed over the western Atlantic by the area of high pressure described in April Review as area No. VII; the barometer on board the Strassburg, 43° N. 55° W., had risen to 30.23, or 767.8, with clear weather. On the 21st the area of low pressure passed northeastward between the British Isles and Iceland, and high pressures covered the ocean, west of the 30th meridian. Thence to the end of April the area of high pressures moved slowly northeastwards towards northwestern Europe, until on the 30th, the pressure over the British Isles reached 30.50, or 774.7. Areas of low barometer (No. XII and XIII of the April Review) moved eastward over Newfoundland on the morning of the 24th, and the afternoon of the 27th, respectively, but passed thence to the northeast without materially affecting the weather to the southward.

Chart No. V shows by isobaric and isothermal lines the mean pressure and temperature, and by small arrows the prevailing direction of the wind, at 7.35 a. m. Washington mean time, over the Northern and portions of the Southern Hemisphere for the month of September, 1878. The barometer observations have been corrected for temperature and reduced to sea-level. At stations lying outside the area included within the lines, and for those in the Southern Hemisphere, the means are shown by figures indicating the temperature in degrees, Fah., and the pressure in English inches. Upon comparing the distribution of atmospheric pressure for the present month (September,

1878) with that for the preceding month (August, 1878) the most marked changes are found to be a decided increase of pressure over the entire area included between the parallels of 30° and 60° N., and extending from 140° W. eastward over North America, the Atlantic ocean, Europe, and Asia, and a decided fall at all stations over the Atlantic ocean to the north and south of those parallels. The increase of pressure referred to above amounts to about 0.10 inch over the small portion of the Pacific and over the eastern half of the Atlantic, from 0.10 to 0.20 over the eastern half of north America and western part of the Atlantic, about 0.15 over Europe, and from 0.20 to 0.35 over the interior of Asia. Over Hindostan, along the coast of China, and at Tokio, Japan, the increase is quite small, and at Chittagong and Nagasaki, near the southern, and at Nikolaievsk, on the Amoor, near the northern margin of the zone of high pressure, a small decrease is perceptible. The most marked decrease of pressure over the Northern Hemisphere is found to the north of the British Isles, the area being bounded on the south by Sandwick, Vestervig, and Stockholm, and on the east and west by Archangel and Godthaab, respectively. The decrease amounts to 0.33 inch at Stykkisholm, 0.26 at Thorshavn, 0.24 at Tromso, and 0.19 at Haparanda. The observations at all stations over the Atlantic south of 25° N., namely, Freetown, Sierra Leone, Porto Praya, Cape Verde Islands, Paramaribo, Guiana, and those in the West India Islands, show a decrease amounting to about 0.03 inch at the three former, and from 0.05 to 0.08 at the W. I. stations.

On chart No. VI are traced the paths of 24 of the principal storm areas which traversed the Northern Hemisphere during the month of September, 1878. They fully represent the two great classes of storms experienced over the Northern Hemisphere, namely, those moving in an easterly path to the north of the 40th parallel, and those having the characteristics of tropical cyclones. Of the latter there are six, namely, Nos. II, X, and XXI, to be found over the western portion of the Atlantic, and Nos. IV, XI, and XV over the western Pacific. The tracks over the Behring Sea region are based upon reports from Saint Michael's (7 daily), Saint Paul's Island (3 daily), and Unalaska (3 daily;) and those over Hudson's Bay and Greenland upon York Factory, schooner Florence (in Northumberland Inlet), Godthaab, and Stykkisholm.

TEMPERATURE OF THE AIR.

The mean temperature of the air for the month of May, 1880, is shown by isotherms on chart No. II. Compared with the average meant temperature of the past eight years for the month of May, the means for the present month show a uniform excess ranging from 3° to 7° over the entire country east of the Rocky Mountains, except in Florida, the Canadian Maritime Provinces, and North and Southeast Rocky Mountain slopes, and a decided deficiency over the Western Plateau and North Pacific coast region. In California the mean for San Francisco is 1°.1 above normal, while those for Sacramento and San Diego are about normal. As will be seen on examining the table of comparative temperatures given in chart No. II, the excess is greatest in the Middle Atlantic states, where it amounts to 7°.4, and the deficiency greatest in the North Pacific coast region, where it is 3°.8.

The following notes regarding the unusual high temperatures of the month are of interest: St. Louis, 8th, heat intense, one sunstroke, fatal; monthly mean temperature 4° above the average for several years. Baltimore, 27th, two cases of sunstroke, both fatal; 29th, a marked increase of the death-rate during the past week of intense heat, 190 deaths against 91 of corresponding week in May of 1879; highest monthly mean temperature on record, 6° above mean of past 10 years. Riley, Ill., monthly mean temperature 7.2° above mean of 19 years. Logan, Iowa, warmest May ever known in this section. Reading, Pa., 27th, this section of the State has suffered with the intense heat, temperature 26th, 27th, 95° in the shade. At Birdsborough, Pa., 27th, temperature 98° in the shade; men in rolling mills compelled to stop work. At Douglasville, temperature 100° in the shade. Colemansville, Lancaster County, one sunstroke, fatal. Hokendoqua, 27th, four men died from the effects of over heat. In the coal regions there has been intense suffering, most of the men compelled to stop work. New York City, 28th, 14 cases of sunstroke, 12 of which were fatal. Boston, 28th, hottest period for many years, two horses killed by heat and two persons fatally injured. Gardiner, Me., monthly mean temperature 3.4° above the mean for 44 years. Sandy Springs, Md., monthly mean temperature 7° above the normal. Thornville, Mich., warmest May for many years. Palermo, N. Y., warmest May in past 23 years. Cleveland, monthly mean temperature 8.2° above mean for past 26 years.

Maximum temperatures.—Maine: 94° at Portland and 79° at Eastport. *New Hampshire:* 96° at * Grafton and 62° on summit of Mount Washington. *Vermont:* 95° at * Charlotte and 86° at * Lunenburg. *Massachusetts:* 97° at Boston and 94° at Springfield. *Rhode Island:* 84° at Newport. *Connecticut:* 92° at * Southington and 89° at * Mystic and New Haven. *New York:* 95° at * Troy, * Ardenia, and * Port Jervis, 94° at New York City, 79 at Buffalo, and 86° at Oswego. *New Jersey:* 101° at * New Lisbon, 98° at * New Brunswick, and 89 at Atlantic City. *Pennsylvania:* 98° at * Egypt, 96° at Philadelphia and *Milton, and 94° at Pittsburgh. *Delaware:* 94° at *Dover. *Maryland:* 95° at *Woodstock and 93° at Baltimore. *District of Columbia:* 96° at Washington. *Virginia:* 98° at Norfolk and 97° at *Accotink. *West Virginia:* 88° at *Helvetia and 86° at Morgantown. *North Carolina:* 100° at *Weldon, 92° at Wilmington, and 87 at *Franklin. *South Carolina:* 89° at Charleston. *Georgia:* 90° at *Forsyth and 89° at Savannah and Augusta. *Florida:* 96° at *Houston, 95° at Jacksonville, 90° at Key West, and 88° at Pensacola. *Alabama:* 92° at Montgomery and 90° at *Mobile. *Mississippi:* 93° at Vicksburg and 86° at *Fayette. *Louisiana:* 96° at Point Pleasant and 88° at New Orleans. *Texas:* 108° at *Ringgold, 104° at Eagle Pass, and 100° at Stockton and Laredo. *Ohio:* 94° at *Ruggles, 88° at Cincinnati, and 86° at Cleveland. *Kentucky:* 90° at Bowling Green and Louisville. *Tennessee:* 91° at Memphis and 86° at *McMinnville. *Arkansas:* 91° at Little Rock and 80° at *Mount Ida. *Michigan:* 91° at *Hudson, 90° at *Thornville, and 83° at Grand Haven. *Indiana:* 93° at Vevay and 85° at Indianapolis. *Illinois:* 92° at *Peoria, 88° at Cairo, and 85° at Chicago. *Missouri:* 95° at *Pierce City and 89° at Saint Louis. *Kansas:* 100° at *Fort Wallace and 90° at Leavenworth. *Wisconsin:* 90° at *Beloit and 87° at La Crosse. *Iowa:* 96° and *Boonsborough and 93° at Des Moines. *Nebraska:* 96° at *Howard and 94° at North Platte. *Indian Territory:* 97° at Fort Sill and 94° at Fort Gibson. *Minnesota:* 91° at Saint Paul and 86° at Duluth. *Dakota:* 94° at Yankton, 92° at Bismarck and 84° at Deadwood. *Colorado:* 89° at *Fort Collins and Denver, and 47° on the summit of Pike's Peak. *New Mexico:* 99° at La Mesilla and 80° at Santa Fé. *Wyoming:* 87° at *Fort Fetterman and 84° at Cheyenne. *Utah:* 87° at *Blue Creek, 80° at Salt Lake City, and 75° at *Coalville. *Nevada:* 90° at *Palisade and *Tecoma, 82° at Winnemucca. *Arizona:* 104° at Yuma and Tucson and 101° at Phœnix and Burkes. *Idaho:* 83° at Boise City and 75° at *Fort Hall. *Montana:* 97° at Fort Keogh and 70° at Virginia City. *California:* 108° at *Indio and *Davis, 97° at Los Angeles, 95° at Visalia, 92° at Red Bluff and 83° at San Francisco. *Oregon:* 90° at Umatilla and 81° at Roseburg. *Washington Territory:* 75° at Olympia.

Minimum temperatures.—Maine: 34° at Eastport, *Gardiner, and *Surry, and 29° at *Orono. *New Hampshire:* 30° at Dunbarton and —1° on Summit of Mount Washington. *Vermont:* 27° at Burlington, and 26° at *Newport. *Massachusetts:* 35° at Springfield, 33° at Boston, and 25° at *South Lee. *Rhode Island:* 37° at Newport. *Connecticut:* 35° at *Southington and New London and 34° at New Haven. *New York:* 34° at New York City and Oswego, 30° at Buffalo and 23° at *Waterburg. *New Jersey:* 32° at *Freehold and *Atco and 30° at *Somerville. *Pennsylvania:* 28° at *Newcastle and 20° at *Franklin. *Delaware:* 40° at *Dover. *Maryland:* 38° at Baltimore and 33° at *Woodstock. *District of Columbia:* 38° at Washington. *Virginia:* 46° at Cape Henry and 32° at Mount Solon. *West Virginia:* 36° at Morgantown and 30° at *Helvetia. *North Carolina:* 45° at Wilmington and 31° at Murphy. *South Carolina:* 53° at Charleston. *Georgia:* 50° at Augusta and 44° at Atlanta. *Florida:* 70° at Key West and 54° at *Houston. *Alabama:* 53° at Mobile and 49° at Montgomery. *Mississippi:* 56° at *Fayette and 52° at Vicksburg. *Louisiana:* 63° *Point Pleasant and 54° at Shreveport. *Texas:* 40° at Davis and 34° at Mason. *Ohio:* 33° at Cleveland and *North Lewisburg and 28° at *Westerville. *Kentucky:* 52° at *Bowling Green and 43° at Louisville. *Tennessee:* 40° at Nashville and *Ashwood and 37° at Knoxville. *Arkansas:* 47° at Little Rock and 43° at *Mount Ida. *Michigan:* 29° at Port Huron, 28° at *Hudson, and 27° at Alpena. *Indiana:* 40° at Indianapolis and 33° at *Spiceland. *Illinois:* 41° at *Riley and 37° at Chicago. *Missouri:* 44° at Saint Louis and 40° at *Ashley. *Kansas:* 44° at Dodge City and 41° at *Cedar Vale. *Wisconsin:* 38° at *Beloit and 31° at *Ripon. *Iowa:* 44° at Dubuque and Des Moines and 37 at *Nora Springs. *Nebraska:* 37° at *Desoto and 29° at *Fort Hartsuff. *Indian Territory:* 52° at Fort Sill and 45° at Fort Gibson. *Minnesota:* 33° at Duluth and Breckinridge. *Dakota:* 31° at Pembina, and 27° at Deadwood. *Colorado:* 24° at *Hermosa and 3° on summit of Pike's Peak. *New Mexico:* 28° at Fort Wingate and 24° at Santa Fé. *Wyoming:* 28° at Cheyenne and 28° at *Fort Fetterman. *Utah:* 32° at Salt Lake City and 25° at *Coalville. *Nevada:* 24° at Winnemucca and 18° at *Otego. *Arizona:* 38° at Wickenburg, 29° at Apache and 27° at Prescott. *Idaho:* 34° at Boise City and 14° at *Fort Hall. *Montana:* 27° at *Helena and 23° at Virginia City. *California:* 40° at Red Bluff and Visalia, 39° at Sacramento, 32° at *Tehachapi, 24° at Campo, and 18° at *Summit. *Oregon:* 35° at Portland and 33° at Roseburg. *Washington Territory:* 34° at Olympia.

Ranges of temperature at Signal Service stations.—The monthly ranges will appear from the maxima and minima just given. The greatest daily ranges vary in New England from 21° at Wood's Holl and 37° at Springfield to 46° at Boston; Middle Atlantic states, 18° at Cape May to 35° at Lynchburg; South Atlantic states, 15° at Cape Lookout, 20° at Savannah to 30° at Wilmington; Eastern Gulf states, 16° at Key West and New Orleans to 26° at Montgomery; Western Gulf states, 15° at Galveston to 28° at Corsicana; Tennessee and the Ohio valley, 24° at Memphis to 31° at Pittsburgh; Lower Lake region, 26° at Erie and Buffalo to 37° at Rochester; Upper

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Those marked with a star (*) are reported by U. S. Army post surgeons or voluntary observers

Lake region, 27° at Grand Haven to 44° at Port Huron and 47° at Duluth and Marquette; Upper Mississippi valley, 27° at Davenport to 41° at Saint Paul; Red River of the North valley, 44° at Pembina to 45° at Breckenridge; Missouri valley, 30° at Leavenworth to 43° at Yankton and 47° at North Platte; Texas, 28° at Decatur, Uvalde, and San Antonio, to 47° at Fort Elliott; Eastern Rocky Mountain slope, 39° at Fort Custer to 41° at Deadwood and 42° at Dodge City; Rocky Mountains, 23° on summit of Pike's Peak to 46° at Helena and Socorro and 49° at Denver; Middle Plateau, 34° at Boise City and Salt Lake City to 40° at Winnemucca; California, 23° at San Francisco to 34° at Red Bluff and 41° at Visalia.

Frost was reported from nearly every state and territory north of the thirty-fifth parallel. East of Mississippi it occurred on the following dates: 1st, 2d, 7th, 8th, 13th, 14th, 15th, 16th, 19th, 21st, and 29th, and west of the Mississippi on the 1st, 2d, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 18th, 20th, 21st, 24th, 25th, 27th, and 31st. In many localities severe injury resulted to fruit and vegetables, as follows: Fort Collins, Colo., 9th, corn and garden crops seriously injured. Southington, Conn., 15th, tender vines blighted. Nile, N. Y., 15th, early fruit severely injured. Weldon, N. C., 14th, potato vines injured. Westerville, Ohio, 1st, early fruit damaged. Jacksonburg and Ringgold, Ohio, 1st, fruit injured. Blooming Grove, Pa., 15th, fruit buds and blossoms injured. Litchfield, Pa., 15th, considerable damage to gardens. Windsor, Vt., 15th, early vegetables damaged. Charlotte, N. C., 1st, injuring potato vines. Yamhill County, Oregon, 11th, garden vegetables generally and wheat in some localities injured.

Ice formed as follows: Roseburg, Oreg., 13th; Salt Lake City, 6th; Winnemucca, Nev., 31st; Springfield, Mass., 1st; Eastport, 1st; Burlington, Vt., 1st (15th, ice in Broad Lake one-eighth inch thick for a distance of three miles off Essex); New Haven, Conn., 1st; Fort Collins, Colo., 7th, one-eighth inch; Southington, Conn., 1st; Fallston, Md., 1st, one-eighth inch; Somerset, Mass., 1st; Fall River, Mass., 1st; Freehold and Linden, N. J., 1st; Ardenia, N. Y., 1st; Waterburg, N. Y., 15th; Palermo, N. Y., 1st, one-half inch; Nile, N. Y., 15th; Bellefontaine and Jacksonburg, Ohio, 1st; Norwalk, Ohio, 1st, three-tenths inch—14th, 15th, one-tenth inch; West Chester, Fallingston, and Milton, Pa., 1st; Litchfield, Pa., 1st, one-half inch; Coalville, Utah, 15th, 25th; Charlotteville, Vt., 1st, ice along shore of lake.

Ground frozen.—Rowe, Mass., and North Volney, N. Y., 1st, quite hard.

PRECIPITATION.

The general distribution of the rainfall, including melted snow, for May, 1880, is illustrated upon chart No. III as accurately as possible from about 500 reports. In a small table on this chart will be found the average precipitation for the month of May, compared with the precipitation during the present month. Throughout the Atlantic states, except Florida, and in the Missouri valley, the rainfall has been deficient, and severe droughts have resulted in these sections. The heaviest rains have fallen in Alabama, Indiana, Michigan, Indian Territory, and Texas; damaging floods occurred in Indiana and Georgia on the 21st, and in Texas from the 27th to 29th, details of which will be found below.

Special heavy rains.—1st, New Ulm, Tex., 2.31 inches; San Antonio, Tex., 2.54 inches; Mason, Tex., 3.64 inches. 3d, Jacksonville, Fla., 2.17 inches. Mayport, Fla., 2d to 4th, 5.53 inches. 8th, Springfield, Ill., 2.66 inches; Peoria, Ill., 3.94 inches; Mount Sterling, Ill., 3.20 inches. 9th, Louisville, Ill., 2.70 inches. 9th to 11th, Litchfield, Mich., 2.30 inches. 8th to 10th, Ashley, Mo., 3.17 inches. 9th and 10th, Logansport, Ind., 4.28 inches. 10th, Niles, Mich., 2.80 inches; Wabash, Ind., 2.15 inches. 10th to 11th, Coldwater, Mich., 2.75 inches. 11th, Key West, Fla., 3.08 inches. 11th to 13th, Gulf Hammock, Fla., 3.55 inches. 14th, Fort Wallace, Kans., 4 inches. 17th to 18th, Pembina, Dak., 3.18 inches. 19th to 21st, Litchfield, Mich., 4.25 inches. 20th, Toledo, Ohio, 1.10 inches in 15 minutes; Fort Sill, Ind. Ter., 2.76 inches. 20th to 21st, Saint Meinrad, Ind., 4 inches; Louisville, 1.95 inches. 21st, Indianapolis, 2.69 inches; Montgomery, 3.33 inches; Wabash, Ind., 3.20 inches; Lansing, Mich., 2.73 inches; New Harmony, Ind., 3.33 inches. 21st to 22d, Elsworth, N. C., 5.50 inches in 22 hours. 22d, Niles, Mich., 3.35 inches; Coldwater, Mich., 3.70 inches; Columbus, Ga., 9.92 inches, 8.50 inches in 10 hours. 23d, Elsworth, N. C., 2.75 inches. 25th to 26th, Tabor, Iowa, 2.11 inches; Manhattan, Kans., 2.81 inches; Breckinridge, 4.05 inches. 25th to 27th, Mobile, 3.41 inches. 26th, Pensacola, Fla., 2.29 inches; Pembina, Dak., 2.64 inches; Fort Barrancas, Fla., 4.23 inches. 26th to 27th, New Orleans, 3.25 inches. 27th, Austin, Tex., 3 inches. 27th to 28th, Fort Sill, Ind. T., 3.59 inches; Nashville, Tenn., 2.25 inches. 28th to 29th, Pilot Point, Tex., 3.05 inches: Saint Meinrad, Ind., 4.50 inches; Denison, Tex., 3.04 inches. 28th, Boerne, Tex., 6.52 inches; Brackettsville, Tex., 12.43 inches. 29th to 30th, Tabor, Iowa, 3.06 inches; Des Moines, 2.91 inches; Cincinnati, 2.23 inches; Louisville, 3.54 inches; Indianapolis, 2.19 inches. 30th, Columbus, Ohio, 1.85 inches; Chattanooga, Tenn., 1.61 inches in 1 hour 35 minutes; Vicksburg, Miss., 4.27 inches; Laconia, Ind., 2.78 inches; Bethel, Ohio, 3 inches. 30th to 31st, Point Pleasant, La., 4.13 inches. 31st, Davenport, 1.60 inches in 3 hours.

Largest monthly rainfalls.—Brackettsville, Tex., 13.11 inches; Fort Barrancas, Fla., 10.98 inches; Elsworth, N. C., 10.43 inches; Fort Sill, 9.74 inches; Saint Meinrad, Ind., 9.55 inches; Coldwater, Mich., 9.40 inches; Wabash, Ind., 8.86 inches; Litchfield, Mich., 8.50 inches; Mayport, Fla., 8.40 inches; Boerne, Tex., 8.29 inches; Logansport, Ind., 8.23 inches; Indianapolis, 8.22 inches; Pembina, Dak., 7.98 inches; Cresco, Iowa, 7.89 inches; Niles, Mich., 7.87; Key West, 7.84 inches; New Harmony, Ind., 7.72 inches; Alpena, 7.36 inches; Anna, Ill., 7.27 inches; Montgomery, 7.07 inches; Mason, Tex., 7.01 inches; Ashley, Mo., 7 inches; Griffin, Tex., 6.42 inches; Jacksboro, Tex., 6.09 inches.

Smallest monthly rainfalls.—Campo, Cal., and along the Visalia and Yuma divisions of the Southern Pacific Railroad from Sumner to Yuma (except Keene, 0.12; Ravenna, 0.10, and White Water, 0.01); Phœnix, Burkes, Grant, and Apache, Ariz.; La Mesilla, and Silver City, N. Mex., and El Paso, Tex., none. Prescott and Yuma, Ariz., trace; Fort Monroe, Va., 0.02 inch; Fort Wingate, N. Mex., and Los Angeles, Cal., 0.04 inch; San Diego, 0.06 inch; Hermosa, Cal., 0.10 inch; Socorro, N. Mex., 0.14 inch; Stockton, Tex., 0.15 inch; Weldon, N. C., 0.17 inch; Cape Henry, Va., 0.18 inch. Visalia, Cal., 0.28 inch; Winnemucca, 0.29 inch; Cheyenne, 0.44 inch; Somerville, N. J., 0.45 inch; Linden, N. J., 0.46 inch; Brookhaven, N. Y., 0.50 inch; Fayetteville, N. C., 0.53 inch; Norfolk, Philadelphia, and Atlantic City, 0.54 inch; Umatilla, Oreg., 0.57 inch; White Plains, N. Y., 0.58 inch; Woodstock, Md., 0.60 inch; New York City, 0.82 inch.

Rainy days.—The number of days on which rain or snow has fallen varies, as follows: New England, 9 to 23; Middle Atlantic states, 4 to 8; South Atlantic states, 3 to 11; Eastern Gulf states, 12 to 18; Western Gulf states, 5 to 12; Lower Lake region, 6 to 15; Upper Lake region, 10 to 20; Ohio valley and Tennessee, 7 to 12; Upper Mississippi valley, 8 to 18; Lower Missouri valley, 9 to 15; Red River of the North valley, 16 to 18; Eastern Rocky Mountain slope, 7 to 15; Texas, 1 to 23; Rocky Mountains, 2 to 17; Middle Plateau, 5 to 14; California, 1 to 8; Oregon, 8 to 21; Washington Territory, 12 to 14.

Cloudy days.—The number varies in New England from 5 to 13; Middle Atlantic states, 1 to 6; South Atlantic states, 1 to 13; Eastern Gulf states, 7 to 13; Western Gulf states, 1 to 7; Lower Lake region, 4 to 7: Upper Lake region, 3 to 11; Ohio valley and Tennessee, 2 to 7; Upper Mississippi valley, 5 to 11; Lower Missouri valley, 5 to 8; Red River of the North valley, 6 to 11; Eastern Rocky Mountain slope, 4 to 8; Texas, 3 to 10; Rocky Mountains, 0 to 9; Middle Plateau, 0 to 8; California, 2 to 7.

Hail was reported from the following States and Territories on the dates named: *Oregon*, 12th. *Washington Territory*, 5th, 7th. *California*, 12th, two miles north of Red Bluff; storm extended over narrow strip one-half mile wide and about two miles long, damaging fruit trees and beating the grain level with the ground. *Idaho*, 5th, 24th. *Nevada*, 12th, 13th. *New Mexico*, 15th, 28th. *Colorado*, 13th, 27th, 28th. *Nebraska*, 4th, 12th, 23d, 24th. *Kansas*, 8th, 9th, 25th, 30th. *Indian Territory*, 26th. *Dakota*, 4th, 8th, 14th, 16th. *Wisconsin*, 7th, at Neillsville; stones 3½ inches in circumference, causing considerable damage 22d. *Texas*, 15th, 18th (28th, 30 miles west of Coleman City violent hail storm destroyed 50 acres of corn). *Iowa*, 6th, 7th, 8th, 18th, 23d, 30th. *Minnesota*, 9th, 22d, 25th, 30th. *Ohio*, 9th, 10th, 11th, 19th, 20th, 21st, 27th, 29th, 31st. *Illinois*, 8th, 9th. *Indiana*, 10th, 19th. *Louisiana*, 25th. *Maryland*, 11th. *Massachusetts*, 6th, 14th. *Missouri*, 26th. *New Hampshire*, 20th, [illegible]5th. *New Jersey*, 14th. *New York*, 27th. *Pennsylvania*, 26th. *Vermont*, 6th, 20th. *Virginia*, 14th. Silver City, Iowa, 30th, 5.30 p. m.; fearfully black clouds came from the S., NW., and SE., forming a junction west of the town, when the most violent action took place between them, followed by a fall of hail over a strip of country 3 to 4 miles wide and about 12 miles in length. Hundreds of stones fell, measuring 11½ inches in circumference; some that were picked up one hour after the storm, and at 10 a. m. the next day, were the size of hens' eggs. Many were rough, jagged blocks of ice, and two were found that together weighed 20 ounces.

Snow.—Snow squalls occurred on the 1st in *Michigan, Pennsylvania, New York, Connecticut, Massachusetts, Vermont, and New Hampshire.* On the summit of Mount Washington it fell on the 1st, 2d, 6th, 12th, 13th, 14th. In *Dakota*, 9th, 16th, 30th. *Montana*, 6th to 9th, 14th, 15th, 24th, 25th. *Wyoming*, 6th, 9th, 30th. *Colorado*, 7th, 9th, 27th, 28th, 31st. On the summit of Pike's Peak, 1st, 3d, 7th, 8th, 9th, 16th, 19th, 20th, 22d, 25th, 26th, 28th, 29th, 31st. *Utah*, 6th, 8th, 9th, 10th, 11th, 23d, 24th, 25th, 26th, 30th. *Nevada*, 5th, 7th, 12th, 13th, 14th. *California*, 12th, on the Coast Range; 31st, visible on the Coast and Sierra Nevada Ranges. *Idaho*, 7th, 9th, 14th. *Washington Territory*, 12th.

Total monthly snow-falls.—The following total monthly snow-falls are reported by the Central Pacific and Southern Pacific Railroads for May, 1880: In the Sierra Nevadas, at Alta, 18 inches; Cisco, 23; Summit, 24; Truckee, 6.50, and Boca, 1; in Nevada, at Humboldt, 2.50; Battle Mountain, 3.58, and at Beowawe and Toano, 2 inches. The observer at Coalville, Utah, reports 14.50 inches.

Floods.—La Crosse, 24th, very heavy rain, rivers and creeks overflowed, trains delayed, and considerable damage to property. Castroville, Tex., 29th, rivers and streams overflowed, carrying away fences and bridges. Pilot Point, Tex., 27th to 29th, great damage to farming interests. Coleman City, Tex., 28th, 29th, 30 miles west of station, unusually heavy rains and destructive floods; Colorado river rose 30 feet during the storm. San Saba, Tex., 27th, very heavy rains; two persons drowned and much property flooded and swept away. Calvert, Tex., 27th, heavy rains, damaging corn, cotton, and oats. Brackettsville, Tex., 28th, 1.30 a. m., heaviest and most disastrous rain storm ever known in this section; all of the city, except portions upon two hills, inundated. The water on Main street rose to the height of eight feet; the first floor of every business house from one to five feet under water; many buildings washed away and over twenty persons reported drowned. Lampasas, Tex., heaviest rain for many years; mail stage washed away and driver drowned; much other damage. Vincennes, Ind., 21st, creeks "terribly" swollen; great damage to growing wheat; fences, bridges, and railroad embankments washed away; a brick yard near town was submerged, and a quarter of a million bricks were washed away. Sullivan, Ind., 21st, severe washouts and much other damage. Huntington, Ind., 21st, Flint creek overflowed, causing considerable damage; railroad tracks submerged and culverts washed away. Wabash, Ind., 21st, great damage to fences, bridges, and crops; streams everywhere overflowed; bottom lands 2 to 10 feet under water; trains delayed. Columbus, Ga., 21st, all railroads broken, no trains running, 67 bridges washed away throughout the county, low lands submerged and all crops damaged; river rose 15 feet in two hours; streets converted into rushing rivers; houses flooded several feet deep; calves, goats, hogs, dogs, and fowls drowned by the score.

Drought.—The following will serve to show the extent of drought in the various sections: Cheyenne, driest month in the past 9 years. Independence, Kans., 28th, first rain in 6 weeks; wheat and oats suffered severely. Bowling Green, Ky., 1st to 20th, exceedingly dry; all crops suffering, oat crop a failure, market gardens seriously damaged. Fallston, Md., 31st, grass and wheat seriously injured; no rain from April 29th to May 22d. Sandy Springs, Md., month unusually dry; all crops suffering. South Lee, Mass., month very dry; "mills on the Housatonic river used all the water on the 24th, an event which has not happened before in 70 years, notwithstanding that the streams have been higher this year than usual." Clear Creek, Nebr., 26th, first good rain since last fall; crops suffering. Auburn, N. H., 18th to 30th, very dry; vegetation suffering severely. Freehold, N. J., month unusually dry. Atco, N. J., 31st, strawberry and hay crops seriously damaged. Somerville, N. J., drought very severe throughout the month. White Plains, N. Y., smallest monthly rainfall in the past 7 years. Catawissa, Pa., throughout month, seriously damaging grain and grass crops. Fallsington, Pa., 22d, first rain in 23 days; month unusually dry. Litchfield, Pa., 20th, much damage to grain and vegetables. Snowville, Va., 1st to 21st, severe drought. Walnut Grove, Va., no rain from 1st to 21st; crops suffering severely. Norfolk, Va., 28th, unprecedented drought in neighboring country; first and early vegetables damaged to a large extent. Helvetia, W. Va., 1st to 19th, unusually dry; rivers and streams lowest for many years. Omaha, Nebr., drought in eastern part of State unprecedented; six months without rain enough to wet the ground: the air is filled with dust.

Rain from a cloudless sky.—Burlington, Vt.. 10th, 26th.

Precipitation during April, received after the issue of April Review.—*Arizona:* Whipple Barracks, 0.14 inch; Fort Lowell, 0.16; Fort Bowie, 0.15; Fort Verde, 0.27; Fort McDowell, 0.28; Fort Apache, 0.46; Fort Grant, 0.04; Fort Mojave, 0.00; Fort Thomas, 0.06. *California:* Benicia Barracks, 8.15; Salinas City, 3.90; Oakland, 8.46; Poway, 3.10; Angel Island, 10.17; Presidio, S. F. Cal., 7.55; Fort Gaston, 13.95; Mount Saint Helena, 27.87; San Gorgonio, 6.94; San Buenaventura, 1.87. *Dakota:* Fort Stevenson, 5.66; Fort Sully, 1.71; Fort Meade, 0.75. *Idaho:* Fort Lapwai, 0.23. *Montana:* Fort Benton, 1.80; Fort Shaw, 1.51; Fort Ellis, 4.24; Fort Keogh, 1.10; Fort Logan, 1.45; Fort Assiniboine, 1.29; Blackfeet Agency, 0.91. *Oregon:* Albany, 2.62; Fort Stevens, 4.83; Fort Klamath, 2.77; Eola, 2.21; Fort Harney, 1.70. *Texas:* Fort Ringgold, 0.70; Fort Brown and Fort Davis, 0.00; Fort Elliott, trace; Laredo, 1.20. *Virginia:* Dover Mines, 1.30. *Washington Territory:* Fort Canby, 4.03; Fort Townsend, 1.30; Neah Bay, 3.52; Bainbridge Island, 2.15; Dayton, 3.81. *Florida:* Okahumpka, 2.12; Daytona, 2.28. *Massachusetts:* Williamstown, 4.77. *Michigan:* Grand Rapids, 6.00. *Nevada:* Wadsworth, 0.87; Brown's, 0.94. *New Jersey:* South Orange, 3.02. *New York:* Troy, 2.07. *Pennsylvania:* Chambersburg, 3.07. *Tennessee:* McMinnville, 7.50; Austin, 5.38; Clarksville, 5.65. *Utah:* Promontory, 2.03; Terrace, 0.30.

RELATIVE HUMIDITY.

The percentages of mean relative humidity for the month range as follows: New England, from 59.6 to 77.3; Middle Atlantic states, 53.9 to 77.4; South Atlantic states, 58.2 to 77.5; Eastern Gulf states, 71.0 to 77.5; Western Gulf states, 68.9 to 78.3; Ohio valley and Tennessee, 55.1 to 67.9; Lower Lake region, 55.4 to 66 5; Upper Lake region, 59.8 to 75.5; Upper Mississippi valley, 54.3 to 61.6; Missouri valley, 51.1 to 56.4; Red River of the North valley, 65.2 to 67.6; Eastern Rocky Mountain slope, 41.0 to 85.0; Western Plateau, 10.0 to 49.7; California, 50.6 to 72.0; Oregon, 65.0 to 73.0. *High stations* report the following averages not corrected for altitude: Pike's Peak, 63.5; Mount Washington, 83.3 per cent.

WINDS.

The *prevailing direction of the winds* for the month of May, 1880, is shown, by arrows flying with the wind, on chart No. II. The prevailing winds over the eastern half of the United States were *southerly*, and along the Pacific coast, over the Plateau districts, and in the Upper Missouri valley, *northwesterly* or *westerly*. Exceptions to the above generalization are to be found in the northwest winds on the summit of Mount Washington, at New York, Pittsburgh, and Marquette; in the northeast winds at Duluth and Jacksonville; in the east winds at Brackettville, McKavett, Indianola, New Orleans, Atlanta, Montgomery, Cedar Keys, Punta Rassa, and Key West; and in the southerly winds at Los Angeles and Olympia.

Total movements of the air.—The following are the largest total movements at the Signal Service stations: Pike's Peak, 19,287 miles; North Platte, 14,329; Chincoteague, 12,905; Breckinridge, 12,107; Delaware Breakwater, 12,034; Fort Elliott, Tex., 11,948; Dodge City, 11,564; Kittyhawk, 11,504; Stockton, 11,462; Fort Sill, 11,006; Cape May, 10,994; Cape Lookout, 10,826; Wood's Holl, 10,839; Cape Hatteras, 10,707; Bismarck, 10,596; Cape Henry, 10,496; Thatcher's Island, 10,081; Yankton, 9,943; Sandy Hook, 9,855; Concho, 9,788; Barnegat, 9,709; Sandusky, 9,457; Indianola, 9,456; Henrietta, Tex., 9,404; Umatilla, 9,343; Pembina, 9,260; Milwaukee, 9,212; Decatur, 9,047; Grand Haven, 8,832; Philadelphia, 8,367; Cheyenne, 8,354; Omaha, 8,344; San Francisco, 8,320; Cedar Keys, 8,278; Red Bluff, 8,249; Boston, 8,117; Saint Paul, 8,115; Key West, 8,039; St. Louis, 8,000. Frost-work prevented a complete record on Mount Washington. The *smallest are:* Augusta, 2,366; La Mesilla, 2,385; Silver City, 2,442; Deadwood, 2,613; Lynchburg, 2,728; Knoxville, 2,800; Roseburg, 2,882; Shreveport, 2,981; Nashville, 3,050; Tucson, 3,159; Little Rock, 3,327; Des Moines, 3,473; Los Angeles, 3,508; Uvalde, 3,547; Fort Davis, Tex., 3,556; Morgantown, 3,562; Visalia, 3,621; Chattanooga, 3,625; Vicksburg and Laredo, 3,802; Cincinnati, 3,963; Montgomery, 3,997.

Local storms.—An unusual number of severe local storms were reported during the month. They occurred on the 8th, 9th, and 10th, during the passage of low area No. IV, and from the 20th to the 29th, during the passage of low areas Nos. VI, VII, VIII, and IX. Kalamazoo, Mich., 8th, 11 p. m., violent tornado two miles east of station, demolishing houses, trees, and fences; Saint Barnabas chapel, 25 by 40 feet, was moved four feet off from foundation; the cloud appeared to have bounded over many places. Hudson and Thornville, Mich., 8th, very violent wind and rain storms, causing much damage to buildings and fences. Yates Center, Kans., 9th, 5 p. m., a severe tornado passed from SW. to NE., a few miles north of station; the cloud appeared as a long, serpent-like column of dense black smoke; many buildings were destroyed and several persons severely injured. Lincoln County, Missouri, 9th, between noon and 1 p. m., a severe tornado started near Highland Prairie, and moved in a northeast direction, demolishing trees, fences, and buildings; width of path about 200 yards. Jacksonville, Ill., 10th, 9 p. m., violent tornado passed along the valley of Big Sandy creek, eight miles south of the town, destroying everything in its path; 20 to 30 buildings were demolished, and miles of fencing laid waste; 25 head of cattle and horses, 30 head of sheep, and seven persons were killed; width of path about one-quarter mile, and course from SW. to NE. Alsey, Ill., 10th, 7 p. m., a severe tornado; not a dozen houses remained standing within city limits; two black and fearful-looking clouds, one from northwest and the other from southeast, met west of the city, from which immediately descended a funnel-shaped cloud, when the work of destruction commenced, and in less than three minutes the entire damage was completed. Arrowsmith, Ill., 10th, very violent wind and rain storm passed over city during early morning, doing a vast amount of damage to buildings; several persons were dangerously injured; loss estimated at $100,000. Clinton, Ill., 10th, heavy wind and rain storm during the evening; buildings, fences, and trees demolished; path very narrow, and course from SW. to NE. Woodlawn, Morgan County, Illinois, 10th, tornado destroyed railroad station and other buildings; four persons killed; path from SW. to NE. Island Pond, Vt., 10th, terrific wind storm, destroying several buildings, steamboat-house, and a large covered bridge 200 feet long. Carbondale, Ill., 20th, 2 p. m., violent tornado struck the southern end of the town, unroofing and demolishing houses, and blowing down trees and fences. State Normal University building very seriously damaged. One of the heavy caissons of the artillery park was driven violently for a distance of nearly 100 yards. Course of storm from SW. to NE. Grafton, N. H., 20th, small but violent tornado during afternoon; the largest trees were uprooted or broken off, and fences and buildings damaged. Hail of large size accompanied the storm; some of the stones were pronged-shaped, two inches long by one wide. Path of storm SW. to NE. Wakeman, Ohio, 22d, 5.20 p. m., violent tornado passed through the northern portion of Wakeman township and across Florence and Vermillion townships to Lake Erie, doing a vast amount of damage to dwellings, barns, orchards, timber, and fences. "The first evidence of the storm was indicated by a violent conflict of the air currents overhead, driving the clouds in every direction; shortly afterwards a spout-like cloud was seen to descend from the clouds to the ground, having a spiral motion from right to left, rapidly assuming greater proportions with increased violence. Solid oak trees, three to five feet in diameter, were twisted off like brittle pipe-stems; animals were carried long distances and dashed in shapeless masses, and poultry were stripped of their feathers and yet in some instances found alive. Few trees of any kind were blown over at the roots, being generally twisted off from four to twenty-five feet from the ground. The funnel-shaped cloud appeared to alternately increase and decrease in size as it moved forward with a swaying motion from side to side. Seen at a distance, the storm cloud seemed filled with objects resembling immense birds sailing around in the spirally moving current, but which proved to be large branches and pieces of timber." Path, fifteen to thirty rods in width and eight to ten miles in length; course SSW. to NNE.; loss, $25,000. Freedom, Ohio, 22d, 7 p. m., severe wind and rain storm; many buildings crushed to the earth and swept away; miles of fencing and much valuable timber demolished. Omaha, 23d, 6.15 p. m., small tornado passed through the northern part of the city, from NW. to SE.; width of path about six hundred feet. The catholic convent and several residences were demolished. Immense clouds of dust accompanied the storm, and fences and telegraph wires were blown down in great confusion. At Council Bluffs several buildings were unroofed and freight cars overturned. Mitchell, Dak., 25th, 7 p. m., severe tornado, three persons killed and many buildings destroyed. Most of the farm buildings in the vicinity of the town were blown to pieces. Course of storm from SW. to NE. Independence, Iowa, 25th, 4.30 p. m., terrific wind and rain storm, much damage to property. Albany, N. Y., 26th, 4.25 p. m, very violent wind storm, trees uprooted, and fences and buildings demolished. Savoy, Tex., 28th; during the evening this town was almost entirely destroyed by a violent tornado; 15 persons killed and 60 wounded. At Suffield, Conn., on the 29th, about 1.30 p. m., a violent tornado, accompanied with torrents of rain and very heavy hail, passed from SW. to NE. through the township, crossing the Connecticut river directly opposite Thompsonville, where it lifted large bodies of water and demolished boats. In Thompsonville, and also through the remaining portions of Enfield township to the eastward, the destruction to property was very severe. From 20 to 30 buildings, several fine orchards and groves of choice forest trees were demolished. Width of storm track about one mile, the boundary lines of destruction on either side being sharply defined, frequently objects in close proximity escaping the slightest injury. In less than 10 minutes from the time the dark clouds were first seen in the west the entire destruction throughout Suffield was completed. The whirling action of the storm cloud was clearly evidenced by the peculiar twisting of the trees from right to left, and the spreading of the *débris* in circles. The loss was estimated at from $30,000 to $40,000.

Sand storms.—Umatilla, Oreg., 7th; Winnemucca, 2d, 3d, 4th, 22d, 23d; Burkes, Ariz., 12th, 13th, 22d, 23d, 24th, 25th; Colorado Springs, Colo., 14th; North Platte, 11th, 12th, 13th, 14th; Yankton, 4th; Fort Garland, Colo., 6th, 17th, 21st; Fort Union, N. Mex., 6th, 7th, 9th, 12th, 13th, 14th, 25th.

Waterspouts.—April 23d, schooner A. K. Bently, in latitude 31° 59′ N., longitude 79° 20′ W., reported a remarkable waterspout in the SE., distant about one mile from vessel. It appeared to be an immense volume of water pouring from a dense black cloud. Yates Center, Kans., May 9, waterspout burst on Vermillion river, 6 miles west of station, raising the water 16 feet in 20 minutes; thousands of fish were killed, not only where the spout burst, but for several miles below. Punta Rassa, Fla., 10th, between 5.50 and 6.05 p. m. a waterspout was seen near Sanibel Island, about two miles from observer, resembling the tall trunk of a cocoanut palm; it was of uniform diameter and brilliant whiteness. Altitude 20° and slightly inclined from the perpendicular at the top towards the east. The base for an apparent distance of 30 or 40 feet was surrounded by a violently agitated mass of water. The body was a hollow cylinder composed of spray and water ascending with a rapid spiral motion from right to left; it moved from NE. to SW., and vanished from the bottom upwards. On Mustang Creek, 4½ miles east of Colorado or Concho river, Texas, on the 28th, a huge waterspout, accompanied by an indescribable hissing, roaring noise, passed down the creek, drowning the horses of a party camped near by, and carrying away all their camp equipage and wagons; thousands of fish were thrown upon the banks.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily indications for May with the telegraphic reports for the succeeding twenty-four hours shows the general percentage of verifications to be 82.8 per cent. The percentages for the four elements are: weather, 88.3; direction of the wind, 81.6; temperature, 79.0; barometer, 81.7 per cent. By geographical districts they are: for New England, 77.4; Middle states, 82.6; South Atlantic states, 90.4; Eastern Gulf states, 87.7; Western Gulf states, 86.2; Lower Lake region, 80.6; Upper Lake region, 81.5; Tennessee and the Ohio valley, 83.0; Upper Mississippi valley, 80.7; Lower Missouri valley, 77.3; Northern Pacific coast region, 84.2; Central Pacific coast region, 85.5; Southern Pacific coast region, 87.5. There were 17 omissions to predict out of 3,813, or 0.45 per cent. Of the 3,796 predictions that have been made, 127, or 3.35 per cent., are considered to have entirely failed; 219, or 5.77 per cent., were one-fourth verified; 430, or 11.33 per cent., were one-half verified; 585, or 15.41 per cent., were three-fourths verified; 2,435, or 64.14 per cent., were fully verified, so far as can be ascertained from the tri-daily weather maps.

Cautionary signals.—188 cautionary signals were displayed during the month, of which 142, or 75 per cent., were justified by winds of 25 miles per hour or over at or within a radius of 100 miles of the station. 33 off-shore signals were displayed, of which 27, or 81.8 per cent., were fully justified; 28, or 84.8 per cent., were justified as to velocity, and 32, or 97.0 per cent., as to direction. 6 of the off-shore were changed from cautionary. 221 signals of both kinds were displayed, of which 169, or 76.5 per cent., were fully justified. The above does not include signals ordered for 50 display stations, where the velocity is only estimated. 114 cases of winds of 25 miles and over per hour from scattered stations were reported, and for which signals had not been ordered.

NAVIGATION.

In the table on the right-hand side of chart No. III are given the highest and lowest readings of the Signal Service river gauges for the month of May, 1880, with the dates of the same. As a general rule the rivers fell throughout the month. The *Red River*, at Shreveport, and the *Arkansas*, at Little Rock, fell steadily throughout the month. The *Missouri* and *Upper Mississippi* changed but little throughout the month. The *Mississippi*, at Cairo, rose 3 feet from the 1st to the 6th, fell slowly to the 28th, and rose 2 feet to end of month; at Memphis it rose from the 1st to the 11th, after which it fell to end of month; at Vicksburg the water fell slowly from the 1st to the 5th, and remained almost stationary thence to 15th; on the 15th a more decided fall, which continued to end of month, set in and the water passed below the danger line on gauge, after having been above that point for a period of 9 weeks; at New Orleans the water fell slowly throughout the month, passing the danger line on the 26th, after having been above that point for a period of 11 weeks. The *Ohio*, *Cumberland*, and *Tennessee* fell generally throughout the month at all stations.

Ice in rivers and harbors.—During the present month Duluth is the only station within the limits of the Signal Service reporting interruption of navigation by ice, and the following notes from this station are interesting: On the 1st, steamer Quebec made her way through 8 miles of ice, which blocked the harbor, and was the first arrival of the season; on the 3d, steamer J. L. Hurd started out, but became blocked in the ice about two miles from shore, and was unable to proceed until the 4th; on the 6th, several vessels were blocked in the ice while coming into port; on the 13th, vessels were still blocked, and the ice in some places was estimated to be 40 feet deep, being backed up by strong NE. winds; on the 15th, some vessels succeeded in passing out, and on the 19th the ice was driven out by strong westerly winds and the lake reported clear.

High tides.—At Indianola on the 1st, 15th, and 16th; on the latter date the water covered the streets, in some places to a depth of 18 inches. At Galveston, 15th, 16th, and 17th; on the 16th many streets were partly under water. At Pensacola, 24th, very high tide.

TEMPERATURE OF WATER.

The temperature of water, as observed in rivers and harbors, with average depth at which observations were taken, is given in the table on the left-hand side of chart No. II. At the following stations observations were not made on the dates indicated: Duluth, 1st to 9th, hindered by ice; San Francisco, 1st to 17th, instrument broken.

ATMOSPHERIC ELECTRICITY.

Thunder-storms were reported from the various districts on the following dates. New England, 3d to 7th, 9th, 10th, 19th to 21st, 26th to 28th; Middle Atlantic states, 5th, 9th, 10th, 11th, 14th, 20th to 23d, 26th, 27th, 28th; South Atlantic states, 4th, 11th, 12th, 22d, 23d, 24th, 28th, and 30th; Eastern Gulf states, 2d, 4th, 10th, 11th, 12th, 13th, 20th, 23d, 24th to 27th, 29th, 30th, 31st; Western Gulf states, 1st, 2d, 4th, 5th, 12th to 16th, 18th, 19th, 20th, 23d to 31st; Lower Lake region, 8th, 9th, 10th, 19th to 22d, 26th, 27th, 29th to 31st; Upper Lake region, 5th, 7th, 9th, 10th, 18th, 19th, 23d, 24th, 31st; Ohio valley and Tennessee, 5th, 9th, 10th, 11th, 12th, 20th, 23d, 24th, 27th, 29th, 31st; Upper Mississippi valley from 3d to 31st; Lower Missouri valley, 3d, 6th, 8th to 19th, 21st, 23d to 31st; Eastern Rocky Mountain slope, 8th, 9th, 14th, 18th, 19th, 20th, 26th, 28th, 31st; Colorado, 19th and 28th; New Mexico, 28th; Utah, 26th; Wyoming, 3d; Idaho, 15th; California, 12th at Princeton and Red Bluff; Washington Territory, 7th and 27th.

Auroras.—During May, 1880, three general auroral displays were observed over the United States, namely, on the 1st and 2d, extending from Eastport, Me., to Montana; on the 14th, extending from New Hampshire and Massachusetts to Lake Superior, and from the 26th to the 28th, from New Hampshire to Montana. The most southerly stations reporting auroras were, Girard, Kans., New Corydon, Ind., and New London on the 1st; Woodstock, Md., on the 4th (very faint), and Cedar Vale, Kans., on the 7th; La Crosse, Wis., 1st, from 8.45 p. m. to midnight; color nearly white, in form of an arch, with lower edge well defined, with center 10° above horizon. Below arch a dense haze, very dark in color, and in striking contrast with the rest of the sky, which was very bright and clear. No beams or columns, merely a diffuse light, quite brilliant at times, nearly disappearing for a few seconds, and reappearing again. Arch extended from about 40° east to 30° west of magnetic meridian. Bismarck, 1st, 9 p. m., observed in northwest, extending upward about 30°. Duluth, 1st, 9 p. m., light grayish color, two arches, breaking up about 10 p. m. into beams of light, shooting upward to a great height, some of larger beams reaching to several degrees beyond the zenith. Aurora also observed at 10 p. m. of 2d. Toledo, 1st, 10.50 p. m., shifting from E. to W. along the north horizon, many streamers reaching to zenith, disappeared at 11.30 p. m. Eastport, 1st, 8.20 p. m. to 2.45 a. m. of 2d. Burlington, Vt., 2d, 11.15 p m. to 12.30 a. m.; 3d, green, dark segment, no arch of light or streamers. New London, 1st, 9 to 11 p. m. Bangor, Me., 2d, 11.35 p. m. to midnight, very brilliant beams and dancers; altitude 45°; azimuth 75° to 290°. Clear Creek, Nebr., 1st, 8 p. m. to 11 p. m., from W. to NE., brightest in NW. Cresco, Iowa, 1st, 9.15 p. m., bright low arch in NE., 10 p. m., a few straggling streamers; 10.30 p. m., disappeared; 2d, 10.30 p. m., a few faint streamers starting from northern horizon. Gardiner, Me., 1st, 9 p. m. to midnight, very bright. 2d, not very bright; obscured by clouds before midnight. Newburyport, Mass., 2d, diffuse light above dark segment; a few streamers, no motion, disappeared at 10.20 p. m. Lima, N. Y., 1st, 9.50 to 10.50 p. m., faint, E. three to five streamers. Saint Paul, 1st, 10 p. m., dark segment, with luminous arc; continuous motion from E. to W.; color, pale yellow and orange; remained visible about 40 minutes; telegraph wires perceptibly affected. Pembina, 1st, appeared at 8.30 p. m., and continued throughout night; no continuous arch except for a minute or two, and dark segment scarcely visible. The aurora extended from about 160° to 280° azimuth, with an altitude at various times reaching to the zenith; colors, crimson, yellow, and green, very transparent. Breckinridge, 1st, 8 to 10.40 p. m., light green color, tinged with red. Burlington, Vt., 14th, from 9 p. m. to 12.30 a. m. of the 15th, light arch of light pale green. Auburn, N. H., from 9.20 p. m. of 14th to early morn of 15th. Toledo, 26th, 8.50 p. m.; altitude of streamers, 30° to 90°; no lateral motion; disappeared at 11 p. m. Oswego, 26th, 9.15 to 9.50 p. m., NE. to NW.; altitude to zenith; dark segment surmounted by diffuse light, from which shot innumerable bright beams. Buffalo, 26th, 9.15 to 9.30 p. m., extending from NE. to NW.; beams having an apparent rapid upward movement to an elevation of about 60°, with a slow lateral movement to the west; color, reddish tinge. Lima, N. Y., 26th, 9.15 p. m. to 10.15 p. m.; streamers 9.37 p. m.; altitude 35°. Bismarck, 27th, from 9 to 10 p. m., altitude about 5°. Trenton, N. J., 8.30 to 8.45 p. m. Burlington, Vt., 28th, from 11.15 to 11.25 p. m.; pale green.

Telegraphic communication interfered with by atmospheric electricity.—Pike's Peak, 19th, 21st; Fort Sill, 26th; Mason, Tex., 1st, 4th, 27th; Boerne, Tex., 28th; Castroville, Tex., 1st, 19th, 20th, 23d, 24th, 27th, 28th, 29th; Fredericksburg, Tex., 1st, 27th, 29th; Uvalde, Tex., 1st, 19th, 23d, 24th; Laredo, Tex., 23d, 24th; Stockton, Tex., 4th, 6th, 12th, 13th, 17th, 18th, 19th, 23d, 24th, 28th, 31st; Davis, Tex., 11th, 14th, 17th; Brackettville, Tex., 2d, 23d, 24th, 28th; Pilot Point, Tex., 28th, 29th; McKavett, Tex., 27th, 28th; Fort Elliott, Tex., 29th, 31st. On the summit of Mount Washington, 12th and 26th, Saint Elmo's fire appeared on tops of anemometer and anemoscope.

OPTICAL PHENOMENA.

Solar halos were reported from the various districts on the following dates: New England, 3d, 4th, 5th, 7th, 8th, 11th, 15th, 18th, 25th, 26th, 28th, 29th; Middle Atlantic states, 1st to 11th, 15th, 19th, 29th; South Atlantic states, 2d, 5th, 11th, 12th, 22d, 29th; Eastern Gulf states, 4th, 5th, 6th, 12th, 14th, 16th; Western Gulf states, 1st, 14th, 15th, 17th; Lower Lake region, 2d to 6th, 9th to 12th, 16th to 20th, 24th, 29th, 31st; Upper Lakes, 1st, 2d, 6th, 8th, 9th, 20th, 21st, 23d, 25th, 29th; Ohio valley and Tennessee, 2d, 4th, 9th, 10th, 11th, 23d, 26th, 28th, 29th, 31st; Upper Mississippi valley, 1st, 2d, 8th, 9th to 13th, 18th to 22d, 25th, 29th; Missouri valley, 1st, 2d, 5th, 7th to 10th, 15th, 17th to 22d, 24th, 25th; Middle Plateau, 4th, 7th, 16th, 18th to 21st, 29th; Calirally be expected to make itself apparent through a corresponding change in the rainfall of the earth, so that when the sun is most powerful there ought to be the greatest rainfall.

2. While the connection indicated above is that which most readily occurs to the mind, yet the difficulty of ascertaining the facts of the case in a manner bearing the smallest approach to completeness is so great as to be at present insuperable. There is, first of all, an intense reference to locality in rainfall, so that the rainfall at one place may differ greatly from that at another place in its near neighborhood. Again, there are, probably, in addition to possible secular inequalities, very great oscillations in the yearly rainfall at any one place, or accidental variations, as we may term them, in our ignorance of their cause. Thirdly, it is in comparatively few places, and those places chosen not with the smallest reference to this particular problem, that we have anything like a trustworthy account of the rainfall throughout a considerable number of years. Fourthly, we have no information of any importance with respect to the rainfall at sea.

3. Besides the formidable catalogue of difficulties now mentioned, we ought to bear in mind the following considerations. The convection currents of the earth are regulated by two things, one of which is constant, while the other may be variable. The constant element is the velocity of rotation of the earth on its axis, while the element of possible variability is the power of the sun. Hence it follows that if the sun be variable it will cause a variation in the direction as well as in the intensity of the earth's convection-currents on the principle which tells us that the resultant of two forces, one constant and the other variable, must vary both in magnitude and direction. Now, if it be true that we have a long period variation, not merely of the intensity, but also of the distribution, of the earth's convection currents, and if we bear in mind the intensely local reference in rainfall, it would be too much to expect that the rainfall inequality should exhibit the same years of maximum and minimum at all places. It is even conceivable that some places might exhibit a maximum when others showed a minimum, while others again might exhibit a double instead of a single period.

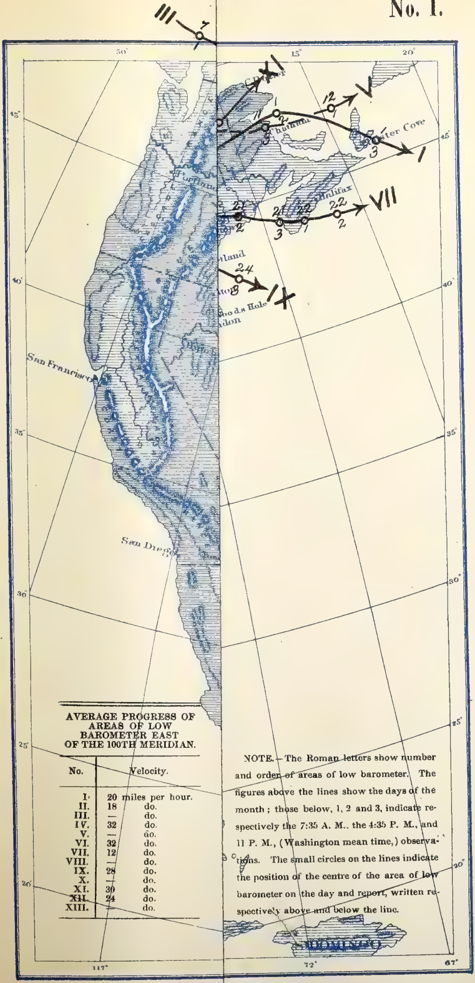
4. It appears to me that if we bear in mind these considerations, it will not answer to add together the rainfalls of a few selected stations as they stand, with the view of determining by this means whether there be a long period inequality in the rainfall of the whole earth. We are not yet in a position to reply experimentally to this question. It does not, however, follow that nothing can be done. Dr. Meldrum and others appear to have achieved good preliminary work in the direction of indicating the existence of a rainfall inequality depending upon the state of the sun. Dr. Meldrum began by pointing out that in a good many places there is a greater rainfall during years of maximum than during years of minimum sun spots, and that this phenomenon repeats itself from one solar cycle to another. Again, Governor Rawson has pointed out the existence of certain localities where the rainfall inequality appears to be of a precisely opposite character, while Dr. Hunter has shown the practical importance of the investigation with reference to certain tropical stations. The subject has likewise been discussed by Piazzi Smyth, Stone, and others.

[From Nature, May 13, 1880.]

The United States weather maps, August, 1878.—The most remarkable feature of the meteorology of the Northern Hemisphere for August, 1878, as compared with July preceding, was the enormous change which took place in the distribution of atmospheric pressure over the Atlantic as far as latitude 60° N., the change being greatest in the region around Ireland and the southwest of England, where it amounted to a fall of about the third of an inch. Pressure was also still further reduced over nearly the whole of the United States, particularly in the north, the deficiency from the normal at New York being over 0.150 inch. In Europe, this lowering of the pressure extended eastward into Russia as far as longitude E. 40°, where it rose to nearly the average. It again fell on advancing further eastward to 0.150 inch below the normal in the valley of the Irtish, rising, however, again to the normal over the western affluents of the Lena. Thus from the Rocky Mountains, across the United States, the Atlantic, Europe, and into Asia as far as the Lena, pressure was under the normal—in other words, over a broad belt going half way round the globe. This region of abnormally low pressure would appear to have stretched south-southwestward from Western Siberia, embracing the regions marked off by Syria, Egypt, Africa as far as Cape Colony, the Mauritius, Western India, and Turkistan. Also in Victoria, Tasmania and New Zealand pressure was very low, being at Dunedin 0.372 inch less than the normal.

In accordance with this distribution of pressure, temperature was from 1° to 2° above the normal in the United States, except in the Northeast, where it fell to the average in the New England States, and fell still further to 1°.6 below it at Saint John's, Newfoundland. Under the influence of low pressure around Ireland the weather map shows a prevalence of strong breezes from the Atlantic over Western, Central, and Eastern Europe as far as Kieff, and over the whole of this wide region the tempera-

No. I.



AVERAGE PROGRESS OF AREAS OF LOW BAROMETER EAST OF THE 100TH MERIDIAN.

No.	Velocity.
I.	20 miles per hour.
II.	18 do.
III.	— do.
IV.	32 do.
V.	— do.
VI.	32 do.
VII.	12 do.
VIII.	— do.
IX.	28 do.
X.	— do.
XI.	30 do.
XII.	24 do.
XIII.	— do.

NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7:35 A. M., the 4:35 P. M., and 11 P. M., (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above and below the line.

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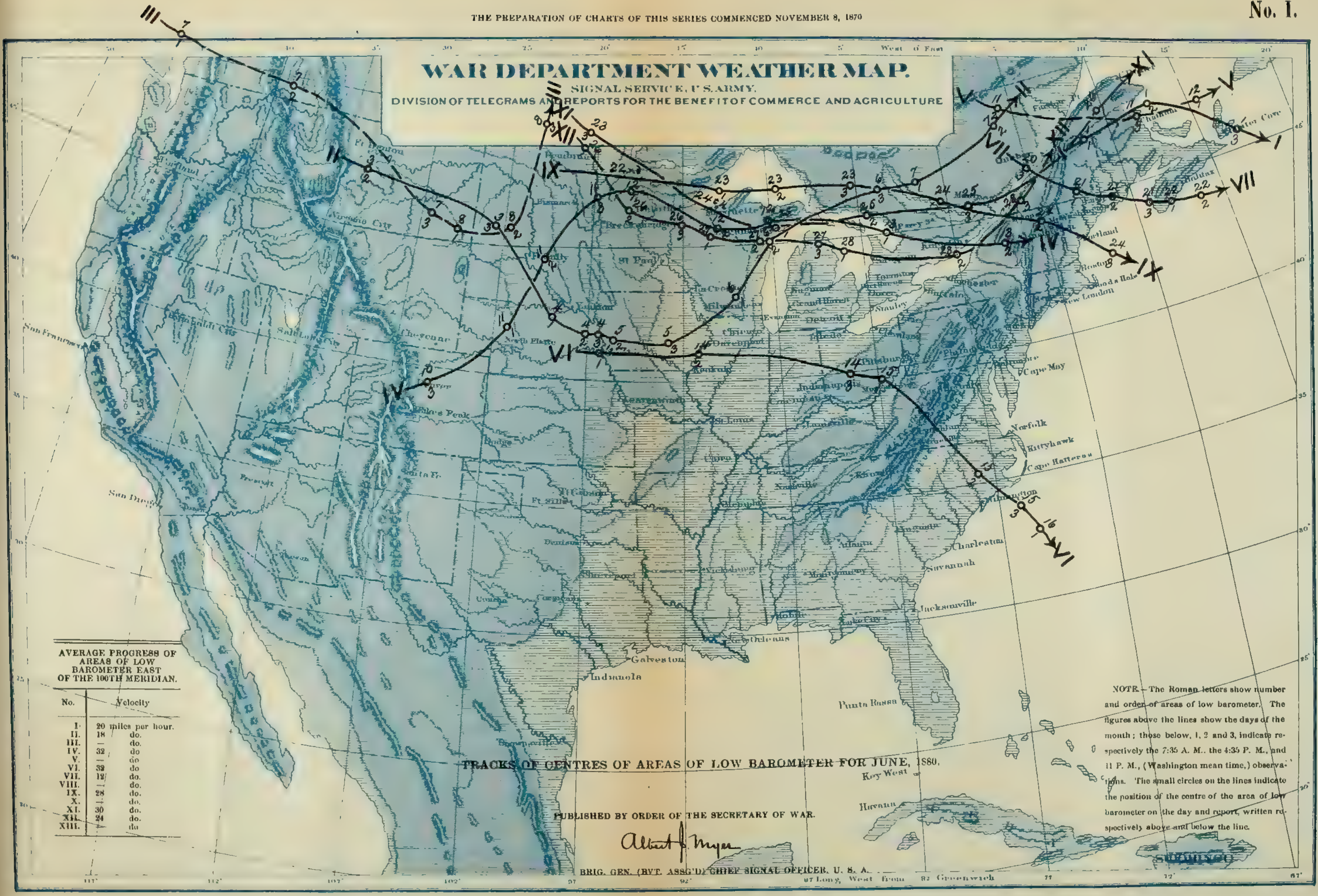
THE PREPARATION OF CHARTS OF THIS SERIES COMMENCED NOVEMBER 8, 1870



WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY,

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE

TRACKS OF CENTRES OF AREAS OF LOW BAROMETER FOR JUNE, 1880.

AVERAGE PROGRESS OF AREAS OF LOW BAROMETER EAST OF THE 100TH MERIDIAN.

No.	Velocity
I.	20 miles per hour.
II.	18 do.
III.	— do.
IV.	32 do
V.	— do
VI.	32 do
VII.	12 do.
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X.	— do.
XI.	30 do.
XII.	24 do.
XIII.	— do

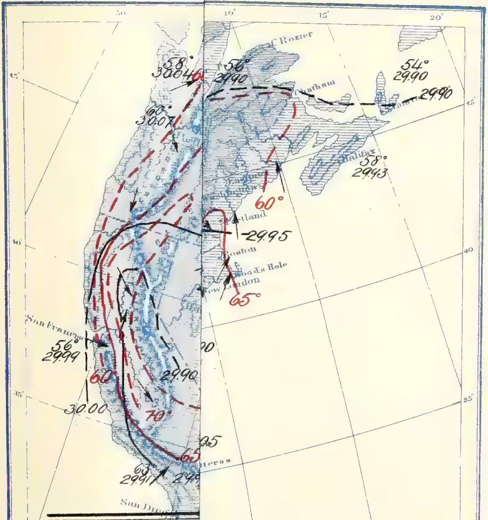
NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7:35 A. M., the 4:35 P. M., and 11 P. M., (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above and below the line.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASS'G'D) CHIEF SIGNAL OFFICER, U. S. A.

No. II.



TEMPERATURE OF WATE
JUNE, 1880.

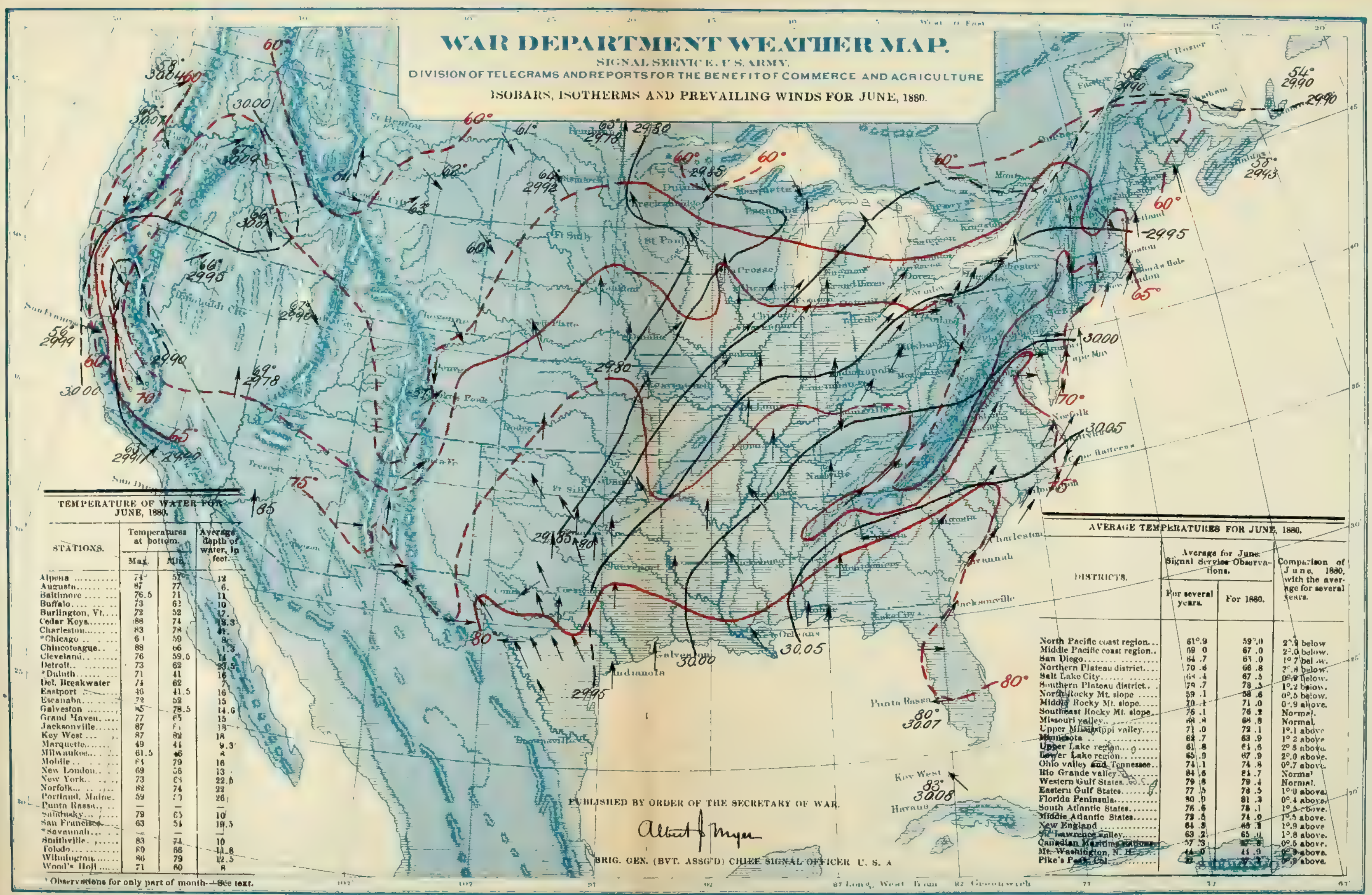
STATIONS.	Temperatures at bottom.	
	Max.	Min
Alpena	74°	57°
Augusta	87	77
Baltimore	76.5	71
Buffalo	73	62
Burlington, Vt.	72	52
Cedar Keys	88	74
Charleston	83	78
*Chicago	69	59
Chincoteague	88	66
Cleveland	76	59.
Detroit	73	62
*Duluth	71	41
Del. Breakwater	74	62
Eastport	46	41
Escanaba	72	52
Galveston	85	78
Grand Haven	77	65
Jacksonville	87	81
Key West	87	82
Marquette	49	41
Milwaukee	61.5	46
Mobile	84	79
New London	69	56
New York	73	65
Norfolk	82	74
Portland, Maine	59	50
Punta Rassa	—	—
Sandusky	79	65
San Francisco	63	54
*Savannah	—	—
Smithville	83	74
Toledo	80	66
Wilmington	86	79
Wood's Holl	71	60

* Observations for only part of m

RAGE TEMPERATURES FOR JUNE, 1880.

CTS.	Average for June. Signal Service Observations.		Comparison of June, 1880, with the average for several years.
	For several years.	For 1880.	
ast region	61°.9	59°.0	2°.9 below.
oast region	69 .0	67 .0	2°.0 below.
	64 .7	63 .0	1°.7 below.
u district	70 .6	66 .8	3°.8 below.
	68 .4	67 .5	0°.9 below.
u district	79 .7	78 .5	1°.2 below.
slope	59 .1	58 .6	0°.5 below.
It. slope	70 .1	71 .0	0°.9 above.
y Mt. slope	76 .1	76 .2	Normal.
	68 .8	68 .8	Normal.
pi valley	71 .0	72 .1	1°.1 above
	62 .7	63 .9	1°.2 above
ion	61 .8	64 .6	2°.8 above.
ion	65 .9	67 .9	2°.0 above.
Tennessee	74 .1	74 .8	0°.7 above.
ey	84 .6	84 .7	Normal.
ates	79 .8	79 .4	Normal.
ates	77 .5	78 .5	1°.0 above.
la	80 .9	81 .3	0°.4 above.
States	76 .6	78 .1	1°.5 above.
States	72 .5	74 .0	1°.5 above.
	64 .3	66 .2	1°.9 above.
lley	63 .2	65 .0	1°.8 above.
ns stations	57 .3	57 .8	0°.5 above.
N. H.	44 .0	44 .9	0°.9 above.
	32 .1	37 .3	5°.2 above.

No. II.



WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE

ISOBARS, ISOTHERMS AND PREVAILING WINDS FOR JUNE, 1880.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER U. S. A.

TEMPERATURE OF WATER FOR JUNE, 1880.

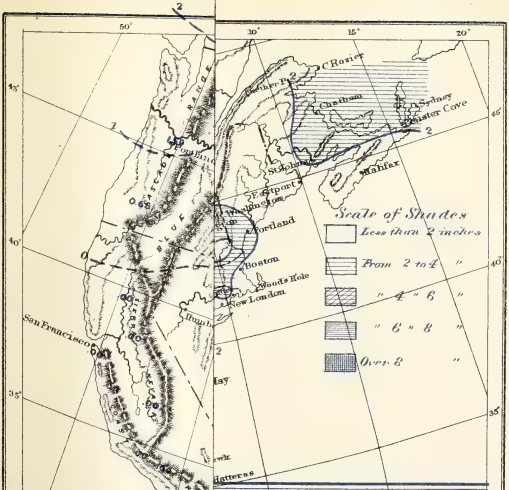
STATIONS.	Temperatures at bottom.		Average depth of water, in feet.
	Max.	Min.	
Alpena	74°	57°	12
Augusta	87	77	6.
Baltimore	76.5	71	11
Buffalo	73	63	10
Burlington, Vt.	72	52	17.
Cedar Keys	88	74	18.3
Charleston	83	78	41.
*Chicago	[illegible]	59	8
Chincoteague	88	66	1.3
Cleveland	76	59.5	14
Detroit	73	62	23.5
*Duluth	71	41	16
Del. Breakwater	74	62	7
Eastport	46	41.5	16
Escanaba	72	52	15
Galveston	85	78.5	14.6
Grand Haven	77	65	15
Jacksonville	87	[illegible]	18
Key West	87	82	18
Marquette	49	44	9.3
Milwaukee	61.5	46	8
Mobile	84	79	16
New London	69	56	13
New York	73	64	22.5
Norfolk	82	74	22
Portland, Maine.	59	[illegible]	26
Punta Rassa	—	—	—
Sandusky	79	65	10
San Francisco	63	54	19.5
*Savannah	—	—	—
Smithville	83	74	10
Toledo	80	66	11.8
Wilmington	86	79	12.5
Wood's Holl	71	60	8

* Observations for only part of month.—See text.

AVERAGE TEMPERATURES FOR JUNE, 1880.

DISTRICTS.	Average for June. Signal Service Observations.		Comparison of June, 1880, with the average for several years.
	For several years.	For 1880.	
North Pacific coast region	61°.9	59°.0	2°.9 below
Middle Pacific coast region	69 .0	67 .0	2°.0 below.
San Diego	64 .7	63 .0	1° 7 below.
Northern Plateau district	70 .6	66 .8	3°.8 below.
Salt Lake City	68 .4	67 .5	0°.9 below.
Southern Plateau district	79 .7	78 .5	1°.2 below.
North Rocky Mt. slope	59 .1	58 .6	0°.5 below.
Middle Rocky Mt. slope	70 .1	71 .0	0°.9 above.
Southeast Rocky Mt. slope	76 .1	76 .2	Normal.
Missouri valley	68 .8	68 .8	Normal.
Upper Mississippi valley	71 .0	72 .1	1°.1 above
Minnesota	62 .7	63 .9	1° 2 above
Upper Lake region	61 .8	64 .6	2° 8 above.
Lower Lake region	65 .9	67 .9	2°.0 above.
Ohio valley and Tennessee	74 .1	74 .8	0°.7 above.
Rio Grande valley	84 .6	84 .7	Normal.
Western Gulf States	79 .8	79 .4	Normal.
Eastern Gulf States	77 .5	78 .5	1°.0 above.
Florida Peninsula	80 .9	81 .3	0°.4 above.
South Atlantic States	76 .6	78 .1	1°.5 above.
Middle Atlantic States	72 .5	74 .0	1°.5 above.
New England	64 .8	[illegible]	1°.9 above
St. Lawrence valley	63 .2	65 .0	1°.8 above.
Canadian Maritime stations	57 .3	[illegible]	0°.5 above.
Mt. Washington, N. H.	44 .0	44 .9	0°.9 above.
Pike's Peak, Col.	[illegible]	[illegible]	0°.9 above.

No. III.



OF RIVERS ABOVE LOW-WATER MARK, JUNE, 1880

ONS.	Danger point on gauge.	HIGHEST WATER. Date.	HIGHEST WATER. Height.	LOWEST WATER. Date.	LOWEST WATER. Height.
VER.	ft. in.	June.	ft. in.	June.	ft. in
....	29 9	20	17 2	1	9 1
SAS.					
....	—	6	3 0	22	†—
RI.					
....	20 0	30	11 10	11	4 4
....	16 0	30	16 2	1	8 10
....	21 0	22	14 5	2, 3	8 7
IPPI.					
....	14 6	17	15 3	3	6 9
....	18 0	19	15 2	3	5 3
....	21 10	23, 24	22 8	4, 5	9 2
....	15 0	26.	18 5	3	17 5
....	14 6	29	18 2	5	8 9
....	30 0	30*	22 2	1	17 1
....	40 0	28, 29	26 10	18	20 0
....	34 0	30	20 3	1	14 8
....	41 0	14, 15	26 6	26	22 6
s........	− 3 6	1	− 5 1	30	− 8 8
....	20 0	16	15 11	12, 13	1 7
....	50 0	20, 21	24 6	13	8 11
....	24 0	21, 22	10 0	8, 9	6 0
LAND.					
....	42 0	3	5 10	26, 27	1 6
SEE.					
....	31 0	4	6 2	28, 29	2 2
HELA.					
....	28 0	15	16 11	12	5 4
....	29 0	16	15 11	12, 13	1 7
AH.					
....	—	3	8 10	25 to 30	5 2
BIA.					
....	—				18 5

AVERAGE PRECI

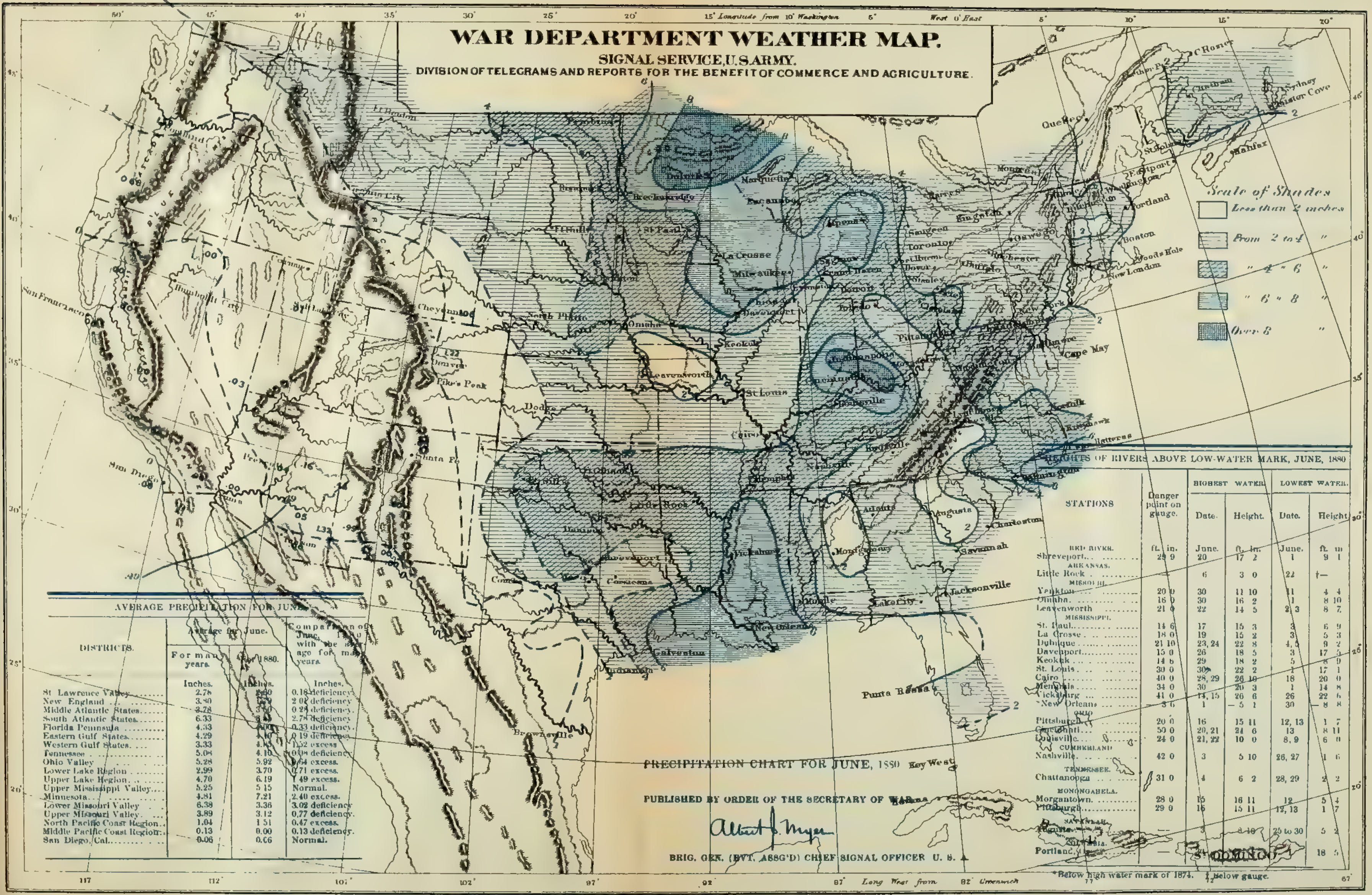
DISTRICTS.	For m yea
	Inch
St. Lawrence Valley........	2.
New England........	3.
Middle Atlantic States......	3.
South Atlantic States......	6.
Florida Peninsula...........	4.
Eastern Gulf States........	4.
Western Gulf States........	3.
Tennessee...................	5.
Ohio Valley.................	5.
Lower Lake Region	2.
Upper Lake Region.........	4.
Upper Mississippi Valley....	5.
Minnesota..................	4.
Lower Missouri Valley......	6.
Upper Missouri Valley......	3.
North Pacific Coast Region..	1.
Middle Pacific Coast Region..	0.
San Diego, Cal..............	0.

gh water mark of 1874. † Below gauge.

117° 72 67°

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.



PRECIPITATION CHART FOR JUNE, 1880

PUBLISHED BY ORDER OF THE SECRETARY OF WAR

Albert J. Myer

BRIG. GEN. (BVT. ASS'G'D) CHIEF SIGNAL OFFICER U. S. A.

AVERAGE PRECIPITATION FOR JUNE.

DISTRICTS.	Average for June.		Comparison of June, 1880, with the average for many years.
	For many years.	For 1880.	
	Inches.	Inches.	Inches.
St Lawrence Valley	2.78	2.60	0.18 deficiency
New England	3.80	[illegible]	2.02 deficiency
Middle Atlantic States	3.78	3.50	0.28 deficiency.
South Atlantic States	6.33	[illegible]	2.78 deficiency
Florida Peninsula	4.33	4.00	0.33 deficiency.
Eastern Gulf States	4.29	4.10	0.19 deficiency.
Western Gulf States	3.33	4.85	1.52 excess
Tennessee	5.08	4.10	0.98 deficiency
Ohio Valley	5.28	5.92	0.64 excess.
Lower Lake Region	2.99	3.70	0.71 excess.
Upper Lake Region	4.70	6.19	1.49 excess.
Upper Mississippi Valley	5.25	5.15	Normal.
Minnesota	4.81	7.21	2.40 excess.
Lower Missouri Valley	6.38	3.36	3.02 deficiency
Upper Missouri Valley	3.89	3.12	0.77 deficiency.
North Pacific Coast Region	1.04	1.51	0.47 excess.
Middle Pacific Coast Region	0.13	0.00	0.13 deficiency.
San Diego, Cal.	0.06	0.06	Normal.

HEIGHTS OF RIVERS ABOVE LOW-WATER MARK, JUNE, 1880

STATIONS	Danger point on gauge.	HIGHEST WATER.		LOWEST WATER.	
		Date.	Height.	Date.	Height.
RED RIVER.	ft. in.	June.	ft. in.	June.	ft. in.
Shreveport	29 9	20	17 2	1	9 1
ARKANSAS.					
Little Rock	—	6	3 0	22	†—
MISSOURI.					
Yankton	20 0	30	11 10	11	4 4
Omaha	16 0	30	16 2	1	8 10
Leavenworth	21 0	22	14 5	2, 3	8 7
MISSISSIPPI.					
St. Paul	14 6	17	15 3	3	6 9
La Crosse	18 0	19	15 2	3	5 3
Dubuque	21 10	23, 24	22 8	4, 5	9 2
Davenport	15 0	26	18 5	3	17 5
Keokuk	14 6	29	18 2	5	8 0
St. Louis	30 0	30	22 2	1	17 1
Cairo	40 0	28, 29	26 10	18	20 0
Memphis	34 0	30	20 3	1	14 8
Vicksburg	41 0	14, 15	26 6	26	22 6
*New Orleans	— 3 6	1	— 5 1	30	— 8 8
OHIO.					
Pittsburgh	20 0	16	15 11	12, 13	1 7
Cincinnati	50 0	20, 21	24 6	13	8 11
Louisville	24 0	21, 22	10 0	8, 9	6 0
CUMBERLAND.					
Nashville	42 0	3	5 10	26, 27	1 6
TENNESSEE.					
Chattanooga	31 0	4	6 2	28, 29	2 2
MONONGAHELA.					
Morgantown	28 0	15	16 11	12	5 4
Pittsburgh	29 0	16	15 11	12, 13	1 7
SAVANNAH.					
Augusta	—	3	8 10	25 to 30	5 2
[illegible]					
Portland	—				18 5

*Below high water mark of 1874. † Below gauge.

ture was above the normal, most notably so over Great Britain and the south of Norway, the mean at Mandal being 4°.2 above the average.

Over New England these Atlantic breezes were southwesterly, but in Scotland easterly. In England the month was one of the rainiest Augusts on record, and in the east of Scotland the rains were also unusually heavy. On the other hand, what invariably happens when the weather in the east of Scotland is characterized by rain and east winds, the weather of the West Highlands was dry and bright.

[Popular Science Monthly and Comptes Rendus.]

Observations made by M. Fautrat, in France, for four years as to the rainfall over forests and over treeless tracts are as follows: That it rains more abundantly over forests than over open ground, especially when the trees are in leaf; that the air above the forest is more saturated with moisture than over the open ground; that the leaves of trees intercept one-third, and in some trees one-half, of the rainfall, and that the leaves and branches restrain the evaporation of the water that reaches the ground, moistening the earth four times as much as it is moistened by the rain that falls on open ground. With respect to the kind of forest, M. Fautrat states that in 1878 the rainfall collected above folious (leafy) trees was 30.5 inches and in the vicinity of the forest on the open ground 29.7 inches. The difference in the favor of the forest is 0.8 inch. During the same time there fell on the top of pines 30.5 inches of water and on the plain at the same altitude 28.6 inches, a difference in favor of pines of 1.9 inches. Forests, and, above all, resinous woods, have the remarkable property of extracting from the rain-bearing currents that cross them a greater volume of rainfall than open grounds.

[La Nature.]

Winter of 1879 *and* 1880, *at Clermont and Puy-de-Dome, France.*—M. Alluard, director of the Observatory at Puy-de-Dome, presents some curious observations upon the comparison of temperatures at Clermont and at the summit of Puy-de-Dome. [The summit of Puy-de-Dome is 3,540 feet above Clermont.] The winter of 1879 and 1880 was the most rigorous known in Auvergne. In the day time a minimum temperature of —9°.4 was once experienced. The mean temperature of the month of December was + 19.°9. While thick fog for days covered Clermont the weather at Puy-de-Dome remained very clear and the mean temperature was 18° higher at Puy-de-Dome than at Clermont. The inversion of temperatures between Clermont and Puy-de-Dome, previously remarked by M. Alluard, have been very frequent. They are shown whenever a zone of high pressure covers Europe, and the differences are greater as the pressures are higher. Thus a comparison of themometers shows when an anti-clyclone is present in France or in Europe. It would be well to know at what height these inversions are first manifested.

Published by order of the Secretary of War.

ALBERT J. MYER,
Brigadier-General, Chief Signal Officer, U. S. A.

PAPER 44.

MONTHLY WEATHER REVIEW, JUNE, 1880.

INTRODUCTION.

In preparing this review the following data, received up to July 13th, have been used, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 139 Signal Service stations and 14 Canadian stations, as telegraphed to this Office; 147 monthly journals and 159 monthly means from the former, and 14 monthly means from the latter; reports from 24 sunset stations; 221 monthly registers from voluntary observers; 41 monthly registers from the United States Army post surgeons; marine records; international simultaneous observations; monthly reports from voluntary observers in, and the local weather service of, Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

The general distribution of the atmospheric pressure, as reduced to sea-level, for the month of June, 1880, over the United States and Canada is shown by isobaric lines on chart No. II. At a few outlying stations the barometric means are given in figures (English inches). The region of greatest pressure (over 30.05 inches) includes the South

Atlantic and East Gulf states, while the least pressures (below 29.80) are found at Pembina, Omaha, and along the eastern slope of the Rocky Mountains from Nebraska to the interior of Texas.

Departures from the normal values for the month.—As compared with the average of the means for the months of June for the past eight years, those for the present month (June, 1880) show a remarkable uniformity. East of a line running along the Mississippi valley from Louisiana to Missouri and thence northeastward to Alpena, Mich., except at Wood's Holl, Portland, and Eastport, on the eastern coast of New England, the departure is slightly above the normal. It amounts to 0.05 inch at Cincinnati, 0.04 at Nashville, and less than the latter amount elsewhere. Along the immediate eastern coast of New England and west of a line drawn as above, the departure is below the normal and amounts to only 0.03 inch at Wood's Holl, Escanaba, Davenport, Santa Fé, Cheyenne, and Pembina, 0.04 at Omaha and Virginia City, and 0.05 at North Platte, Denver, and Salt Lake City.

Barometric ranges.—The local barometric range, as reduced to sea-level, is marked by great irregularity over the United States east of the Rocky Mountains. Along the Gulf coast it is very small, amounting to 0.24 inch at Key West, 0.29 at Punta Rassa and 0.31 at New Orleans. From these stations northward to Iowa, Wisconsin, Michigan, Ohio, Virginia, and North Carolina there occurs a rapid increase in the range, which at Omaha amounts to 1.15 inch; Des Moines, 1.29; Madison, 1.26; Marquette, 1.19; Grand Haven, 1.08; Cleveland, 0.78; Lynchburg, 0.71, and Charlotte, N. C., 0.70. North and westward of the region of greatest range, namely, Iowa and Wisconsin, a rapid decrease occurs, and at Pembina and Cheyenne the ranges are 0.61 and 0.49, respectively. Over Pennsylvania, Maryland, and Delaware, the range is comparatively small (0.60 inch at Washington, D. C.), but thence northeastward it increases to 0.90 at Boston and 0.91 at Eastport, Me.

Areas of high pressure.—Apart from the general and permanent area of high pressure which during June prevails along the South Atlantic coast, but three different areas of high pressure have been sufficiently marked to merit description. Nos. I and II are the usual outflows of cold, dry air southeastward from the Saskatchewan region, while No. III appears to have been an encroachment of the high pressure of the Pacific ocean.

No. I.—This area, central the morning of the 1st in the Lower Missouri valley, moving slowly eastward, covered the Ohio valley and Lower Lake region during the 2d, and the Atlantic states during the 3d. On the morning of the 4th the highest pressure of the area was reported from the Canadian Maritime Provinces; Father Point barometer, 30.31, or 0.45 above the normal. During the 5th and 6th the area gradually withdrew eastward in advance of low area No. II. After the passage of low area No. II the pressure increased in the Canadian Maritime Provinces, and covered those provinces, New England, and Middle Atlantic states, until the 10th, after which it dissipated. Except in the Gulf and a portion of the South Atlantic states, the passage of the area was marked by the minimum temperatures of the month for the entire country east of the Rocky Mountains. Frost was reported from scattering stations in Dakota, Nebraska, and Wisconsin during the 1st; from New York, 2d to 4th, and Pennsylvania, 4th. Cautionary off-shore signals were displayed from afternoon till midnight of the 1st, from Boston southward to Chincoteague, Va., and cautionary signals along the Carolina coast from the 1st to the 3d, and on the Virginia and New Jersey coasts during the 2d. The signals—at a few stations somewhat late—were generally justified. The following maximum wind velocities were reported. Barnegat, N. 35; Chincoteague, NE. 35; Delaware Breakwater, N. 42, and Kittyhawk, NE. 44.

No. II.—From midnight of the 14th until the morning of the 16th the pressure steadily increased in the Northwest, the maximum pressure of the area occurring at the latter date at Duluth—barometer 30.28, or 0.36 above the normal. The centre of the area, with nearly unchanging pressure, remained in the Lake region from the 16th to the 19th, while the pressure in the Atlantic states rose considerably above the normal during that time. The area gradually dissipated during the 20th and 21st. During the continuance of this area the minimum temperatures of the month occurred at most stations in the Gulf and at many in the South Atlantic states. The signals ordered in the Lake region for low area No. VI remained displayed (except on Lake Superior) in connection with this area until midnight on the 15th, when they were lowered, having been fully justified, as shown elsewhere.

No. III.—During the 18th this area appeared on the California coast, and gradually moving northeastward during the 19th covered the entire Pacific slope, and extended eastward into the Plateau districts. During the 20th it slowly dissipated. On the morning of the 20th frost destructive to vegetation was reported at Boise City, Idaho; frost and ice at Winnemucca, Nev., and at Yreka, Cal., crops and fruit were badly injured by heavy frost, while ice formed in places. The highest pressure occurred at Red Bluff, Cal., the afternoon of the 19th; barometer 0.36 above the normal.

Areas of low pressure.—Thirteen areas are described, ten of which have been charted. No area has been charted entirely across the continent. The areas have been generally ill defined and of but little energy. No. II and VI are the only areas which crossed any portion of the country with well defined centers. No. II was a storm of unusual violence and duration for June.

No. I.—This area, a continuation of No. X of the May Review, during the 1st passed from the Saint Lawrence valley eastward over the Atlantic ocean.

No. II.—During the 2d and the morning of the 3d the pressure gradually decreased on the North Rocky Mountain slope; on the afternoon of the latter day the barometer at Fort Keogh was 0.27 below the normal. Moving southeastward, the area was central the afternoon of the 4th in the Lower Missouri valley; Omaha barometer 29.25, or 0.50 below the normal. During the preceding eight hours an abnormal barometric fall of over 0.10 inch occurred over the greater part of the Lower Missouri and Upper Mississippi valleys, while exceedingly heavy rains fell in Minnesota. During the day violent local storms occurred as follows: at Saint Louis one person was killed, several buildings blown down, and much damage to property done, both in the city and south of it; the wind attained a velocity of S. 52 miles at 11 a. m. in Saint Louis. At and near Milwaukee the wind attained a velocity of SW. 60 miles at 2.30 a. m. Three vessels were dismasted a short distance outside the harbor and several others damaged in canvas and spars. From that afternoon until the afternoon of the 5th the center remained stationary in the Lower Missouri valley, with steadily decreasing pressure; Omaha barometer at latter date 29.05, or 0.71 below the normal. During the preceding twenty-four hours, brisk southerly winds, high temperatures, and heavy rainfalls prevailed in the Upper Mississippi valley, while to the westward and northward of the Lower Missouri valley, high northerly winds, low temperatures, and heavy rainfalls were reported. At Omaha, at 6 p. m. of the 5th, the barometer touched 28.85—its lowest point—and half an hour later the wind veered suddenly from SW. to NW., and reached a velocity of 60 miles. At midnight of the 5th the storm was central in eastern Missouri; Des Moines barometer 28.97. Moving northeastwardly, on the afternoon of the 6th the central area was in northern Michigan; Escanaba barometer 29.09, or 0.76 below the normal. During the night of the 5th and 6th the storm was unusually severe over Lake Erie and the entire Upper Lake region. Moving from Michigan in a northeasterly course, parallel to the Saint Lawrence valley, the central area passed into the Province of Quebec during the 7th. In connection with the passage of this area occurred exceedingly heavy rainfalls from the 3d to the 6th in Wisconsin and northern Michigan, which greatly damaged crops, flooded the country generally, and swept away over 50,000,000 feet of lumber in Wisconsin. Cautionary signals were ordered for the entire Upper Lake region at noon of the 4th, for Lake Erie the morning of the 5th, and for Lake Ontario the afternoon of the 5th; they were lowered on Lakes Superior and Michigan on the morning of the 6th and later in the day in the rest of the Lake region. These signals were fully justified by unusually high winds from the 4th to the 7th. The following maximum velocities were reported: Duluth, NW. 31; Rochester, W. 32; Alpena, SE. 33; Chicago, W. 36; Grand Haven, SE. 40; Toledo, SW. 42; and Milwaukee, W. 48. During the 5th and 6th cautionary signals were displayed along the Atlantic coast from Sandy Hook southward to Cape Lookout. These signals were all justified by maximum velocities ranging from SE. 30 at Sandy Hook, and SW. 30 at Cape Lookout, to SE. 39 at Delaware Breakwater.

No. III.—The center of this area was apparently on the coast of British Columbia on the morning of the 7th, at which time the barometer at Olympia was 29.74, or 0.34 below the normal. The advance of this area produced general rains in the North Pacific coast region during the 6th and 7th. Following a course a little S. of E., its center on the afternoon of the 8th was in Dakota; Fort Buford barometer 0.47 below the normal. Changing its course northeastward, by the morning of the 9th it had passed into Manitoba.

No. IV.—This area appears to have sprung up from the remains of area No. III. As the central part of that area passed northeastward into Manitoba during the night of the 8th, a considerable area of depression existed in the Middle Rocky Mountain region, where it remained nearly unchanged until midnight of the 10th, when a sharp barometric fall occurred in Colorado; Denver barometer 0.35 below the normal. During the 11th it passed northeastward, and by midnight was in the valley of the Red River of the North. Thence moving in an easterly course across the Lake region, it merged during the 13th with the remains of low area No. V, and formed an extensive area of low pressure which covered the Atlantic slope from North Carolina to Nova Scotia, the pressure along the immediate coast from New England northward being 0.50 below the normal. During the 14th the area moved eastward over the Atlantic ocean. No signals were displayed in connection with the passage of this area. During the 12th and 13th frequent cases of high winds were reported from the Lake region and the Atlantic coast from North Carolina northward.

No. V.—In the afternoon of the 11th a sharp barometric fall was reported from New England and the Saint Lawrence valley, at which time the area was apparently central in the Province of Ontario. On the morning of the 12th the area was central in

New Brunswick; Eastport barometer 0.34 below the normal. During the 12th the pressure steadily decreased in New England and the Canadian Maritime Provinces; Sydney barometer, the morning of the 13th, 0.50 below the normal. The subsequent description of this area is given as that of No. IV, with which it united on the 13th. No signals were displayed and no dangerous winds reported in connection with this area.

No. VI.—During the 13th the pressure decreased slowly in the Lower Missouri valley, forming a decided depression by the morning of the 14th, when the Leavenworth barometer stood at 29.50, or 0.35 below the normal. Moving directly eastward, the center was in the Mississippi valley that afternoon—Saint Louis barometer 0.37 below the normal—and by midnight reached southwestern Ohio. During the 13th and 14th, in connection with this area and advancing high area No. II, heavy rainfalls occurred in the greater part of the Upper Mississippi and Ohio valleys, causing numerous local floods and doing great damage to crops. Central the morning of the 15th in West Virginia, it moved thence southeastward, and during that night passed off the North Carolina coast over the Atlantic ocean. During the afternoon of the 13th cautionary signals were ordered for the Upper Lake region, and during the 14th for Lake Erie. The following maximum wind velocities were reported: Detroit, SW. 28; Toledo and Chicago, NE. 32; Milwaukee, NE. 34; Sandusky, NE. 37. On the morning of the 14th cautionary signals were displayed along the Atlantic coast from Cape Lookout northward to Sandy Hook. They were all justified by maximum wind velocities ranging from E. 25 at Atlantic City and NW. 28 at Cape May to NE. 35 at Delaware Breakwater, NE. 40 at Cape Lookout, and NE. 44 at Kittyhawk.

No. VII.—During the 20th the pressure fell steadily over the Saint Lawrence valley, where this area was central at midnight of the 20th. Moving slowly southeastward through Maine during the 21st, it passed off the Nova Scotia coast the afternoon of the 22d, at which time the Halifax barometer stood at 29.52, or 0.38 below the normal. During the 21st and 22d northwesterly winds, ranging from 26 to 40 miles, were reported from various stations on the New England and New Jersey coasts. No signals were displayed during the passage of this area.

No. VIII.—From midnight of the 21st until the morning of the 24th an ill-defined area of low pressure prevailed over Louisiana and southern Texas, disappearing on the latter date. Its center was probably in the western part of the Gulf of Mexico. The only high wind—probably local—reported was E. 29 at New Orleans the afternoon of the 22d. No signals were necessary, and none were ordered during the passage of this area.

No. IX.—This area gradually developed in northern Minnesota or Manitoba during the 22d. Moving in an easterly course, it passed over Lake Superior during the 23d and was central the morning of the 24th in Ontario, whence, by a southeasterly path, it passed off the Maine coast at midnight of the latter date. No signals were displayed during its passage. The area was one of but little energy; high winds (from 25 to 27 miles) occurred only at three widely separated stations in the Lake region.

No. X.—During the 23d the pressure steadily decreased on the North Pacific coast. On the morning of the 24th the barometer at Portland, Oreg., was 0.23 below the normal. The pressure remained slightly below the normal until the 30th. During the prevalence of this area no rain fell on the Pacific coast.

No. XI.—Apparently central at midnight of the 23d in Manitoba, the center of this area moved southeastward and remained over the Lake Superior region during the 24th. Central the morning of the 25th in northern Michigan, it reached the valley of the Saint Lawrence by midnight, and passing down that valley it disappeared over the Gulf of Saint Lawrence on the 26th. No signals were displayed during the passage of this area. But four cases of brisk winds, at widely separated stations, were reported during its passage.

No. XII.—This area, central in Manitoba the morning of the 26th, reached eastern Minnesota at midnight. Moving slowly in an easterly course, it was central over the Upper Lake region until the 28th, on the afternoon of which day it reached the Province of Ontario, and thence passed down the valley of the Saint Lawrence. Brisk SW. winds, ranging from 25 to 30 miles, were generally reported from the Lower Lake region on the 28th. On the Atlantic coast cautionary signals were ordered on the afternoon of the 28th from Portland, Me., to Chincoteague, Va. The signals were lowered the next morning, having been justified by velocities ranging from SW. 26 at Barnegat to N. 29 at Cape May and SW. 31 at Thatcher's Island.

No. XIII.—From midnight of the 29th the pressure fell from Kansas to Texas until midnight of the 30th, at which time the barometer at Dodge City was 0.19 below the normal.

INTERNATIONAL METEOROLOGY.

The international charts, Nos. IV, V, and VI, accompany the present Review. They are for the months of May, 1880, and October, 1878.

On chart No. IV will be found the probable course of the principal low pressure areas over the north Atlantic ocean during the month of May, 1880. As during the preceding month (April, 1880), the weather over the north Atlantic has continued remarkably fine and free from severe or protracted storms. The month opened with a belt of high pressures, extending over Europe from the Black Sea to the British Isles and France, and thence over the Atlantic to Newfoundland and the Bermudas. On the 1st, over the western portion of the Atlantic, barometric readings above 30.40 inches, or 772.1^{mm}, were reported over a region extending from 50° N. 25° W. to 35° N. 53° W. Ship Hippolyta, in 42° N. 45° W., on the southeast margin of this ridge of high pressures, reported during the night of April 30th and May 1st, a very heavy N. to E. gale, with high, sweeping sea. From 2 to 3 a. m. the gale was furious, force 11, but moderated towards daybreak. From the 1st to the 11th this area of maximum pressures appears to have moved northeastward with more or less regularity, and on the latter date to have covered northwestern Europe and the Atlantic for some distance to the westward, over which latter region high pressures continued until the 17th, and caused the continued northeasterly winds which prevailed during this period (10th to 17th) over the eastern Atlantic near the parallel of 50° N. The first protracted storm of the month followed the track shown on the present chart as area No. I, and was fully described as low area No. I in the May Review. On the 7th it passed eastward over Newfoundland, and on the 8th was encountered by S. S. Nederland in 43° N. 42° W., barometer 29.86, or 758.4, temperature 62° Fahr., wind SSW., force 4, high SSW. sea. On the 9th it was followed over this region by a return to high pressure and a rapid fall in temperature; the Nederland, in 41° N. 47° W., reported barometer 30.19, or 766.8, temperature 46° Fahr., NNW. 2. It is probable that this low area remained during the 9th and 10th near 50° N. 40° W., and is the same as that to be described as area No. IV; but reports at present to hand do not warrant the joining of the two tracks. The second storm (No. II, chart IV) apparently developed off the coast of Portugal on the 4th, and subsequently moved eastward over the Mediterranean. On the 8th a small depression (No. III, chart IV) was central to the southwest of Ireland, which subsequently moved southeastward over the Bay of Biscay and southern France. Ship Hippolyta reported "on the 8th, in 49° N. 15° W., 8 p. m., strong NE. gale, force 11, and high cross seas; midnight (8th–9th), gale moderating." No. IV appeared over mid-ocean on the 11th. On the 12th and 13th, U. S. S. Saratoga, near the Azores, recorded the following very low pressures for this region: 12th, 39° N. 24° W., 29.43, or 747.5 calm, heavy rain squalls; 13th, 39° N. 20° W., 29.49 or 749.0 WSW., force 7, fair. On the 14th the easterly winds on the northern margin of this area increased in force, and S. S. Indiana, in 51° N. 15° W., recorded ESE. 8, barometer 29.89 or 759.2. On the 16th the barometer at the Madeiras (Funchal) read 29.61 or 752.0, and from the 17th to the 21st this area appeared to spread eastward over the Mediterranean to the Black Sea region. No. V is a continuation of low area No. IV, already described in the May Review. On the 14th S. S. Scythia, in 41° N. 59° W., reported barometer 29.67 or 753.6, wind NNW. 4, light rain; and on the 16th, in 44° N. 45° W., 29.35 or 745.4, WSW. 9, heavy rain, heavy swell from WSW. High winds, occasionally described as of hurricane force, were experienced over the western portion of the Atlantic during the 15th and 16th, but by the 17th only moderate gales. During the 18th and 19th there was a gradual return to high pressures, and very low temperatures were recorded. Thus, on board the S. S. Hibernian the thermometer fell from 40° F. on the 17th, in 49° N. 39° W., to 30° F. on the 19th, in 47° N. 51° W., and on board the S. S. Celtic from 54° F. on the 16th, in 46° N. 40° W., to 33° F. on the 18th, in 42° N. 52° W. During the 17th the area of high pressures over northwestern Europe and adjacent portions of the Atlantic ocean commenced to move in rear of low area No. IV. Until the 23d this movement was southerly over the eastern Atlantic ocean towards the Spanish Peninsula, after which high pressures spread eastward over southern Europe. Low areas Nos. VI and VII moved eastward to the north of the British Isles on the 23d and 26th, respectively, the former being followed by westerly gales to the west of Ireland. Steamship Britannic, on the 23d, 51° N. 23 W., reported barometer 29.85 or 758.1, wind W., force 7, rain, heavy WNW. swell. From the 26th to the 29th low pressures also prevailed in the region of Newfoundland, but, as far as present reports show, were not accompanied by high winds.

The following account of a severe storm off Buenos Ayres is reported by U. S. S. Marion: "February 14th, 1880, 35° 56′ S. 53° 28′ W., 4 p. m., barometer 29.77 falling, NE. moderate breeze, threatening. 15th, 36° 23′ S. 54° 08′ W., wind increasing in heavy rain-squalls, force 3 to 6 from NE. until 3 a. m., barometer 29.54, when the wind hauled to N. and W.; noon, barometer 29.35, wind NW., 6 to 7; 2 p. m., barometer 29.26, lowest reading, wind W. by N., 5 to 8; 4 p. m., barometer 29.32, wind SW. by S., 7 to 9; hove to in 37° S. 54° 16′ W.; 4 to 8 p. m., wind SW. by S., force 7 to 10; 8 p. m., barometer 29.41, wind SW., force 10 to 11; ship laboring in heavy, rough, confused sea; 9 p. m to 2 a. m., of 16th, barometer rising from 29.40 to 29.62, wind WSW., 8 to 10. 16th, 2 a. m. to 1 p. m., wind SW. by W., subsiding in squalls; 1 p. m., barometer 29.91, wind SW., force 6, clear sky and rough sea."

Chart No. V shows, by isobaric and isothermal lines, the mean pressure and temperature, and, by small arrows, the prevailing direction of the wind, at 7.35 a. m., Washington mean time over the Northern and portions of the Southern Hemispheres, for the month of October, 1878. The barometer observations have been corrected for temperature and reduced to sea-level. At stations lying outside the area included within the lines, and for those in the Southern Hemisphere, the means are shown by figures indicating the temperature in degrees, Fahrenheit, and the pressure in English inches. Upon comparing the distribution of atmospheric pressure for the month (October, 1878), at present under consideration, with that for the preceding month (September, 1878), the most marked changes are found to be a continued and large increase in pressure over the whole of Asia, including Japan and the eastern and extreme southern portions of Europe, and a remarkable decrease over western Europe, eastern half of North America (except near the Gulf of Mexico), and over almost the whole of the north Atlantic. A decided increase, however, is found over Sweden and Norway (except extreme southern portions), Iceland, and southern Greenland—the region of maximum decrease during September. The increase of pressure over the various regions referred to above, amounts to 0.15 inch at Godthaab, 0.17 at Stykkisholm, about 0.10 in northern portions of Norway and Sweden, northern and western Russia, and from the Black Sea to Tunis, while over southeastern Russia and thence eastward to Japan it is about 0.25. It amounts to 0.32 at Barnaul, 0.28 at Zi-Ka-Wei, 0.26 at Nagasaki, and 0.20 at Tokio. In Hindostan it ranges from 0.08 at Belgaum and Chittagong, to 0.11 at Sibsigar, and 0.18 at Lahore, and at Nikolaievsk on the Amoor the increase amounts to 0.05. The decrease over the Atlantic and neighboring land areas amounts to about 0.12 for the region of the great American lakes to Newfoundland, gradually increasing thence eastward until it reaches 0.30 over the eastern Atlantic from 45° to 55° N. and 10° to 20° W.; over the British Isles it is 0.31 at Valentia, 0.19 at Great Yarmouth, and 0.18 at Sandwich; thence northward, eastward, and southward it gradually, but rapidly, falls to 0.11 at Thorshavn and 0.06 at Copenhagen and Madrid. The most important change in the distribution of pressure is thus seen to be a large decrease (0.30 inch) over the northeastern Atlantic ocean (*i. e.* to the west of France and Ireland), and a corresponding increase over central Asia. The general direction of the winds during October, 1878, at 7.35 a. m., Washington mean time, may be summarized as follows: From the Rocky Mountains to Hudson's Bay, along the immediate north American coast, from Chesapeake Bay to Cape Cod, and over the center of the Atlantic, northwesterly; from Texas and the interior of the Gulf States to the lakes and Saint Lawrence valley, and from the Azores and Madeiras to the Faroë Islands and thence over nearly the whole of Europe and northern Asia, southwesterly; in Iceland, southern Greenland, Newfoundland and thence to the West Indies and Florida, northeasterly. In Hindostan calms predominated, except the continued westerly monsoon on the Bombay coast (rainfall at Bomba 4.92 and Belgaum 6.64 inches), and over the Gulf of Bengal. Along the Japan and China coasts the northeast monsoon was fully established, the direction being northerly at Tokio, northeast at Shanghai, and east at Hong-Kong. Over the regions of southerly winds the mean temperature of the month was generally above the normal; thus, in the Saint Lawrence valley, the temperature was 5° above the mean; in Ireland and southern England 3° to 3°.5 above; and in Germany, at Freiburg, and in eastern Russia, at Penza, nearly 6° above.

On chart No. VI are traced the paths of twenty-eight of the principal storm areas which traversed the Northern Hemisphere during the month of October, 1878. Nine of them, namely Nos. II, IV, VII, VIII, XI, XII, XV, XVIII, and XXVI, originated to the south of the thirtieth parallel, while the rest probably developed over the temperate zone and moved in a general easterly course. The most violent storms of the month, in connection with these areas, may be briefly summarized as follows: As area No. I moved slowly eastward, from the 1st to the 7th, it was attended by hurricane winds over the Atlantic, between the parallels of 40° and 50° N. No. II, the continuation of No. XXI of the September, 1878, chart, moved from the region of the Bahamas on the 1st, northeastward between the Bermudas and Newfoundland, to the British Isles by the 10th, as a severe tropical cyclone; during the 8th, however, the region of low pressure increased in area and the attending winds became somewhat less violent. No. III caused the following high velocities in the Behring's Sea region: Saint Michael's, 6th, E. 52 miles; Saint Paul's Island, W. 45, and Unalaska Island, terrific SW. gale. No. IV, a typhoon moving westward from the Philippine Islands to Hainan. U. S. Flagship Monocacy, stationed at Hong-Kong, reported in connection with this storm as follows: "On the 8th a very heavy gale was experienced in the vicinity of Hong-Kong, evidently due to a moderate typhoon, the center of which was passing in a southwesterly direction along the coast of China, leaving Hong-Kong on its right; incoming vessels reported very heavy gales south of Formosa on the 7th and off Hainan on the 9th; numerous vessels dismasted and several wrecked." Much damage resulted at Hong-Kong, Canton, and Macao. No. V was attended by a destructive tornado in Iowa and by damaging winds in the Lake region and Saint Lawrence valley during the 8th and 9th, and by heavy gales over the Atlantic, between 40° and 60° N., from the 10th to 13th. No. VII moved rapidly from the

Gulf of Mexico on the 10th, and was accompanied by hurricane winds from the 11th to the 14th between the American coast and the Bermudas; at Cape Lookout the anemometer measured a velocity of 72 miles per hour, from the NE., on the 11th, and on the evening of the 12th a severe thunderstorm passed over the Bermudas, during which 2.62 inches of rain fell in two hours. Off the New England and Nova Scotia coasts the storm was exceedingly severe, and numerous disasters to shipping resulted. Nos. XI and XII, hurricanes over the Atlantic. No. XVIII, in its passage from Cuba to New England, is one of the severest storms on record; at Havana the wind increased to 35 miles, with violent gusts; at Key West to 46 miles; at Cape Lookout to 100 miles; at Philadelphia and Barnegat to 72 miles; on summit of Mount Washington to 120 miles, and at Portland, Me. (anemometer cup blown away), estimated, 70 miles. An immense amount of damage to property resulted from this storm. No. XXI, with its subsidiary centers of depression, was attended by severe winds over northwestern Europe from the 22d to the 30th. No. XXV was attended by very severe winds over Behring's Sea: Saint Paul's Island, W. 60 miles, and Saint Michael's, E. 37. No. XXVI was attended by very low pressures over an extensive area, reaching from Japan to Behring's Sea, during which the barometer fell to 29.62 at Tokio and 29.08 at Nikolaeivsk on the Amoor on October 29th to 28.93 at Saint Paul's Island on the 31st, and to 29.08 at Saint Michael's on November 2.

TEMPERATURE OF THE AIR.

The mean temperatures for June, 1880, are shown by isotherms on chart No. II. The table of average temperatures on that chart shows that east of the Rocky Mountains an excess of temperature generally prevailed, while to the westward deficiencies occurred. The greatest excess prevailed in the Upper Lake region (2°.8 above the normal) and thence eastward to the Atlantic ocean. Deficiencies were reported from the entire Pacific slope and the Plateau districts, reaching 2°.9 in the Northern Pacific coast region, and 3°.8 in the Northern Plateau district.

Maximum and minimum temperatures.—Upon charting the maximum temperatures for June, 1880, great irregularities appear. In general they range from 85° to 95°. Temperatures at or above 100° have been reported from nearly every station in Arizona and the Rio Grande valley. Unusually high temperatures were reported as follows: 100° at Jacksonville, Charleston, S. C., Savannah, Wilmington, Fort Elliott, Tex., and Fort Keogh, Mont.; 101° at Norfolk; 102° at Dodge City; 103° at Umatilla—the only station on the Pacific slope exceeding 99°. The highest temperature reported was 117° at Phœnix, Ariz. The following stations reported maxima under 85°: Escanaba, 84°; Wood's Holl and Los Angeles, 83°; San Francisco, 82°; Milwaukee 81°; Buffalo, 80°; Eastport, 79°, and San Diego, 73°; Mount Washington, 63°; Pike's Peak, 58°. Minimum temperatures above 70° were reported from Key West (73°) and the lower Rio Grande valley. The following stations report temperatures under 37°: Apache, Ariz., and Olympia, 36°; Pembina, 35°; Pioche, 34°; Santa Fé and Deadwood, 33°; Prescott, Ariz., 32°; Campo, Cal., and Helena, Mont., 31°; Virginia City, Mont., 30°; Winnemucca, 29°; Mount Washington, 28°, and Pike's Peak, 8°. The following list shows the maximum and minimum temperatures in each state and territory:

Maximum temperatures.—*Maine:* 96° at *Cornish, 90° at Portland, and 79° at Eastport. *New Hampshire:* 98° at *Dunbarton and *Grafton, and 63° on the summit of Mount Washington. *Vermont:* 95° at *Charlotte, 93° at *Windsor, and 89° at Burlington. *Massachusetts:* 99° at *Westborough, 94° at Springfield, and 93° at Boston. *Rhode Island:* 89° at *Fort Adams, and 86° at Newport. *Connecticut:* 95° at *Mystic, and 92° at New Haven. *New York:* 98° at *Schroon Lake, 85° at *Ardenia, 92° at New York City, and 91° at Albany. *New Jersey:* 100° at *Atco, 99° at *Linden, and 93° at Sandy Hook, Barnegat, and Atlantic City. *Pennsylvania:* 97° at *Milton and Pittsburgh, 95° at *Wellsboro, and 94° at *Chambersburg and Philadelphia. *Delaware:* 92° at *Dover. *Maryland:* 95° at Baltimore. *District of Columbia:* 96°.5 at Washington. *Virginia:* 101° at Norfolk. *West Virginia:* 89° at Morgantown and Helvetia. *North Carolina:* 103° at *Weldon and 100° at Wilmington. *South Carolina:* 100° at Charleston. *Georgia:* 100° at Savannah. *Florida:* 104° at *Houston and 100° at Jacksonville. *Alabama:* 98° at Montgomery. *Mississippi:* 94° at Vicksburg. *Louisiana:* 94° at *Point Pleasant and 93° at Shreveport. *Texas:* 108° at Eagle Pass, 106° at Stockton, and 100° at Fort Elliott. *Ohio:* 95° at *Bellefontaine and 93° at Cincinnati. *Kentucky:* 94° at Louisville. *Tennessee:* 96° at Knoxville, Nashville, and Memphis. *Arkansas:* 92° at Little Rock. *Michigan:* 94° at Marquette, 91° at Detroit. *Indiana:* 98° at *Laconia and 91° at Indianapolis. *Illinois:* 97° at Peoria and 93° at Cairo. *Missouri:* 95° at *Pierce City and 93° at Saint Louis. *Kansas:* 102° at Dodge City and 90° at Leavenworth. *Wisconsin:* 94° at *Edgerton and 90° at La Crosse. *Iowa:* 96° at *Glenwood and 93° at Dubuque and Des Moines. *Nebraska:* 100° at *Genoa and 97° at Omaha. *Indian Territory:* 94° at Fort Sill. *Minnesota:* 88° at Saint Paul. *Dakota:* 95° at Deadwood and Fort Buford. *Colorado:* 106° at *Fort Lewis, 96° at Denver. *New Mexico:* 104° at La Mesilla. *Wyoming:* 100° at *Fort Fetterman and

97° at Cheyenne. *Utah:* 93° at Salt Lake City. *Nevada:* 94° at Winnemucca. *Arizona:* 117° at Phœnix, 114° at Florence, and 110° at Tucson, Yuma, and Burkes. *Idaho:* 91° at Boise City. *Montana:* 100° at Fort Keogh. *California:* 99° at Visalia and Red Bluff, and 73° at San Diego. *Oregon:* 103° at Umatilla. *Washington Territory:* 90° at Olympia.

Minimum temperatures.—Maine: 41° at *Orono and 43° at Eastport. *New Hampshire:* 28° on the summit of Mount Washington, 38° at *Dunbarton and *Grafton. *Vermont:* 40° at *Lunenburg and 41° at Burlington. *Massachusetts:* 42° at *South Lee and 48° at Boston. *Rhode Island:* 49° at Newport. *Connecticut:* 46° at *Mystic and 47° at New Haven. *New York:* 38° at *Schroon Lake and 42° at Buffalo. *New Jersey:* 46° at *Dodge Mine. *Pennsylvania:* 37° at *Dyberry and 49 at Pittsburg. *Delaware:* 56° at *Dover. *Maryland:* 45° at *Woodstock, 52° at Baltimore. *District of Columbia:* 49° at Washington. *Virginia:* 42° at *Mount Solon and *Wytheville and 49° at Lynchburg. *West Virginia:* 38° at *Helvetia and 46° at Morgantown. *North Carolina:* 48° at *Franklin and 52° at Charlotte. *South Carolina:* 62° at Charleston. *Georgia:* 58° at Atlanta. *Florida:* 65° at Cedar Keys. *Alabama:* 68° at Mobile, Montgomery, and *Green Springs. *Mississippi:* 63° at Vicksburg. *Louisiana:* 63° at Shreveport. *Texas:* 44° at Fort Elliott, 53° at Stockton and 72° at Laredo. *Ohio:* 44° at *Westerville and 46° at Cleveland. *Kentucky:* 52° at Louisville. *Tennessee:* 52° at Knoxville. *Arkansas:* 50° at *Mount Ida and 60° at Little Rock. *Michigan:* 37° at Marquette and 46° at *Lansing. *Indiana:* 50° at *New Harmony and *Laconia and 54° at Indianapolis. *Illinois:* 43° at *Marengo and 52° at Chicago. *Missouri:* 44° *Pierce City and 57° at Saint Louis. *Kansas:* 45° at *Wellington and 57° at Dodge City. *Wisconsin:* 36° at *Ashland, 48° at La Crosse. *Iowa:* 42° at *Nora Springs, 50° at Dubuque. *Nebraska:* 42° at North Platte. *Indian Territory:* 55° at Fort Sill and Fort Gibson. *Minnesota:* 37° at Breckinridge. *Dakota:* 33° at Deadwood, 39° at Fort Buford. *Colorado:* 8° on summit of Pike's Peak, 19° at *Summit, and 24° at *Fort Garland. *New Mexico:* 33° at Santa Fé. *Wyoming:* 30° at *Fort Fetterman and 37° at Cheyenne. *Utah:* 40° at Salt Lake City. *Nevada:* 29° at Winnemucca. *Arizona:* 32° at Prescott. *Idaho:* 40° at Boise City. *Montana:* 38° at Fort Keogh. *California:* 31° at Campo, and 47° at Red Bluff and Visalia. *Oregon:* 37° at Roseburg. *Washington Territory:* 36° at Olympia.

Ranges of temperatures at Signal Service stations.—The monthly ranges will appear from the maxima and minima just given. The greatest daily ranges vary in New England from 17° on the summit of Mount Washington to 30° at Springfield and Boston and 33° at Burlington; Middle Atlantic states, 20° at Cape May to 26° at Albany and 31° at Norfolk; South Atlantic states, 14° at Cape Lookout to 21° at Jacksonville and 28° at Wilmington and Smithville; East Gulf states, 16° at Key West to 24° at Mobile and Montgomery and 26° at Pansacola; West Gulf states, 15° at Galveston to 26° at Little Rock and 29° at Corsicana; Ohio valley and Tennessee, 21° at Cairo to 28° at Pittsburg and 29° at Nashville and Knoxville; Lower Lake region, 21° at Sandusky to 29° at Rochester; Upper Lake region, 21° at Chicago to 28° at Marquette and Alpena; Upper Mississippi valley, 21° at Davenport to 25° at Saint Louis and 30° at Saint Paul; Red River of the North valley, 31° at Pembina to 36° at Breckinridge; Missouri valley, 25° at Leavenworth to 32° at Omaha and Bismarck and 33° at Yankton; Texas, 27° at San Antonio and Denison to 42° at Fort Elliott; Rocky Mountain slope, 29° at Fort Sill to 38° at Deadwood and 40° at North Platte; Rocky Mountains, 29° at summit of Pike's Peak to 40° at Sante Fé and 45° at Cheyenne; Middle Plateau District, 36° at Salt Lake City to 39° at Boise City and 51° at Winnemucca; California, 22° at San Francisco to 37° at Red Bluff and 40° at Visalia.

Frost.—Wisconsin—Embarrass, 1st. *Dakota*—Pembina, 1st. *Nebraska*—Austin, 1st, injuring vegetation slightly; North Platte, 28th, "light hoar frost." *Pennsylvania*—Dyberry, 4th. *California*—Fort Bidwell and Salinas City, 18th; Yreka, 19th, "seriously damaging fruit and growing crops;" Campo, 23d, 24th, heavy, 25th. *Colorado*—Pike's Peak, 22d, 25th. *New York*—Waterburg, 2d, 3d, 4th; Palermo, 2d, 3d; North Volney, 2d, 4th; Niles, 2d. *Washington Territory*—Olympia, 15th. *Vermont*—Woodstock, 3d, slight. *Utah*—Coalville, 11th, hoar.

Ice.—Winnemucca, Nev., 5th, 10th, 20th. Yreka, Cal., 19th, "in some localities."

PRECIPITATION.

The general distribution of the rainfall, for June, 1880, is shown on chart No. III, as accurately as possible from about 500 reports. In a table on this chart will be found the average precipitation for June, as compared with that of the present month. The rain has been unusually local in its character. The greatest deficiency (Lower Missouri valley, 3.02 inches) occurred adjacent to the greatest excess (2.40 inches), in

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* Those marked with a star (*) are reported by U. S. Army post surgeons or voluntary observers.

Minnesota. The other great departures from the normal reported, are: New England, 2.01 inches deficient; South Atlantic states, 2.78 deficient; Upper Lake region, 1.49 excess, and Western Gulf states, 1.51 excess. For the fifth successive month marked deficiencies have been reported from the greater part of the Atlantic slope. Since January 1, 1880, the rainfall has been deficient on that slope as follows: New England, 3.44 inches; Middle Atlantic states, 4.93 inches, and South Atlantic states, 5.72 inches. In connection with this deficiency serious droughts are reported in New Jersey, portions of New York and Pennsylvania, and of less severity from the interior of New England. Exceedingly heavy rains in the Upper Mississippi and the Ohio valleys, at various times during the month caused extensive freshets, which are elsewhere noted in detail.

Special heavy rains.—1st, Denison, Tex., 3 36 inches. 3d, Cedar Keys, Fla., 2.98; Rock Island, Ill., 3.74. 4th, Independence, Ia., 3.00; Manhattan, Kans., 2.28; Breckinridge, Minn., 2.77; Dubuque, Ia., 2.95; Davenport, Ia., 3.50; Lawrence, Kans., 1.80, 2 hours and 45 minutes; Le Claire, Ia., 2.94. 4th and 5th, Duluth, Minn., 3.02. 5th, Monticello, Ia., 2.75; Northport, Mich., 5th to 7th, 6.70, 5.20 in one day; Alpena, Mich., 5th and 6th, 2.83. 6th, Marquette, Mich., 2.45. 9th, Oregon, Mo., 2.07; 9th and 10th, Embarrass, Wis., 4.30. 11th, Baltimore, 2.66; Duluth, Minn., 2.80; Norfolk, 11th and 12th, 3. 30. 13th, Rockford, Ill., 2.89; Vevay, Ind., 1.85 in one hour; Fort Hartsuff, Nebr., 3.97; 13th and 14th, Lansing, Mich., 3.96; Ponca, Nebr., 4.75; Helvetia, W. Va., 3.08. 14th, Cumberland, Md., 3.60; Madison, Wis., 3.47; Cincinnati, 2.62; Bethel, Ohio, 3.85; near Cincinnati, 4.00, 1 inch fell in 30 minutes and 3 inches in 3 hours. 15th, Cape Hatteras, N. C., 2.95; New Geneva, Pa., 3.08; Confluence, Pa., 2.20. 21st, Silver City, N. Mex., 0.93; Fall River, Mass., 0.67 in 15 minutes. 23d and 24th, Thomasville, Ga., 2.55; 23d, Galveston, 2.55 in 4 hours and 15 minutes; 23d and 24th, Fort Wallace, Kans., 5.37. 24th, Galveston, 2.56 in 8 hours; Helena, Ark., 2.00. 25th, Detroit, Mich., 1.56 in 8 hours. 26th, Stockton, Tex., 1.09 in 22 minutes. 27th, Corning, Mo., 1.45 in 10 minutes; Lynchburg, 1.00 in 20 minutes. 28th, Anna, Ill., 2. 50; Denison, Tex., 3.60; Melissa, Tex., 2.00 in 6 hours. 29th, Fort Elliot, Tex., 2.40; Wellsburg, W. Va., 2.37 in 21 hours; Evansville, Ind., 2.50. 30th, Yates Centre, Kans., 1.00 in 1 hour; Cape Lookout, N. C., 4.04; Creswell, Kan., 3.50 in 1½ hour; Ashwood, Tenn., 1.30 in 90 minutes.

Largest monthly rainfalls.—Mount Auburn, Ohio, 13.47 inches; Embarrass, Wis,, 11.40; Northport, Mich., 11.01; College Hill, Cincinnati, 10.50; Duluth, 10.40; Denison, Tex., 10.00; Cincinnati, Signal Station, 9.86; Madison, Wis., 9.31; Bethel, Ohio, 9.25; Wellsboro, Pa., 9.09; Fort Wallace, Kans., 8.94; Cincinnati (Woodward High School) 8.79; Cedar Keys, Fla., 8.76; Cresco, Ia., 8.75; Cape Hatteras, 8.59; Fort Hartsuff, Nebr., 8.52; Alpena and Indianapolis, 8.48; Jacksonburg, Ohio, 8.35; Galveston, 8.33; Guttenburg, Ia., 8.06; Breckinridge, 7.90; Spiceland, 7.86; New Geneva, Pa., 7.69; Stanley, Ontario, 7.59; Helena, Ark., 7.47; Davenport 7.21.

Smallest monthly rainfalls.—Alcatraz, San Buenventura, Point San Jose, San Gorgonio, Princeton, Salinas City, Lompoc, San Francisco, Los Angeles, Red Bluff, Sacramento and Visalia, Cal., Winnemucca, Nev., and Yuma, Ariz., none; Burkes and Tucson, Ariz., La Mesilla, N. Mex., and El Paso, Tex., trace; Salt Lake City, 0.01 inch; Pioche, Nev., 0.03; Hermosa, Col., and Prescott, Ariz., 0.04; Florence, Ariz., 0.05; Laredo, Tex., 0.09; Boise City, 0.11; Eagle Pass, Tex., 0.12; Fort Fred Steele, Wyo., 0.14; Fort McDermitt, Nev., 0.15; Fort Verde, Ariz., 0.16; Fort Garland, Colo., 0.18; Fort Wingate, N. Mex., 0,19; Fort Douglass, Utah, 0.22; Fort Hall, Idaho, Fort Union, N. Mex., and Battle Creek, Mich., 0.25; Fort Bidwell, Cal., 0.26; Summit, Colo., 0.28; Hector, N. J., 0.40; Fort Apache, Ariz., and Helena, Mont., 0.46.

Rainy days.—The number of days on which rain or snow has fallen varies as follows: New England, 9 to 18; Middle Atlantic states, 6 to 15; South Atlantic states, 5 to 13; Eastern Gulf states, 8 to 19; Western Gulf states, 8 to 20; Ohio valley and Tennessee, 8 to 15; Lower Lake region, 12 to 16; Upper Lake region, 10 to 20; Upper Mississippi valley, 11 to 15; Missouri valley, 10 to 14; Red River of the North valley, 11 to 15; Eastern Rocky Mountain slope, 4 to 12; Rio Grande valley, 1 to 4; Plateau districts, 0 to 9; California, 0 to 1; Oregon, 6 to 14.

Cloudy days.—The number varies in New England from 5 to 11; Middle Atlantic states, 3 to 10; South Atlantic states, 2 to 11; Eastern Gulf states, 7 to 9; Western Gulf states, 0 to 8; Ohio valley and Tennessee, 4 to 11; Lower Lake region, 4 to 14; Upper Lake region, 8 to 16; Upper Mississippi valley, 7 to 11; Missouri valley, 4 to 12; Red River of the North valley, 6 to 8; Eastern Rocky Mountain slope, 0 to 12; Rio Grande valley, 1 to 4; Plateau districts, 0 to 5; California, 0 to 10; Oregon, 10 to 19.

Hail.—Fort Hale, Dak., 23d, stones weighing seven and one half ounces. Fort Meade, Dak., 11th, 22d. Fort Niagara, N. Y., 30th. Fort Concho, Tex., 6th. Fort Fetterman, Wyo., 4th, 13th, 30th. Southington, Conn., 13th. Lyndon, Ill., 29th, fields of corn entirely destroyed and osage hedges stripped of their leaves; hail fell in such quantities that it was found the next day in small ravines. Laconia, Ind., 28th. Monticello, Iowa, 5th, 13th. Guttenburg, Iowa, 28th. Yates Center, Kans., 8th. Gardiner, Me., 21st.

Fallston, Md., 12th, 25th. Rowe, Mass., 20th. Thornville, Mich., 2d. Genoa, Nebr., 5th, 11th. Princeton, N. J., 21st. Ardenia, N. Y., 21st. Westerville and Jacksonburg, Ohio, 13th. Dyberry, Pa., 16th, (21st did much damage to crops). Catawissa, Pa., 11th. Ashwood, Tenn., 30th. Salt Lake City, 4th. Pike's Peak, 20th, 22d. Cheyenne, 12th, 17th. Fort Gibson, 7th, severely injuring vegetation, stones half inch in diameter. North Platte, 23d, 30th. Stockton, Tex., 9th, (26th, size of walnut). Cedar Keys, Fla., 3d. Keokuk, 29th. Breckinridge, 4th, 22d. Saint Paul, 4th, one half inch in diameter. Milwaukee, 2d, completely covered ground, considerable damage to vegetation. Charlotte, N. C., 29th. Augusta, Ga., 30th. Philadelphia, 31st. Albany, 20th. Mount Washington, 16th.

Snow.—Utah, Fort Douglass, 4th, 9th, "few flakes." *California*, 18th, Fort Bidwell, Yreka, Red Bluff, "seen on high peaks of Sierra Nevada and Coast range." *Oregon*, 18th, Umatilla, "fell on Butter Creek hills, nine miles south of station." *Colorado*, Pike's Peak, 5th, 18th, 21st, 23d, "heavy snow storm with much electricity" 24th to 27th, 29th. *Nebraska*, North Platte, 27th, "few flakes." *New Hampshire*, Mount Washington, 16th.

Floods.—The following is a brief account of the extensive floods of the Upper Mississippi and the Ohio valleys during June, 1880. Bellevue, Iowa, 4th, Maquoketa River running over its banks, causing great destruction to property; a large boom at the city broke, sending adrift thousands of logs, and also one at Moore's Mill, entailing a large loss. One steamer and a barge sunk near the city. All railroad communication seriously obstructed and one railroad bridge swept away. La Crosse, Wis., 11th, 5,000,000 feet of logs carried away by high water; loss $40,000. 17th, Mississippi river rose 13 inches in past 21 hours, water higher than since 1858; travel between North Side and Vine Street depot obstructed by water to the depth of 2 feet; no trains arrived for 36 hours. Galena, Ill., 11th, Commerce and Washington streets nearly submerged, water around Barrows and Taylor's Mill 5 to 6 feet deep. Water rose steadily in the river at the rate of half a foot an hour. Cincinnati, 14th, many cellars were flooded and streets badly washed; along the river, which rose 8 feet in five hours, considerable lumber and merchandise were washed away. The damage to Miami canal was very severe. At Glendale, near Cincinnati, the entire portion of the city near the depot was flooded in less than 20 minutes. In several streets the water was waist deep and little streams in the vicinity of Mill Creek were enlarged from 3 to 200 feet, and at some parts swollen to a depth of 12 feet. Jones Station, Butler County, Ohio, 14th, destruction to crops by water very great, hundreds of acres through the valley submerged. At Le Sourdsville crops seriously damaged. At Port Union, large field of grain washed away, loss estimated at tens of thousands of dollars. At Overpecks Station, great damage to crops; many large bodies of water formed in vicinity. As far as Seven Mile the same disastrous results were reported. Nearly all of the railroads in Butler, Hamilton, and Clermont Counties, Ohio, were seriously damaged; miles of track, heavy embankments, and trestles were washed away. Several bridges were severely injured or carried away. Baltimore, Md., 12th, very heavy rain, several streets badly washed, culverts broken, cellars flooded, and street-railway travel seriously interfered with. Eau Claire, Wis., 15th, river at this point highest ever known; water rose 24 feet in 48 hours. The loss to lumbering interests, by the carrying away of logs, will reach one and one half millions of dollars. Mill dams and bridges all along the river were swept away. At Menomonee, Wis., the Red Cedar River rose very rapidly, causing a loss to the Cedar Falls Manufacturing Company of 10,000,000 feet of logs and their dam. At Brainard and Fort Ripley, Crow Wing and Morrison Counties, Minn., 15th, railroad and highway bridges washed away; railway tracks badly washed out and many farms near Brainard entirely under water. Chippewa Falls, Wis., 15th, both bridges at the city were swept away and all on Duncan creek except one. Many houses in lower portion of city flooded, several million feet of logs carried away, loss $1,000,000. Waupaca County, Wis., 15th, great damage to building and crops along Pigeon and Embarrass Rivers. The entire grain crops throughout Embarrass valley destroyed. Clinton, Iowa, 23d to 25th, large portion of the town flooded, all saw mills, paper mills, and sash factories closed. All railway tracks under water and warehouses approached by boat. All the islands in the vicinity were flooded, and gardens, crops, and other property destroyed; loss $30,000. Warsaw, Ill., 23d to 25th, all lumber yards submerged and mills filled to the depth of from 2 to 6 feet. Several serious breaks were made in levee below the city. The principal highway to the city was covered with 4 feet of water, and 20,000 acres of fine farming lands 11 miles below were inundated. Thousands of acres on the Missouri side in the same condition, causing great loss to farmers. Dubuque, Iowa, 23d and 24th, river 22 feet 8 inches above low water mark and 14 inches above high water of 1870; such a body of water surpasses the memory of the oldest inhabitant. All railroad communication ceased and all machine shops and saw mills flooded and work suspended. A ferry boat was employed to transfer passengers to and from one of the hotels. All warehouses along the river were flooded and large quantities of merchandise carried away. Prairie du Chien, Wis., 23d to 25th, river higher than ever known before.

One-third of the city covered with water to the depth of 6 to 8 feet. All railroad communication interrupted, about 50 miles of track were submerged, and several bridges carried away. Davenport, Iowa, 26th, river 18 feet 5 inches above low water mark, the highest since 1870. The city cemetery was overflowed and a number of coffins washed out. Several large mills compelled to stop work. Below the city many cultivated fields entirely submerged. Rock Island Ill., 26th, river 17.5 feet above low water mark; large portion of the city under water; west of Ninth street a large number of houses floated about from their foundations, 200 families were driven from their houses; all the western portion of the city appeared like a lake dotted with roofs of houses. The Rock Island car shops were surrounded by water and the employés were carried to and from their work in row boats. The loss to private property alone is estimated at over $100,000. Burlington, Iowa, 26th, all the bottom lands opposite the city flooded, causing vast damage to growing crops; river over 8 miles wide. A vast area of fine farming country between Burling and Iowa River completely submerged; crops almost a total loss. On the Illinois shore the water extended nearly 4 miles into the interior, covering the entire tract of the bottom lands; loss to agricultural interests very great. Montrose, Mo., bottom lands above the town completely inundated, causing great damage to crops. Keokuk, 29th, river 18 feet 2 inches above high water mark. All railroad communication interrupted; railroad shops completely surrounded with water. Alexandria, Iowa, 23d to 25th, highest water since the great flood of 1876. Southern part of the city partly submerged and the bottom land in that vicinity covered with water, causing great damage to growing crops. A large quantity of wood was swept away from Watson's Island, which was entirely covered with water. On June 30th, at 3 a. m., the Sny levee, below Quincy, Ill., broke between East Hannibal and Cincinnati landing. The crevasse during the day obtained a width of half a mile. Fully 200,000 acres of the finest farming land, all under cultivation, was flooded. The levee protected a piece of country 40 miles long by from 4 to 10 miles wide. Three persons were drowned. Much stock was lost and great damage done to corn and hay, the wheat having generally been harvested. Estimated loss over $100,000. *Oregon and Washington Territory*, 27th to 30th, lower part of of Portland, Oreg., flooded; many streets and stores flooded; much damage to growing crops in Lower Columbia and Willamette valleys. 30th, the bottoms between Clackamas River and Oregon City overflowed, doing much damage. Sauvies Island and Columbia slough, and all farms on west bank of Willamette river completely submerged. The town of Freeport, Wash. Ty., and all surrounding flat country under water, driving residents to the hills for safety. The whole country around Monticello, Wash. Ty., submerged, doing much damage to growing crops. 28th to 30th, three miles of railway, between the Dalles and Celilo, under water. 29th, unprecedented flood in Cowlitz's River, Wash. Ty., water 3 feet higher than ever before known. At railroad bridge, 20 miles above its mouth, river 16½ feet above low water. Northern Pacific Railway, between Kalama and Cowlitz, under water for a distance of 15 miles. Lewiston, Idaho, 27th, Snake River 4 inches above extreme high water of 1876. 30th, Wallula, Wash. Ty., river at a stand, 1 foot and 11 inches below high water of 1876. Skagit river, Wash. Ty., (no date given), higher than ever before known. The dike on the river broke, doing great damage to crops. June 30th, at Portland, Oreg., river reached 27 feet 4 inches (within 1 inch of high water of 1876), overflowing Front and First streets, doing many thousand dollars' worth of damage. The Dalles, Oreg., 26th to 28th, all of Front street under water, flooding the principal hotels and stores of the city. 28th, river above high water of 1871 and near that of 1876; greater part of railway track under water; loss and damage by flood very great.

Droughts.—New Jersey, exceedingly severe in Bergen, Passaic, and Essex Counties. 30th, Hackensack and Mount Claire, water for domestic purposes very scarce. Atco, very dry, crops much injured, wells failing. Somerville, drought for past two months, very injurious to hay. Freehold, very dry, crops suffering. *New Hampshire*, 13th to 20th, Auburn, very severe. *New York*, 30th, Hector, drought very severe. White Plains, "drought commenced on last day of April and has continued to July 1st, during which time (62 days) only 1.43 inches of rain fell; all vegetation is suffering severely." *Georgia*, 23d, Augusta, very severe, injuring gardens and crops. *Kansas*, 15th, Creswell, small streams nearly all dry. *Maryland*, 28th, Sandy Springs, wheat crop very poor, owing to severe drought. *Massachusetts*, 26th, Springfield, vegetation suffering. Connecticut river very low, only 13 inches above low water.

Rainfall during May received too late to be used in May Review.—Arizona: Whipple Barracks, Fort Lowell, Fort Bowie, Fort McDowell, Fort Verde, Fort Apache, and Fort Mojave, 0.00; Wickenburg, 0.17. *California:* Benicia Barracks, 0.84; Angel Island, 1.14; Alcatraz, 0.95; Presidio, S. F., 0.88; Fort Yuma, 0.00; Fort Gaston, 3.48; Fort Bidwell, 1.38. *Colorado:* Fort Lyons, 1.09. *Dakota:* Fort Randall, 6.21; Fort Stevenson, 3.29; Fort Sisseton, 3.50; Fort Sully, 1.88; Fort Totten, 4.38; Fort Hale, 3.68. *Idaho:* Fort Lapwai, 2.40. *Montana:* Fort Benton, 1.54; Fort Shaw, 2.36; Fort Ellis, 7.13; Fort Logan, 2.58; Fort Assiniboine, 0.79. *Nebraska:* Camp Sheriden, 1.60. *Nevada:* Fort McDermitt, 0.39. *Oregon:* Fort Stevens, 4.91; Fort Klamath, 1.24;

Fort Harney, 0.72. *Texas:* Rio Grande City, 1.64; Brownsville, 1.56. *Washington Territory:* Fort Canby, 5.22; Fort Townsend, 2.20; Neah Bay, 6.62; Bainbridge Island, 3.20. *Wyoming:* Fort Fred Steele, 0.78.

RELATIVE HUMIDITY.

The percentages of mean relative humidity for the month range as follows: New England, from 62 to 86; Middle Atlantic states, 57 to 87; South Atlantic states, 57 to 80; Eastern Gulf states, 65 to 77; Western Gulf states, 68 to 73; Ohio valley and Tennessee, 61 to 72; Lower Lake region, 63 to 73; Upper Lake region, 68 to 81; Upper Mississippi valley, 63 to 69; Missouri valley, 62 to 69; Red River of the North valley, 75; Eastern Rocky Mountain slope, 20 to 68; Rio Grande valley, 49 to 74; Plateau districts, 17 to 43; California, 36 to 76; Oregon, 39 to 63. High stations report the following averages not corrected for altitude: Pike's Peak, 48.2; Mount Washington, 82.3 per cent.

WINDS.

The prevailing direction of the wind during the month of June, 1880, is shown by arrows flying with the wind on chart No. II. The prevailing direction along the entire Atlantic slope and in the Lake region was southwest; in the great central valleys, south; In Texas, southeast; To the westward of 102° W. the prevailing direction was northerly to the northward of the parallel 40°, and southwesterly to the southward of that parallel. The prevailing directions on Mount Washington, NW., and Pike's Peak, SW., were normal.

The maximum velocities per hour are generally given in the description of the areas of low pressure. The following are the maximum velocities exceeding 50 miles per hour that have been reported during June, 1880: Madison, Wis., 50 S.; Saint Louis, 52 S.; Dodge City, 52 NW.; Kittyhawk, 52 NE.; Delaware Breakwater, 54 NW.; Breckenridge, 56 NE.; Portsmouth, N. C., 56 NW.; Omaha, 60 NW.; North Platte, 62 N.; Cape Henry, 64 NW.; Mount Washington, 70 NW., and Pike's Peak, 72 SW.

Total movements of the air.—The following are among the largest total movements in the various districts: Pike's Peak, 12,978; Cape Lookout, 12,940; North Platte, 12,580; Fort Stockton, 10,581; Delaware Breakwater, 9,643; Umatilla, 9,136; San Francisco, 9,098; Indianola, 8,453; Sandusky, 8,363; Milwaukee, 8,199; Bismarck, 7,932; Wood's Holl, 7,392; Saint Louis, 7,113; Cedar Keys, 6,875; Cairo, 5,874. The record on Mount Washington is incomplete, owing to the frost work. The smallest are: Atlanta, 1,669; La Mesilla, 1,743; Lynchburg, 2,364; Roseburg, 2,486; Deadwood, 2,971; Springfield, Mass., 3,021; Los Angeles, 3,185; Nashville, 3,270; Little Rock, 3,958; Duluth, 4,356; Oswego, 4,368.

Local storms.—The following account of the tornado at Savoy, Fannin County, Texas, was received too late for the May Review: About 10 p. m., May 28th, 1880, two large black clouds (one moving from SE. and the other from the NW.) met SW. of the town and formed one funnel-shaped cloud, causing a low rumbling sound to be heard. During the formation, vivid electrical discharges in the shape of large balls of fire occurred. Pendent from the cloud was a long cylinder of vaporous formation, which rotated from W. to E. by the south point and touched the earth continuously during its passage through the town. The track was about 180 yards wide, direction SW. to NE., duration about two minutes. No wind was felt outside the path. The tornado left the earth N. of the town and was not again heard of. Its passage was marked by hail and followed by heavy rain, which continued several hours. Twelve persons were killed and over sixty wounded, some fatally. Every house in the track, 48 in number, was destroyed. The surrounding country is a rolling prairie with no native timber. Saint Louis, Mo., June 4th, strong S. wind attaining, at 11 a. m., velocity of 52 miles. The storm was accompanied by thunder, lightning, and heavy rain. One person was killed and several injured. Several buildings were unroofed and much damage done to others. Considerable damage was also done south of the city. Pottawattamie County, Iowa, 10th, during p. m., terrible tornado swept through the southeastern portion of the county, destroying everything in its path, which averaged about a half mile in width. Wind clouds, of very portentous appearance, were first observed forming both in the east and west. In a short time they came together and formed a conical shaped cloud, which rapidly extended downward to the earth, when the work of devastation commenced. At one place, a farmer's house, surrounded by a frail fence, was carried out of the yard and dashed to pieces, leaving every board of the fence remaining in its place. Twenty persons were killed outright and all buildings literally torn to pieces. The passage of the storm was almost instantaneous; no rain accompanied it. Brownsville, Mower County, Minnesota, 11th, very violent wind storm causing great destruction to buildings and fences; one person killed. Sparta, Monroe County, Wisconsin, 11th, round house of the Chicago and Northwestern Railroad blown down and several other buildings demolished. Glendale, Ohio, 14th, 8 p. m., violent wind and rain storm passed through the village from SW. to NE. Scarcely a dwelling remained uninjured; scores of the largest trees either uprooted or twisted off near the ground. Many of the largest buildings were torn to pieces and heavy objects carried long distances. Loss to buildings estimated at $80,000. Near Springdale the damage was proportionately severe, 15 buildings were either badly injured or completely destroyed and several animals killed. At Evendale six buildings were wrecked and five animals killed. In the vicinity of Montgomery, several buildings destroyed, and scores of trees uprooted or twisted off. At Venice and Symmes Corner, Butler County, the destruction was particularly severe; acres of timber were shorn of their branches; fields of grain in the shock were scattered in every direction; large orchards were completely destroyed; dwellings and out-buildings were either unroofed or entirely blown down. Between 50 and 60 buildings were badly injured or destroyed and several animals killed. The heavy iron bridge, 113 feet long, spanning Indian creek, was whirled from its abutments. Two other heavy bridges in the vicinity were similarly destroyed. Numerous chickens and turkeys were found dead in the path of the storm, with the feathers completely stripped from their bodies. The noise accompanying the storm was described as terrible, resembling the report of a large cannon in its reverberations. In Morgan township the storm was very severe; buildings, fences, and trees were damaged to the extent of about $20,000. At Miamiville the storm left the town in ruins. The large covered bridge over the Little Miami river was swept away. Riverside, Del., 12 p. m., violent wind storm causing great damage to peach orchards, several buildings demolished. At Middletown, Del., the roof of the National Hotel was lifted and carried half a mile; many other buildings badly wrecked, and several peach orchards entirely destroyed. Shelbyville, Ind., 14th, p. m., very violent tornado; many buildings destroyed and great damage done to farm property, one person killed. The storm moved from SW. to NE.; path very narrow. New York City, 14th, p. m., very heavy wind storm, many buildings unroofed and otherwise injured; storm continued for about 15 minutes. At Paterson and Newark, N. J., buildings were damaged to the extent of $25,000.

Waterspouts.—Cape Henry, 12th, 6 p. m., three distinct waterspouts were observed at sea 200 yards from station, moving southeastward with extreme rapidity, disappearing when about two miles below station. The spiral motion in each spout was from left to right. Fort Barrancas, Fla., 2d, 10.10 to 10.50 a. m., four miles from shore moving slowly southeastward.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily indications for June, with the telegraphic reports for the succeeding 24 hours, shows the general percentage of verifications to be 88.7 per cent. The percentages for the four elements are: Weather, 87.7; direction of the wind, 88.5; temperature, 88.6; barometer, 90.0 per cent. By geographical districts they are: For New England, 86.6; Middle states, 87.1; South Atlantic states, 92.5; Eastern Gulf states, 91.9; Western Gulf states, 92.6; Lower Lake region, 89.9; Upper Lake region, 86.0; Tennessee and the Ohio valley, 90.4; Upper Mississippi valley, 85.2; Lower Missouri valley, 83.4; Northern Pacific coast region, 77.0; Central Pacific coast region, 100.0; Southern Pacific coast region, 100.0. There were 12 omissions to predict out of 3,690, or 0.33 per cent. Of the 3,678 predictions that have been made, 82, or 2.23 per cent., are considered to have entirely failed; 99, or 2.69 per cent., were one-fourth verified; 348, or 9.46 per cent., were one-half verified; 345, or 9.38 per cent., were three-fourths verified; 2,804, or 76.24 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

Cautionary signals.—89 cautionary signals were displayed during the month, of which 76, or 85.4 per cent., were justified by winds of 25 miles per hour or over at or within a radius of 100 miles of the station. 12 off-shore signals were displayed, of which 8, or 66.7 per cent., were fully justified; 9, or 75.0 per cent., as to direction; 10, or 83.3 per cent., as to velocity. 101 signals of both kinds were displayed, of which 84, or 83.2 per cent., were fully justified. The above does not include signals ordered for 50 display stations, where the velocity is only estimated. 117 cases of winds of 25 miles and over per hour, from scattered stations, were reported, for which signals had not been ordered. 11 signals were ordered late.

NAVIGATION.

In the table on the right hand side of chart No. III the highest and lowest stages of water, as recorded on the river gauges, occurring during the month of June, 1880, at Signal Service stations, are given with the dates of the same. The following is a general résumé of the condition of the rivers during the month. The Red River at Shreveport rose slowly from 9 feet on the 1st to 17 feet on the 20th, and fell to 14½ feet by the 30th. The Arkansas at Little Rock remained very low and almost stationary throughout the month. The Missouri at Yankton rose from 6 feet on the 1st to 10 feet on the 5th, but fell to about 4½ feet by the 10th; on the 13th a second rise set in which continued to end of month, when the water reached 12 feet; at Omaha it rose from 9 feet on the 1st to 12 feet on the 6th; fell slowly to 10½ feet by the 13th, and afterward rose to 16 feet 2 inches (or 2 inches above danger line) by the 30th; at Leavenworth it rose from about 8½ feet from 1st to 3d to 12 feet on the 7th; fell to 10½ feet on the 13th, rose to 14 feet by the 22d, and remained almost stationary to end. The Mississippi at Saint Paul rose from 7 feet on the 1st to 15 feet 3 inches on the 17th, passing the danger line, 14½ feet on the 15th; from the 17th it fell slowly to 9 feet on the 30th; at La Crosse it remained almost stationary, about 5 feet, until the 5th, when the rise set in; by the 19th the water had reached 15 feet 2 inches, after which it fell to 9 feet 5 inches by the 30th; at Dubuque it remained almost stationary, about 9½ feet, until the 7th, when it commenced to rise slowly, and passing the danger line, 21 feet 10 inches, on the 21st, reached 22 feet 8 inches on the 23d, after which it fell to 18½ feet by the 30th; at Davenport it remained almost stationary, about 8 feet, until the 15th, when the rise set in, and, passing the danger line, 15 feet, on the 19th, reached 18 feet 5 inches on the 26th. Maj. D. W. Flagler, U. S. Army, at Rock Island Arsenal, gives the highest water (above low water of 1863) at Rock Island bridge 17.15 feet on the 26th, and at Moline bridge 22.75 feet on the 25th and 26th. He says: "This is the highest water of which there is any certain record along this portion of the Mississippi river, and it is certainly the highest water that has occurred since 1851. According to the best evidence I can obtain this high water was along the Rock Island rapids generally 1.08 feet higher than the high water of 1870." At Keokuk it remained almost stationary, about 9½ feet, until the 17th, when the rise set in, and, passing the danger line, 14½ feet, on the 22d, reached 18 feet 2 inches on the 29th; at Saint Louis, Cairo, and Memphis it remained almost stationary throughout the month, rising slowly towards the end; at Vicksburg and New Orleans it changed but little throughout the month. The Ohio, at Pittsburgh, remained low and almost stationary until the 13th; on the 14th, 15th, and 16th it rapidly rose to 15 feet 11 inches, after which it fell to end; at Cincinnati it remained almost stationary until the 14th, when it commenced rising and reached 24 feet 6 inches on the 20th; at Louisville it changed but little throughout. The Tennessee, at Chattanooga, the Cumberland, at Nashville, and the Savannah, at Augusta, changed but little during the month. The high water in the upper Mississippi during the latter half of the month resulted in immense damage to property along the banks, which will be found in detail under the head of *Floods.*

Icebergs.—In view of the remarkable number of icebergs and extensive fields of ice which have been reported off the banks of Newfoundland, the following table has been compiled from such marine reports as have fallen under the notice of this office. The quantity of ice reported has been greater than that of any year since 1875. In this connection, the following meteorological notes are of interest: Maritime Register, June 9th: "The past winter in southern Greenland has been very severe and the spring very stormy." London Times, June —: The winter of 1879–'80 in Iceland very mild, pressure low; early and enormous discharges of polar icefields and icebergs since March, 1880. Large iceberg reported by steamer Nederland, June 21st, in 40° 12′ N., 44° 18′ W., is probably one of the most southerly ever reported in that longitude.

Month.	Extreme limits of icefield.								
	East side.			South side.			West side.		
	Date.	W. long.		Date.	N. lat.		Date.	W. long.	
Year 1880.		°	′		°	′		°	′
February	20	47	00	23	44	00	23	49	10
March	16	46	00	22	42	30	24	49	36
April	30	45	36	27	42	50	2	50	00
May	18	45	16	21	40	35	31	54	00
June	2	44	00	21	40	12	21	55	25

Month.	Total number estimated as per schedule.	Dimensions of large bergs.			
		Height.		Length.	
		Extreme.	Mean.	Extreme.	Mean.
	Number.	Feet.	Feet.	Feet.	Feet.
Year 1880.					
February	25	300	125	500	240
March	133	120	67	....	....
April	87	300	....	....	....
May	779	300	130	15, 840	2, 800
June	401	400	215	2, 040	1, 300

Contrary to the popular opinion in this respect, these enormous fields of ice do not lower the temperature of the Atlantic slope, which in its entire extent from the Canadian Maritime Provinces to Florida has experienced during May and June mean temperature decidedly above the normal.

High tides.—Galveston, Tex., 12th, large portion of east part of island submerged. Cape Lookout, N. C., 16th and 17th. Fort Macon, N. C., 18th. Portsmouth, N. C., 15th and 17th.

TEMPERATURE OF WATER.

The temperature of water as observed in rivers and harbors at Signal Service stations, with average depth at which observations were taken, is given in the table on the left-hand side of chart No. II. At the following stations, the thermometers being broken, prevented observations on the dates given: Chicago, 11th to 17th; Duluth, 6th to 16th; Savannah, 2d to 25th. The report from Punta Rassa has not been received.

ATMOSPHERIC ELECTRICITY.

Thunder-storms.—New England, 1st, 2d, 6th, 7th, 11th, 12th, 13th, 14th, 16th, 17th, 21st to 30th. Middle Atlantic states, 1st to 3d, 6th to 14th, 16th, 17th, 21st to 30th. South Atlantic states, 1st, 2d, 3d, 6th, 7th, 8th, 9th, 11th to 16th, 25th, 30th. Lower Lake region, 6th, 9th to 14th, 25th to 30th. Upper Lake region, 1st to 6th, 9th to 15th, 18th, 19th, 23d to 30th. East Gulf states, 1st to 15th, 19th to 30th. West Gulf states, 1st, 2d, 5th, 6th, 9th to 16th, 20th to 30th. Ohio valley and Tennessee, 2d, 6th, 11th to 14th, 19th to 30th. Upper Mississippi and Lower Missouri valleys, 1st to 30th. Eastern Rocky Mountain slope, 4th, 12th, 17th, 18th, 20th to 25th, 29th, 30th. Arizona, 19th, 20th. Oregon, 10th. Washington Territory, 7th.

Auroras.—On the 12th the aurora was observed in New Hampshire and Wisconsin, and at Vevay, Ind. Cloudy weather in the Lower Lake region probably prevented observations in that section. On Mount Washington, at 8 p. m., faint; color, pale straw. Milwaukee, from 8 to 9 p. m., faint; color, pale blue, changing to indistinct orange; altitude, about 10°; no motion. Vevay, Ind., until 1.30 a. m. of the 13th; altitude, about 45°; faint flashes of white light, alternating with faint pulsations of crimson color. On the 15th auroral displays occurred from Maine to Dakota. Gardiner Me., not visible at 9, but quite bright from 11 p. m. to 1 a.m. At Montreal, Can., auroral display. Burlington, Vt., faint, with distinct dark segment, from 11.15 p. m. to 12.15 a. m. of the 16th. Milwaukee, from 8 to 9 p. m., from N. to W.; faint; altitude, about 5°; color, well defined blue, shading into orange at the horizon; motionless, except slight tremor in blue light. Escanaba, 9 p. m. to 10.15 p. m.; arch of pale yellow, extending from 45° to 60° azimuth; altitude, about 20°. Pembina, 9 p. m., faint, but indistinct, owing to bright moonlight; 16th, display reported from Vermont to Iowa. Burlington, Vt., from midnight to 12.30 a. m. of the 17th; faint, no definite characteristics. Escanaba, 8.45 p. m., of increasing brilliancy till 9.30 a. m., then gradually fading away; disappeared at 11 p. m.; well defined beams of 2° breadth, reaching an altitude of 45°; color, pale yellow. Thornville, Mich., from 9.30 to 10 p. m., faint; slight movement of rays from E. to W. Monticello, Iowa, display at 11 p. m. Isolated cases of displays occurred as follows: Gardiner, Me., 18th, from 1 a. m. to 2. 30 a. m.; extent, 45° from N. to NE., resembling the light of the rising moon. Burlington, Vt., 14th, faint from 11.15 p. m., till after midnight; bright arch of light. Burlington, Vt., 27th, from 12 to 12.25 a. m., bright arch, with distinct dark segment, but no streamers. Milwaukee, 11th, 8 to 10 p. m., faint; extending from N. to W.; color, pale blue, shading to indistinct orange at horizon; interspersed with dark, hazy streaks, seemingly arising from nucleus of dark segment; no perceptible motion. Pembina, 14th, 9.40 p. m., to morning of 15th, extent from 180° to 255° azimuth; altitude, 15°. One narrow arch, lower edge well defined, but upper irregular and broken, with motion as of faint phosphorescent flames, rising from a ribbon of half smothered fire; marked intermittence of brilliancy. Occasionally quick luminous rays shot towards the zenith, with the tremulous motion characteristic of "merry dancers." The peculiarity of the display was the color of the arch, which was uniformly green, varying in shade, but at no time displaying any other variety of color. Independence, Iowa, 5th, auroral display. Saint Meinrad, Ind., 3d, 8 to 9 p. m., in NW., faint, extent, 35°, altitude, 20°; 10th, 9 p. m., faint on account of bright moonlight; 11th, 9 to 11 p. m., extent, 120°, altitude, 30°, diffuse arch of yellowish white. Bellefontaine, Ohio, 26th, 9 p. m., seen through rift in clouds. The most southerly station reporting during the month was Saint Meinrad, Ind.

OPTICAL PHENOMENA.

Solar and lunar halos were not very numerous during the month, but were most frequently observed along the Atlantic coast, in Tennessee and the Ohio valley, and in Oregon.

Mirage.—New London, Conn., 12th, nearly all day and from 8 to 8.30 p. m.

MISCELLANEOUS PHENOMENA.

Earthquakes.—San Francisco, Cal., 24th, 12.47 a. m.

Prairie and forest fires.—Pike's Peak, 4th, 7th, 8th, 11th, 14th, 16th, 19th ; Santa Fé, 8th to 14th ; Colorado Springs, 9th.

Locusts.—30th, Hudson, Mich., very numerous one mile west of this place. Umatilla, Oreg., very numerous ; much damage to gardens ; 25th, still very destructive ; 5th, Umatilla, Oregon, very numerous in county, doing much injury to gardens ; 25th, still very destructive. Fort Sill, Ind. T., 10th, large numbers of young grasshoppers. Reno, Nev., June 18th, have done considerable damage to growing grain ; hatching out in myriads ; north end of Sierra valley already stripped of every green thing, but at south end the insects are just hatching out. Fort Gibson, Ind. T., 29th, flying west. Winnemucca, Nev., 30th, very large numbers of young grasshoppers in Paradise valley.

Sunsets.—The characteristics of the sky at sunset as indicative of fair or foul weather for the succeeding 24 hours have been observed at all Signal Service stations. Reports from 144 stations show 4,255 observations to have been made, of which 21 were reported doubtful ; of the remainder, 3,374, or 79.3 per cent., were followed by the expected weather.

Atmospheric electricity.—*New Mexico.*—Santa Fé, 4th, 16th to 20th, 24th. *Colorado*—Colorado Springs, 23d. *Texas*—Castroville, 1st, 6th, 25th, 29th ; Laredo, 5th, 9th, 12th ; Coleman City, 15th ; Concho, 5th, 15th, 27th, 29th ; Stockton, 3d, 12th, 15th, 25th, 26th ; Fort Davis, 6th, 11th, 12th, 15th, 25th, 26th, 29th ; Fort McKavett, 16th ; Fort Elliott, 15th.

Army worm.—Freehold, N. J., 10th, ruining many fields of grass and grain ; 17th, Whitehall and Nazareth, Pa., have destroyed large fields of grass and rye ; 11th, at and near Northport, and along the shores of Great South Bay, Long Island, doing great damage to crops ; 11th, at Eatonville, and from Freehold to Mount Pleasant, N. J., exceedingly destructive. Kent County, Del., early part of month, doing great damage to growing grain ; 3d, Hempstead and Islip, Long Island, doing great damage.

Meteors.—Macon, Ga., 30th, about midnight a brilliant meteor appeared near the zenith like a great mass of fire as large as a barrel and whirling in the air. It moved slowly down the northeastern sky, and when at an elevation of 45° the light changed to a brilliant red, paled into saffron, and then into all shades of green. At an elevation of 30° the light disappeared, and at the expiration of about three minutes a terrible explosion followed. Light was sufficiently brilliant to awaken people in their houses. Was observed at Hawkinsville, 40 miles south, and at Eatonton, 50 miles north. Little Rock, Ark., 14th, very bright ; color, violet ; course from E. to W. ; trail about 10° long ; 22d, 10.05 p. m., color, yellow ; course from E. to W. ; trail 15° long. Mayport, Fla., 29th, 8.15 p. m., very brilliant meteor ; color, yellowish white ; course W. to E. Shreveport, 28th, 10 p. m., very large and brilliant ; course from zenith to southern horizon ; about midway to horizon exploded, scattering pieces in all directions.

Zodiacal light.—Yates County, Kansas, 1st, 2d, 5th, 6th, 8th, 9th. Nashville, Tenn., 10th, very bright. Mr. Charles Hasselbrink, Havana, Cuba, reports: May 31st, 8.30 p. m., light bright and sensibly intermittent, but not rapid or sudden ; 9.30 p. m., axis inclined to south about 45°, azimuthal extension (35 to 40 degrees) remarkable. June 1st, 8 p. m., light exceedingly bright, of a whitish blue tint ; 8.25 p. m., inclined to south 65°, and at 9 p. m., 45° ; intermittence frequent and sensible ; 7th, 8 to 10 p. m., very bright and extensive ; intermittence very sensible ; inclination of axis to the south 45°. Constant cloudiness from 2d to 6th and 8th to 12th.

Sun spots.—The following record of observations, made by Mr. D. P. Todd, assistant, has been forwarded by Prof. S. Newcomb, United States Navy, superintendent Nautical Almanac Office, Washington, D. C. :

Date.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	
June, 1880.									
2d, 4 p. m..	0	1	0	20*	0	1	2	8	Faculæ.
4th, 3 p. m..	0	0	0	2	0	0	2	6	Faculæ.
8th, 4 p. m..	2	7	....	....	1	2	2	7	
11th, 4 p. m..	0	0	0	0	0	0	1	5	
16th, 4 p. m..	1	7	....	....	1	7	1	7	Spots probably disappeared by solar rotation.
17th, 3 p. m..	1	3	0	0	1	3	2	10	

*Approximated.

Date.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	
18th, 4 p. m..	0	7*	0	0	0	0	2	17*	Faculæ.
19th, 3 p. m..	1	6	0	0	0	0	3	23*	Faculæ. Many of the spots small.
21st, 4 p. m..	0	0	1	1	0	0	2	22*	Many of the spots small.
22d, 5 p. m..	0	12	0	0	0	0	2	34*	Many of the spots small.
23d, 5 p. m..	0	0	0	4	0	0	2	30*	Many of the spots small.
28th, 5 p. m..	2	20*	1	15	......	......	3	35*	Faculæ.
30th, 9 a. m..	0	0	1	15	0	0	2	20	Faculæ.
30th, 5 p. m..	0	0	0	0	0	0	2	20	Faculæ.

* Approximated.

Mr. William Dawson, at Spiceland, Ind., reports: 1st, 2 groups (low power and poor air); 2d, 2 groups, 53 spots; 3d, 2 groups, 24 spots; 5th, 1 group, 2 spots; 7th, 1 group, 8 spots; 10th, 3 groups, 25 spots; 11th, 2 groups, 16 spots; 12th, 2 groups, 10 spots; 13th, 2 groups, 7 spots; 16th, 1 group, 7 spots, and 2 groups, 12 spots; 17th, 2 groups, 26 spots; 18th, 2 groups, 54 spots; 19th, 3 groups, 62 spots; 20th, 3 groups, 85 spots; 24th and 25th, 3 groups, 80 spots; 27th, 2 groups, 45 spots; 28th, 3 groups, 28 spots; 29th, 5 groups, 26 spots. A large spot has just disappeared by solar rotation. Mr. H. D. Gowey, at North Lewisburg, Ohio, reports: 23d, 8.45 a. m., group; 25th, 9.30 a. m., on SW. quarter near equator.

Mr. F. Hess, Fort Dodge, Iowa, reports: "1st to 13th, about 30 spots traversed the sun and disappeared by rotation; 9th, a new spot, among extensive faculæ, appeared, which at 10 a. m. of the 11th had disappeared. New groups of spots and faculæ appeared on the 14th and 17th and remained visible to end of month—most numerous on the 25th, when 38 spots were visible.

Mr. David Trowbridge, at Waterburg, N. Y., reports: 22d, group visible without a telescope.

EXTRACTS.

[From Nature, June 17, 1880.]

A meteorological conference was held at Sydney in November last, the representatives of the different colonies being Messrs. James Hector for New Zealand, Charles Todd for South Australia, R. L. J. Ellery for Victoria, and H. C. Russell for New South Wales. The whole question of weather telegrams was under anxious consideration. The system in present operation embraces only the colonies of South Australia, Victoria, New South Wales, and Queensland, but a resolution was passed declaring it desirable to secure the co-operation of the Governments of Western Australia, Tasmania, and New Zealand in the system of intercolonial weather telegrams. The facts pointed out by Mr. Todd as to the great regularity observed by the atmospheric disturbances in pursuing a course from west to east, and the statement by Dr. Hector that early notices could be sent to Queensland of the origin and progress of the dangerous and suddenly occurring cyclones that cross the northern part of New Zealand, sufficiently attest the practicability of the system of weather warnings and their practical value. For instance, the great storm which wrecked the Dandenong in September, 1876, could have been telegraphed in sufficient time to have prevented the great loss of property which took place at the different ports along the coast of New South Wales. We have the greatest pleasure in noting a deliverance by the conference to the effect that weather telegrams and forecasts shall in all cases depend upon the observations used for general meteorological and climatological statistics. Much emphasis was laid on the establishment of high level stations with a more special view to the investigation of the winds; and the conference recommended that there be established in each of the colonies, upon a high mountain peak, a meteorological observatory for the special study of winds and other meteorological phenomena.

Published by order of the Secretary of War.

ALBERT J. MYER,
Brigadier-General, Chief Signal Officer, U. S. A.

PAPER 45.

List of boards of trade, chambers of commerce, and other organizations, apart from those directly connected with agriculture, which had on June 30, 1880, appointed permanent committees to confer with the Chief Signal Officer of the Army.

Name of organization.	State.	Committee.
Chamber of Commerce of New York.	New York	Edward Hincken, F. B. Thurber, George W. Blunt, James S. T. Stranahan, James H. Frothingham.
Board of Trade, Buffalo	New York	A. Richmond, G. S. Hazard, J. H. Vought.
Board of Trade, Detroit	Michigan	Theodore P. Hall, James Flynn, A. G. Hibbard.
Board of Trade, Chicago	Illinois	John T. Lester, J. J. McDermid, W. J. Pope.
Produce Exchange, Toledo	Ohio	W. T. Walker, H. D. Walbridge, W. H. Bellman.
Chamber of Commerce, Milwaukee	Wisconsin	J. L. Hathaway, J. B. Merrill, E. M. Peck.
Chamber of Commerce, Duluth	Minnesota	Charles F. Johnson, Dr. V. Smith, M. J. Forbes.
Board of Trade, Baltimore	Maryland	Andrew Reid, R. W. Cator.
Board of Trade, Cleveland	Ohio	R. K. Winslow, R. T. Lyon, J. C. Sage.
Chamber of Commerce, Charleston	South Carolina	E. H. Frost, W. P. Hall, F. W. Dawson.
Chamber of Commerce, Memphis	Tennessee	B. J. Semmes, T. H. Allen, W. P. Proudfit.
Board of Trade, Oswego	New York	J. L. McWhorter, A. H. Failing, W. R. Hosmer.
Committee appointed by mayor, Rochester.	New York	G. Schofield, J. Siddons, H. S. Hebard.
Board of Trade, Portland	Maine	C. H. Farley, M. N. Rich, Wm. Senter.
Board of Trade, Mobile	Alabama	Hon. P. Hamilton, T. Henry, esq., F. G. Bromberg.
Chamber of Commerce, Wilmington.	North Carolina	A. H. Van Bokkelen, G. Harriss, W. L. De Rossett.
Board of Trade, Indianapolis	Indiana	Hon. J. C. Fletcher, Samuel Kingan, H. C. Wilson.
Chamber of Commerce, Saint Paul.	Minnesota	R. O. Sweeney, D. R. Breed, M. N. Kellog.
Merchants' Exchange, Saint Louis.	Missouri	Web. M. Samuel, George H. Rea, John W. King, T. Henry Morgan, J. F. Baker, R. J. Whitledge.
Board of Trade, Davenport	Iowa	J. M. Dalzel, F. W. Angell, C. E. Beiderbecke.
Board of Trade, La Crosse	Wisconsin[1]	W. W. Jones, D. A. McDonald, David Austin.
Cotton Exchange, New Orleans	Louisiana	C. Bussey, G. W. Embry, J. H. Allen.
Chamber of Commerce, New Haven.	Connecticut	Hon. H. G. Lewis, J. T. Platt.
Chamber of Commerce, Cairo	Illinois[1]	W. P. Halliday, P. Cuhl.
Board of Trade, Cincinnati	Ohio	J. Dexter, H. Colville, W. S. Munson, T. Kelsall, A. G. Conzo.
Board of Trade, Albany	New York	E. A. Durant, jr., J. H. Reynolds, C. B. Tillinghast.
Board of Trade, Dubuque	Iowa	Dr. A. Horr, J. S. Hetherington.
Board of Trade, Louisville	Kentucky	W. R. Belknap, Dr. J. W. Holland, J. B. Speed.
Meteorological Committee, Springfield.	Massachusetts	E. W. Bond, H. C. Lee, J. G. Benton, E. Ingersoll, S. D. Brooks, A. P. Stone.
Meteorological Committee, Newport.	Rhode Island	S. C. Bailey, S. W. Macy, B. Finch, T. Cogeshall, L. P. Clarke, S. H. Norman, S. Powell.
Chamber of Commerce, Cincinnati.	Ohio	W. S. Munson, A. Erkenbrecher, H. Gœpper.
Board of Trade, Nashville	Tennessee	J. D. Plunkett.
Cotton Exchange, Savannah	Georgia	C. M. Holst, A. L. Hartridge, E. M. Green.
Cotton Exchange, Nashville	Tennessee	J. F. Wheeless.
Merchants' Club, Omaha	Nebraska	J. E. Boyd, G. H. Collins, O. H. Ballou, W. Stephens.
Chamber of Commerce, San Francisco.	California	J. W. Raymond, W. W. Dodge, J. S. Taber.
Meteorological Committee, Jacksonville.	Florida	F. Jordan.
Polytechnic Society of Kentucky, Louisville.	Kentucky	J. L. Smith, J. D. O'Leary, S. G. Stevens.
Meteorological Committee, Indianola.	Texas	H. J. Huck, J. H. Dale, D. Sullivan, W. P. Milby.
Cotton Exchange, Mobile	Alabama	W. H. Gardner, J. A. McCaw, A. Proskaner.
Merchants' Exchange, Baltimore	Maryland	W. G. Atkinson, W. G. Loud, O. M. Vesper.
Board of Trade, Omaha	Nebraska	Thos. Gibson, C. F. Goodman, D. S. Barriger.
Maritime Exchange, Philadelphia	Pennsylvania	E. K. Stevenson, J. S. Waln, G. W. Griffin.
Chamber of Commerce, Los Angeles.	California	Dr. J. P. Widney, J. de Barth Shorb, I. W. Lord.
Meteorological Committee, Sandusky.	Ohio	J. O. Moss, R. B. Hubbard, C. N. Ryan.
Cotton Exchange, Norfolk	Virginia	G. L. Arps, H. S. Reynolds, J. N. Vaughan.
Chamber of Commerce, Astoria	Oregon	A. C. Kinney, C. L. Parker, J. H. Robb.
Coal, Iron and Manufacturers' Association, Chattanooga.	Tennessee	E. M. Wight, J. F. Shipp, G. C. Connor.

List of boards of trade, chambers of commerce, and other organizations, &c.—Continued.

Name of organization.	State.	Committee.
Committee appointed by mayor, New London.	Connecticut	James Fitch, E. A. Delanoy, R. M. Waterman, Leonard Smith, C. W. Woodbridge, G. T. Marshall, H. S. Bartlett.
Board of Trade, Springfield	Illinois	Frank Fleury, Isaac H. Hawley, E. P. Burlingham, M. G. Hall.
Society of Natural History, San Diego.	California	G. W. Barnes, C. J. Fox, E. J. Buell.

PAPER 46.

LIST OF MARINE DISASTERS ON THE LAKES FOR THE YEAR ENDING JUNE 30, 1880.

JULY, 1879.

3.—Schooner E. J. McVey, lumber, water-logged in a gale on Lake Michigan.
Schooner Belle Mitchell lost jib-boom in a gale on Lake Erie.
Schooner Wells Burt ran aground in the Detroit River; released.
Schooner Lillie Amiott, water-logged and lost masts in a squall on Lake Michigan.
Schooner Nevada lost mainsail in gale on Lake Erie.
Schooner Maumee Valley had foremast shattered by lightning on Lake Huron.
4.—Schooner Bates put into Manitowoc water-logged.
Schooner W. B. Allen, ore, put into Beaver Harbor, leaking.
6.—Schooner W. B. Phelps lost jib-topsail in a gale on Lake Michigan.
Steam-barge Chamberlain lost fore and main-topmasts in gale off Point aux Barques.
Schooner Watertown lost all canvas in gale on Lake Michigan.
Schooner J. B. Merrill lost fore and main gaffs; schooner Ottawa, foresail; schooner Nevada, three jibs in gale on Lake Michigan.
Schooner Knight Templar went ashore at Frankfort, Mich.; released.
7.—Schooner Ida H. Bloom ran ashore at Frankfort, Mich.
8.—Tug Active sprang a leak at Oswego.
9.—Brig H. Rooney ran aground and sprang a leak in a storm on Saint Clair River; released.
10.—Schooner M. S. Bacon, coal, was found in a leaking condition on the east shore of Lake Michigan.
Steam-barge Nelson Mills ran aground near Walpole Island, Lake Saint Clair; released.
11.—Schooner S. B. Conklin had mainmast shattered by lightning at Cleveland.
Schooner Chas. Foster ran aground at Chicago; released.
Schooner Geo. H. Warmington had mast damaged by lightning on Lake Erie.
12.—Propeller Pridgeon, and schooner Hazard ran aground at Chicago; released.
14.—Schooner Gifford passed Detroit with foretop-mast gone.
Propeller Cuba ran ashore at Lake View, Lake Michigan; released.
15.—Schooner Golden West lost most of her canvas in gale on Saginaw Bay.
Schooners T. P. Sheldon, Oneida, and Annie Vought lost portions of canvas in gale on Lake Huron.
Propeller Colorado was disabled outside Buffalo by damage to shaft.
16.—Schooner P. S. Marsh damaged center-board near Milwaukee.
Schooner Cheney Ames had mainsail torn in a squall on Detroit River.
George Easch, sailor on schooner Quinby, was drowned at Algonac, Mich., by capsizing of a yawl.
17.—Steam-barge Ohio ran aground in Lake Saint Clair; released.
19.—Tug Alpena with barges Northern Light and Saint Clair ran aground on a reef in the Niagara River; released.
20.—Schooner Guiding Star arrived at Chicago with mainmast head gone.
Scow Sea Bird sprang a leak on Lake Saint Clair.
21.—Schooner Grenada sprang a leak at Chicago.
23.—Scow Quickstep arrived at Milwaukee with main topmast splintered by lightning.
Schooners Walhalla, J. & A. Stronach, and P. S. Marsh sprang a leak in Lake Michigan.
24.—Schooner Acontias sprang a leak and lost jib-boom in gale off Point aux Barques.
A large raft was driven ashore and several others broken up in a gale on Lake Huron.

25.—Propeller Canisteo ran aground in Detroit River; released.

Steamer Toronto ran aground near Niagara; released.

Schooner T. W. Ferry ran aground at Saint Joseph, Mich.; released.

26.—Scow Farrell, sand, sprang a leak and sank at dock in Detroit River.

Steamer Wanderer ran aground on a rock near Crystal Bay; released.

Schooner Annie Colman ran ashore near Grand Marias; total loss.

27.—Schooner New Dominion, sand, struck a rock and sank near Limekiln Crossing; raised.

28.—Propeller W. T. Graves ran aground inside Turtle Island light; released.

Barge Eliza ran aground on Dunkirk Reef; released.

31.—Barge Buckhout ran aground at Bay City; released.

AUGUST, 1879.

3.—Sail-boat Humming Bird lost deck load of shingles in a squall on Lake Huron.

Propeller City of Fremont was slightly damaged by lightning near Sault Ste. Marie.

4.—Propeller Avon ran aground at Chicago; released.

Schooner Jane Bell ran aground at Lake Saint Clair flats; released.

5.—Steam-barge Leland ran aground on Pèche Island, Lake Saint Clair; released.

Schooner Two Fannies arrived at Chicago with canvas damaged and foretop-mast head gone.

6.—Schooner Martha ran ashore at Waukegan, Ill; released.

Schooner W. B. Allen, grain, went ashore on Point au Pelee Island, Lake Erie; released.

Barge Susan Ward lost mast and sail in a squall on Lake Erie.

Schooner E. W. Rathbun and scow H. Moore each lost jib-boom in a gale on Lake Huron.

8.—Steam-barge Nelson Miller ran aground on Grassy Island, Detroit River; released.

10.—Barge Sunbury was towed into Detroit, water-logged.

Schooner Regulator arrived at Chicago leaking badly.

Schooner Geo. H. Seaver, water-logged in gale on Lake Michigan.

Tug Mayflower lost shoe in heavy weather on Lake Erie; the barge Spaulding in tow water-logged and sank; total loss.

12.—Schooner Mary Anne capsized outside Grand Haven; total loss.

Schooner Mediator lost some canvas in a blow on Lake Huron.

13.—Schooner E. Hall, coal, sprang a leak and sank, Lake Ontario; value $1,500.

14.—Scow Frankie Wilcox arrived at Milwaukee with fore and main sails gone.

Propeller Milwaukee, schooner Maria Martin, propeller Russia and steam-barge Wetmore aground at Chicago.

Schooner New Dominion, lost mainmast, mainsail, and small boat in gale on Lake Erie.

Propeller Kinkardine ran aground on the shoals near Grenadine Island, Saint Lawrence River; released.

15.—Schooner B. F. Wade was towed into Milwaukee water-logged.

Schooner Alleghany ran ashore on Racine Point; released.

Steamer Northwest had wheel-house broken in by a heavy sea on Lake Erie.

Steam-barge Glasgow water-logged in a gale on Lake Huron.

Schooner Mayflower run ashore in a gale at Rock Falls, Lake Huron.

Sail-boat Hannah and a steam stone-picker went ashore in a gale at Forestville.

16.—Schooner Two Fannies ran aground in Detroit River; released.

Schooner R. C. Crawford sprang a leak on Lake Erie.

Barge Venice went ashore on Point au Pelee Island; released.

Steamer City of Fremont ran aground at Drummond's Island; released.

17.—Barge India was towed into Detroit in a water-logged condition.

18.—Propeller St. Catherines, railroad iron, struck a rock and sank in Lake Saint Louis; raised.

Steam-barge Ohio, ore, ran aground in South Passage, Put-in-Bay Islands; released.

20.—Schooner S. Watson, coal, ran ashore on Bois Blanc Island; released.

Schooner Canton, wheat, ran aground near Black Can, Lake Erie.

Schooner Annie P. Grover, coal, ran ashore near Malden, Ontario; released.

Schooner J. H. Magruder was dismasted in a gale on Lake Huron.

21.—Schooner Cal. Hathaway lost center-board on Lake Erie.

Scow Louisa was found in a disabled condition on Lake Huron.

22.—Propeller Nyack ran aground in the river at Milwaukee.

23.—Schooner Leslie May had main and foremast-heads shattered by lightning on Lake Saint Clair.

24.—Schooner Ford River lost jib-boom in a gale on Lake Michigan.
Steamer Bret Harte lost rudder and sprang a leak in a blow at Lincoln Park pier, Chicago.
Schooner Arundel arrived at Milwaukee with jib-boom gone.
Steamer Ruby sprang a leak in a gale outside Chicago.
Tug Sill ran aground in the channel at Kenosha.
Tug Ransom ran aground above Saint Clair Flats Canal.
25.—Scow Champion ran aground in Lake Saint Clair.
26.—Schooner Belle Walbridge, lumber, sprang a leak on Lake Michigan.
27.—Propeller Scotia ran aground at Chicago.
28.—Steam-barge Antelope ran aground at the mouth of Chicago Harbor.
Schooner Oneonta lost mainsail and fore-gaff in squall on Lake Erie.
29.—Steam-barge Inter-Ocean ran aground at Chicago.
30.—Propeller Milwaukee ran aground at entrance to Detroit River.

SEPTEMBER, 1879.

1.—Steamer City of Owen Sound lost rudder and went ashore in a fog near entrance of Georgian Bay.
2.—Schooner Lewis Day, lumber, sprang a leak in gale on Lake Michigan.
In a gale on Lake Michigan, the schooner Driver, was damaged against breakwater at Chicago; schooners Ellinwood and Wells lost portions of canvas; schooner Kitty Grant sprang a leak and lost mainsail; and schooner A. Rust, lumber, went ashore at Michigan City, proving a total wreck; value, $6,000.
3.—Schooner Nassau, wheat, shifted cargo and sprang a leak in gale off Milwaukee.
Schooner Rising Star lost mainmast, mainsail, and small boat in gale on Lake Erie.
Propeller Bertschy, shingles, sprang a leak and went ashore in a gale on Lake Huron; total wreck; value, $11,000.
Barge Manitowoc sprang a leak in gale on Lake Michigan.
Schooner J. B. Kitchen, lumber, twisted rudder stock in gale on Lake Michigan.
Schooner Wm. H. Rounds went ashore in gale on Lake Huron; released.
Schooner D. Wells was blown against the breakwater at Sand Beach and seriously damaged.
Tug Saugatuck lost a raft in gale near Cheboygan, Mich.
Propeller Philadelphia ran aground in Detroit River—leaking.
Schooners M. A. Lyndon, Gulnare, Boody, and Augustus Ford lost portions of canvas in gale on Lake Erie.
Tug Andrews ran ashore in gale at Toledo; released.
Propeller Alice Strong ran ashore near Black River, Lake Erie; released.
Brig Starlight lost mainmast and canvas in gale on Lake Erie.
Tug Syracuse went ashore in a gale at Bay Port, Lake Erie; released.
Schooner J. D. Sawyer lost anchor and 150 feet of cable at Escanaba.
Frank Woolsey, captain of barge Yankee was lost overboard in a gale on Lake Erie.
4.—Propeller Avon, grain and flour, ran aground on the Limekiln Crossing; released, leaking badly.
Schooner Mariner sprang a leak and water-logged on Lake Erie.
Schooner Clara put into Saint Joseph, Mich., with some canvas, jib-boom, and foretop-mast gone.
Schooners St. Clair and Morris put into Southampton, Ontario, with most of canvas gone.
Barge Floretta, corn, sprang a leak in gale on Lake Michigan; cargo damaged.
Schooner L. B. Stone went ashore in gale at Chaumont, Ontario; released, leaking.
6.—Propeller New York ran aground at entrance to Detroit River.
7.—Schooner Three Brothers, coal, ran ashore at North Point, Thunder Bay; released.
Schooner C. G. Breed, coal, lost sails and ran ashore at Nine-Mile Point, Thunder Bay; released, leaking.
Scow Marion Dixon ran ashore in gale at Holland, Mich.; released.
Schooner L. Watson lost mainsail in gale on Saginaw Bay.
Steamer Bengal ran aground at Saint Helen's Shoals, Saint Lawrence River.
Scow Planet had mainmast head sprung on Lake Huron.
8.—Propeller Nyack, schooner S. J. Tilden, and propeller Barnum ran aground at Limekiln Crossing.
Schooner Pride of America, wheat, sprang a leak outside Port Colborne.
Barge C. H. Weeks was towed into Milwaukee, leaking badly.
Schooner W. B. Ogden arrived at Goderich, leaking badly.
Schooner Glad Tidings put into Michigan City with shoe gone and rudder nearly twisted off.

9.—Propeller Duluth became disabled in machinery near the Sault Canal.

10.—Steam-barge Thompson broke down in machinery in gale on Lake Michigan.

Schooner Miami sprang a leak on Lake Erie.

11.—Propeller Delaware ran aground at Chicago.

Schooner Ithaca sprang a bad leak abreast of Milwaukee.

12.—Steam-barge Swan ran aground in the Straits of Mackinaw.

Schooner Harvest Queen ran aground in the mouth of the Sault River; released, leaking.

Schooner Harrison, ore, ran aground on Hog Island, Straits of Mackinaw; released, leaking.

Steam-barge Vanderbilt sprang a leak and water-logged in gale on Lake Huron.

Schooner Kate Farley lost mainsail in gale on Lake Huron.

13.—Tug Crusader damaged machinery in gale on Lake Michigan.

Schooner Nassau broke fore-boom in a blow on Lake Erie.

Barge Rutter ran aground at entrance to piers, Buffalo.

Coasting schooner Alice was driven on the pier in entering Holland Harbor in a gale; total wreck.

14.—Schooner Stafford was blown from dock and driven ashore at Lexington, Mich.; released.

Barge Shiawassee, lumber, was towed into Sand Beach water-logged.

Barge Star of the North sprang a leak in gale on Lake Huron.

15.—Scow Mary Helen, grain, missed the piers and went ashore at Montague, Mich.; total loss.

Steam-barge Saginaw and barges ran aground near Port Huron.

Schooner Argo sprang a leak and sank at Saint Clair, Mich.; raised.

Schooner Nina Bailey broke from tug and went ashore at Ludington, Mich.; released.

Scow Aunt Ruth lost mainmast in a blow on Lake Huron.

16.—Schooners L. M. Perry and Gladiator were damaged in canvas in squall on Lake Erie.

Schooner Wanderer, lumber, ran ashore on the False Ducks, Lake Erie; released, leaking.

Schooner Grant, grain, ran ashore on South Bay Point, Lake Ontario; released.

Propeller Persia lost life-boat and sails in gale on Lake Ontario.

17.—Schooner Montana lost both masts in gale on Lake Erie.

Scow St. Joseph lost foremast and schooner Emma Mayes fore and main masts in gale on Lake Huron.

Schooner Helvetia was blown from moorings against propeller Idaho, at Buffalo; both damaged.

Schooner Wm. Home, grain, lost some canvas in gale on Lake Erie.

Schooners Homer and Felicitous were damaged in spars in gale on Lake Michigan.

Propeller J. J. Clark was towed into Detroit with shaft broken.

Schooner C. J. Magill had canvas damaged in gale on Lake Erie.

18.—Schooner G. P. Heath, lumber, ran ashore at Saint Joseph, Mich.; released in sinking condition.

20.—Schooner Cobb ran aground at entrance to Detroit River.

Steamer Townsend ran aground entering Cleveland Harbor.

21.—Propeller Albion struck bottom and sank in a fog at entrance of Lachine Canal; raised.

23.—Schooner G. Pfister, coal, ran ashore on Middle Island Reef, Lake Huron, in gale; released, leaking.

25.—Propeller Annie Young ran aground in Saint Clair River, near Marine City.

26.—Propeller St. Catherines ran aground at entrance to Lachine Canal; released, leaking.

Schooner Monticello went ashore near Duluth; released.

28.—Steam-barge Jarvis Lord ran ashore on Beaver Island in a fog; released.

29.—Propeller Bismarck had wheel broken, and barge Marinette lost foretop-mast in gale on Lake Michigan.

Schooner Lizzie A. Law lost canvas, and schooner Sunrise lost canvas and sprang a leak in the Straits of Mackinaw.

October, 1879.

1.—Propeller Commodore ran aground opposite Grosse Point, Lake Saint Clair.

2.—Propeller Dromedary, ore, struck a rock and sank in the Welland Canal; raised.

Schooner C. J. Wells arrived at Chicago with most of her canvas gone.

Schooners Van Valkenberg and Lamb ran aground at Limekiln Crossing; the former collided with the drill-scow Far Down; both damaged.

Schooner B. Parsons was disabled by loss of canvas and spars in squall on Lake Michigan.

3.—Barge Hannaford, lumber, was towed on South Sheboygan Point in a fog; released.

Schooners Brightie, H. G. Cleveland, and Timothy Baker, in tow, ran aground in Sault Canal; released, leaking.

Schooner Jane Bell ran ashore on Gull Island, Lake Michigan, in a fog; released, damaged.

Propeller Conestoga ran aground between the harbor piers, Milwaukee.

4.—Schooner Acorn, ore, arrived at Detroit leaking badly.

Schooner Sunrise was towed into Grand Haven leaking badly.

5.—Schooner May Lyon was towed on to North Point Reef, near Milwaukee, in a fog; released, leaking.

Schooner Sam Flint missed stays and went ashore near Mackinaw City; released.

6.—Schooner Reindeer arrived at the Sault with fore and main masts gone.

8.—Steamer Clinton ran aground near Sand Beach in a fog.

Schooner Duncan City lost jib-boom and head gear in collision with schooner Lotus in a fog on Lake Michigan.

9.—Steamer Roanoke went ashore on Point aux Barques Reef; released; jettisoned 500 barrels flour.

Propeller New Dominion ran ashore on False Ducks Island; released, water-logged.

10.—Propeller Niagara, with tow of two barges, ran aground at Toledo; barges collided after grounding and damaged each other.

12.—Propeller Ontario ran aground opposite Port Huron.

Schooners M. L. Collins and Racine, lumber, went ashore at Lincoln Park, Chicago, in a fog; released.

Schooner Tom Sims, lumber, went ashore near Winnetka, Ill.; released.

Schooner King Sisters, ore, went ashore near Highland Park, Ill.; released, leaking.

Schooners Maggie Thompson and Tri-Color collided in a fog on lake Michigan.

Schooner Our Son, ore, ran aground on a reef in Green Bay; released; jettisoned 50 tons of cargo.

13.—Schooner Rising Star, wheat, ran ashore on Grape Island, Lake Ontario, in a fog; released.

14.—Propeller Mineral Rock and barge ran aground in Lake Saint Clair; released.

Schooner C. J. Wells went ashore on a reef near Saint Martin's Island, Lake Michigan; released; jettisoned 6,000 bushels of wheat.

16.—Schooner L. M. Davis went ashore on Pilot Island Reef, Green Bay; released.

17.—Steam-barge Olean ran aground near Fighting Island; released.

Scow Frankie Wilcox, at anchor, parted cable and went ashore in gale at Manistee, Mich.; total wreck; value, $2,500. The cook, J. J. Sullivan, was drowned.

18.—Propeller A. A. Turner struck in channel at Bay City, causing a leak.

Schooner Lem. Ellsworth ran aground at Saint Clair Flats.

Schooner O. M. Bond, coal, struck a reef and sank outside Sand Beach; raised; lost 150 tons of cargo.

Schooner Sam Flint passed Port Huron with squaresail-yard and mainsail gone.

Schooner S. V. R. Watson ran aground at Saint Clair Flats.

Schooner Sasco, lumber, sprang a leak on Lake Huron.

Steamship Eirene ran ashore in Greenish Bay near Quebec; total wreck.

Tug Jno. Owen ran a tow of four schooners aground at Saint Clair Flats.

19.—Propeller Jas. Fisk, jr., ran aground at Saint Clair Flats Canal.

Scow Nellie Winlack went ashore in a gale near South Haven Mich.; released, much damaged.

20.—Schooners Jessie Drummond and Albicore ran aground near Toronto.

21.—Schooner Sligo, grain, went ashore ten miles above Oswego; released.

Scow Humming Bird water-logged and sank at Bay City; raised.

23.—Barge Roscius went ashore on a reef in Niagara River; released.

Schooner S. G. Andrews, lumber, went ashore in a gale at Leland, Mich; released.

Schooner Kate Kelley split sails and had cargo shifted in gale on Lake Michigan.

Schooner E. M. Davidson went ashore on Pilot Island; total wreck.

Steam-barge Tecumseh lost mizzen mast in gale on Lake Huron.

Bark Arabia was disabled by entire loss of spars and canvas in gale on Lake Michigan.

Schooner La Petite missed the piers and went ashore at Port Maitland, Ontario; released.

Schooner Cora, lumber, went ashore at Saint Joseph, Mich.; released.

Schooner E. P. Royce broke steering gear in gale on Lake Michigan.

Schooner L. B. Shephard lost rudder in gale on Lake Michigan.

Schooner Scud, grain, went ashore in gale at South Bay Point; released, badly damaged.

23.—Schooner A. P. Nichols lost foresail in gale on Lake Michigan.
Schooner Gulnare lost foretop-mast in gale on Lake Erie.
Schooner Rumball parted lines at dock and went ashore in gale at Waubaushene.
Schooner Bell Stevens lost most of her convas in gale on Lake Erie.
24.—Schooner H. Rooney, marble, missed piers and went ashore at Charlotte, N. Y.; cook, Ellen, Fisk, drowned.
Tug Mocking Bird broke cylinder and crank-pin on Lake Huron.
Schooner Wm. Jones lost mainmast head in gale on Lake Michigan.
Propeller Mineral Rock was partially disabled by damage to machinery on Lake Erie.
25.—Schooner B. F. Gardner went ashore in gale at Windmill Point, Lake Erie; total wreck, value, $5,000.
26.—Schooner Prince Edward, lumber, ran ashore on Cockburn Island; released.
Schooner Eveline Bates sprang a leak off Manitowoc.
Propeller Buffalo ran aground near Pêche Island, Lake Saint Clair.
27.—Propeller Nebraska was partially disabled by damage to one of her engines in Lake Erie.
Barge Rutter ran aground at Saint Clair Flats Canal.
Schooner Three Belles lost mainsail and stays in gale on Lake Michigan.
Schooner West Wind went ashore in gale below Coburg, Ontario; total wreck; value, $4,000.
28.—Barge H. B. Tuttle lost foremast in gale on Lake Huron.
Steamer Amazon struck on the bar and went ashore in gale at Grand Haven; total loss; value, $60,500; most of cargo of flour and provisions, worth $90,000, was lost.
Schooner Gamecock went ashore in gale at Saugatuck, Mich.; total loss.
Propellor Tuttle lost foretop-mast head in gale on Lake Huron.
Schooner Nellie Wilder lost fore and main masts in gale on Lake Michigan.
29.—Schooner Gracie M. Filer had sails split and center-board broken in gale on Lake Michigan.
Schooner Wm. Sturges lost 25,000 feet of lumber in gale on Lake Michigan.
Barge S. A. Wood lost foretop-mast head in gale on Lake Michigan.
Schooner Jno. Miner broke rudder in gale on Lake Huron.
Steam-barge Wm. Edwards was driven against pier at Cleveland in gale; leaking.
Schooner Shaudon was dismasted in gale off Grand Haven.
Schooner Hungarian water-logged in gale on Lake Michigan.
Schooner Republic had cabin broken in by a heavy sea on Lake Erie.
Scow Curlew, lumber, went ashore on Ballast Island Reef in gale; total wreck.
Schooner Annie Vought sprang a leak in gale on Lake Erie.
Schooner W. W. Gifford sprang a leak and had mainmast sprung in gale on Lake Erie.
Scow Nettie, stone, sprang a leak and sank in gale on Lake Erie; total loss.
30.—Steamer Minneapolis ran aground on the bar at Grand Haven; released, leaking.
Scow Mary Lydia, staves, water-logged and capsized in gale near Kelly's Island.
Schooner Grand Trunk lost all canvas in gale on Lake Erie.
Schooner J. G. Masten had mainmast sprung in gale on Lake Erie.
31.—Propeller Juniata ran aground at Chicago.
Schooner North Star went ashore at Midland, Ontario, in gale; released.

NOVEMBER, 1879.

1.—Schooner Craftsman lost mizzenmast in gale on Lake Huron.
Schooner R. C. Crawford struck on bar entering Saint Joseph, Mich., and sprang a leak.
2.—Schooner Ithaca, lumber, sprang a leak and went ashore in gale at Saint Joseph, Mich.; total wreck.
Propeller Menomonee went ashore in a snow-storm north of Milwaukee; released.
Schooners Island City and Rainbow were seriously damaged by collision in snow-storm at Cheboygan.
Schooner Mineral State, wheat, went ashore in gale on Point Abino, Lake Erie; released, much damaged.
In a gale on Lake Michigan, schoonor Josephine Lawrence lost part of deck-load of shingles; schooner Una lost deck-load of wood; schooner Itasca lost fore-boom; schooner Narragansett lost fore-boom, and sprang a leak; and schooner Brigham sprang a leak.
Barges Uranus and Lone Star, in tow, collided with scow Orphan Boy in snow-storm at Cheboygan; all damaged seriously.
Barge N. J. Glidden lost both anchors and chain in gale on Lake Huron.
Schooner Reindeer, lumber, went ashore in a gale near Chicago; total wreck.
Scow Sandy Morrison went ashore in a snow-storm at South Haven, Mich.

2.—Schooner D. Provost and scow St. Joseph went ashore in a gale at Sand Beach; released.

Schooner Morning Lark went ashore in a gale at Port Austin; released.

Schooner Gold Hunter went ashore in entering Olcott Harbor in a gale; total wreck; value, $5,000.

A sailor named Lee was lost overboard from schooner Elgin in gale on Lake Erie.

Barges Brunette and Wetmore ran aground at Limekiln Crossing.

Barge Almeda sprang a leak in gale on Lake Huron.

Barge Worthington lost foresail in gale on Lake Huron.

Schooner Helena lost topmasts and sprang a leak in gale off Cleveland.

Schooner China went ashore in a gale in Georgian Bay; released.

3.—Schooner B. F. Bruce arrived at Chicago with fore-boom gone and leaking badly.

The following arrived at Chicago after gale on Lake Michigan: Schooner Charlotte Raab, jib-boom gone and canvas damaged; schooner F. L. Danforth, minus mainsail; scow White Oak, leaking; schooner Radical, leaking and canvas gone; schooner Magnolia, two jibs and portion of deck-load of slabs gone.

Passed Port Huron after gale on Lake Michigan: Schooner Ontario, fore-boom, fore-gaff, and part of deck-load of lumber gone; schooner West Side, fore-boom gone; steam-barge Enterprise, part of deck-load of lumber gone.

Propeller Wm. Cowie and tow ran aground near Marine City.

Schooner Attica, lumber, went ashore in gale at Saint Joseph, Mich.

4.—Propeller Conestoga, steam-barges Inter-Ocean and Consort, schooner Guiding Star, steam-barge Chauncey Hurlbut, and barge Northwest ran aground in Lake Saint Clair.

Propeller Passaic and tow and propeller Milwaukee ran aground in Detroit River.

5.—Schooner J. & A. Stronach was damaged in canvas and spars in gale on Lake Michigan.

Schooner Argo ran ashore on Chantry Island.

6.—Steam-barge B. Morley ran aground opposite Port Huron.

Tug Relief with tow of barges ran ashore on Grosse Isle, Detroit River; released.

Scow German was disabled by loss of rudder in gale on Lake Erie.

7.—Schooner J. C. Harrison passed Mackinaw much damaged in spars and canvas after gale on Lake Michigan.

Scow Bay Trader went ashore in trying to make the harbor of Port Bruce, Ontario, in a gale.

Scow Wm. Parks, coal, went ashore in gale on Point au Pelee Island, Lake Erie.

8.—Schooner Grace Murray passed Port Huron with foretop-mast gone.

9.—Schooner Guido, lumber, went ashore in gale at Pierport, Mich.; released, canvas gone.

Barge Florence Lester sprang aleak in gale on Lake Michigan.

Schooner Trumpf, pig-iron, went ashore in gale on Sumner Island; released, leaking badly.

10.—Schooner Spy, brick, went ashore at Oak Creek, Wis.; released, leaking badly.

Schooner Saco, lumber, arrived at Erie water-logged.

Schooner Westchester arrived at Chicago leaking badly.

11.—Schooner Mariner, ties and posts, went ashore in gale near Horn's Pier, Wis.; total wreck; value, $2,500.

Schooner M. A. Muir, grain, ran ashore on North Harbor Reef; released.

Schooner C. H. Johnson ran aground opposite Port Huron.

Schooner Jno. Bean, jr., went ashore in a fog on Grosse Point, Lake Michigan; released.

Propeller Starucca ran aground on Harson's Island, Saint Clair River.

12.—Schooner Maine, lumber, arrived at Milwaukee, leaking.

Schooner C. K. Hines, wheat, went ashore in a fog near Point Abino; released.

Barge Argonaut lost portion of canvas in squall on Detroit River.

Schooner Jessie was blown from anchorage at Limekiln Crossing and driven ashore; released.

A sailor, name unknown, was lost overboard from schooner Our Son in gale on Lake Erie.

Schooner Plow Boy, salt, went ashore in gale at Charlotte, Mich.

Schooner Minnie Blakely was disabled by loss of sails in gale on Lake Huron.

14.—Schooner C. G. Breed, wheat, was struck by a squall on Lake Erie, causing her to capsize and sink; vessel and cargo (24,000 bushels) a total loss; value of vessel, $6,500. Mate William Vincent, Second-Mate James B. Smith, Seamen John McCloud and James Lawler, and Cook George Fenton were lost.

Schooner Jessie Drummond lost jib-boom in a squall on Lake Erie.

Schooner Gosshawk lost portion of canvas in gale on Lake Erie.

16.—Schooner Hattie Howard, lumber, went ashore in gale at Oswego; total wreck value, $4,500.

Schooner David Vance ran aground at the head of Pêche Island.

16.—Schooner Bertie Calkins went ashore in a gale at Manistee, Mich.; release.

Schooner Sasco suffered damage in canvas and spars in gale on Lake Erie.

Schooner Ontonabee, lumber, water-logged in gale on Lake Huron.

Schooner New Dominion, lumber, sprang aleak in gale on Lake Michigan.

Schooner Queen City sprang aleak, lost rudder, and fore and main masts in gale on Lake Huron.

17.—Scow Ida H. Bloom struck a rock and sank near Clay Banks Wis.; total loss.

Schooner Sasco went ashore in a gale at Fairport, Lake Erie; total loss; value, $4,000.

Schooner Dauntless, stone, went ashore on Snake Island Shoal; released.

Tug Seymour, with four small tugs, two derricks, and ten scows in tow, were caught in gale on Lake Erie—three tugs and two derricks sunk—ten scows ashore; value of property lost, $10,000; six lives were lost.

19.—Propeller Hurd ran ashore near Skillagalee, Mich.; released after jettisoning 250 kegs of beer.

Scow Clara Parker ran ashore in gale near Chicago; released.

Schooner D. S. Andrews lost fore-yard in gale outside Chicago.

Schooner Wallin went ashore in gale near Holland, Mich.; total loss.

Scows Maple Leaf and Rose; schooners Mystic, Margaret Dall, C. O. D. and J. A. Holmes went ashore in gale at Grand Haven; Maple Leaf a total loss; others released in damaged condition.

Schooner Howlett lost foresail in gale on Lake Michigan.

Schooner Luckey missed the piers and went ashore in gale at Manistee, Mich.; released.

Schooner North Star ran ashore in gale at Little Sturgeon Bay; total loss; value, $3,500.

Schooner Alvah Bradley lost most of her canvas in gale on Lake Michigan.

Schooner Yankee Blade lost both anchors and chain at Sand Beach.

Tow-barge Dolphin went ashore in gale, near Port Huron.

Tug J. P. Clarke capsized near Belle Isle, Detroit River; Mrs. Ray, cook, was drowned.

Steam-barge Whiting, schooners Bahama and Hutchinson, and barges Prairie State, Lewis Wells, and Wm. Raynor struck on reef in a gale at Sand Beach; the Whiting and Hutchinson sank; Wells and Prairie went to pieces; Jno. Wood, Wm. Little, Robert Ogden, J. Woods, ——— Hayes, and an unknown man were drowned.

Schooner J. B. Merrill lost two anchors in gale on Lake Huron.

Schooner Mercury ran aground in gale near Pentwater, Mich.; released, much damaged. Henry Hawkins, one of the crew, was drowned.

Barge Mary Birckhead went ashore in gale at Port Huron; released.

Schooners E. B. Hale, Jessie Phillips, and Laura Johnson were damaged in canvas and spars on Lake Michigan.

Barge Wauwanosh went ashore in gale near Sarnia; released.

Steamer City of Detroit had bulwarks broken in and several horses killed in gale on Lake Erie.

Schooners M. Minch and C. H. Minch ran aground in Saint Clair River.

Schooner W. B. Ogden broke from anchorage at Sand Beach and drifted into schooner North Cape; both damaged.

Schooner W. B. Phelps, cargo, 17,000 bushels wheat, went ashore in gale at Glen Haven, Mich.; vessel and cargo a total loss; value of vessel, $10,000; Dan Kelly, captain; George Kelley, Frank Golden, Robert Dorray, and August Boness, of the crew, were lost.

20.—Schooner Alida, wood, went ashore in gale near Manitowoc, Wis.

Schooner Juniata, pig-iron, was struck by a squall entering Cleveland and driven ashore; released.

Schooner Samana, corn, went ashore in a gale at Port Colborne; released, much damaged.

Schooner Frank D. Barker went ashore in gale at Bar Point; released.

Schooner Pinta foundered in gale on Lake Ontario, Gus. Howell, Wm. Quinn, and Jos. Quinn, members of the crew, were lost.

Schooner Dominion went ashore in gale at South Bay Point, Lake Erie; total wreck.

Schooner Gerritt Smith, lumber, went ashore in gale at Big Sodus; released.

Schooner Mixer ran aground on bar at Sturgeon Bay.

Schooner Regina ran ashore on Nine-Mile Point, Lake Huron; released.

Schooner Wacousta, stave bolts, water-logged, and went ashore on Presque Isle, Lake Erie; released.

Schooner Sumatra struck on a pile entering Cleveland in a gale; scuttled and sunk to prevent going ashore; raised, much damaged.

Propeller Ontario, pig-iron, went ashore in gale on Green Island, Lake Erie; released.

20.—Schooner Laura Bell lost all canvas and went ashore in gale near Sault Ste. Marie.

Schooner Two Fannies, iron ore, went ashore in gale at Elk Rapids, Mich.; released, much damaged.

Schooner L. C. Butts was disabled by loss of all canvas in gale on Lake Huron.

Schooner Gen. Worth went ashore in gale at Ludington, Mich.; released.

Schooner Woodduck went ashore in gale on the False Ducks, Lake Ontario; released.

Schooner American, wheat, went ashore in gale on Point Peninsula, Lake Ontario; released.

Schooner Charles Crawford lost mizzenmast and went ashore in gale near Point au Barques light; released.

Schooner Jas. F. Joy was disabled by loss of canvas and spars in gale on Lake Huron.

21.—Schooner Northumberland was dismasted in a gale and capsized near Point Peninsula, Lake Erie; total loss.

Propeller Belleville broke rudder and wheel in gale on Lake Erie.

22.—Schooner Little Belle struck pier and went ashore in gale at Montague, Mich.; total loss.

Propeller Badger State went ashore on Bois Blanc Island in gale; released, leaking.

Scow Curlew went ashore in gale at Alcona, Mich.; total wreck; value, $2,000.

A sailor named Fitzgerald was accidentally killed on schooner Augustus in gale in the Straits of Mackinaw.

Barge J. H. Rutter broke steering gear in gale on Lake Michigan.

Thomas Bucke, sailor on propeller Canada, was lost overboard in gale on Lake Michigan.

23.—Lewis Day, captain of tug Kittie O'Neil, was lost overboard in gale in the Straits of Mackinaw.

Schooner Carlingford, lumber, went ashore in gale near Buffalo; released.

Steamer J. A. Dix sprang aleak and broke stem by striking an anchor at Manitowoc.

Propeller New York struck bar and sank at Ludington, Mich.; raised.

Steamer Waubuno, with thirty persons aboard, foundered in gale on Lake Huron; all hands lost; value of vessel, $8,000.

Schooner Marquis went ashore in gale at Sodus Point; released.

Schooner Northman lost steering gear in gale on Lake Huron.

Schooner Trenton foundered in gale on Lake Erie; value, $5,000.

24.—Tug Edwards sprang aleak and sank in Little Sturgeon Bay; raised.

Schooner Edward Blake, salt, went ashore on Presque Isle, Lake Ontario; released; leaking; cargo, total loss.

Steam-barge S. A. Irish, shingles, arrived at Milwaukee water-logged.

The Bar Point light-ship parted cable and went ashore at Anderton Ont., in gale; released.

Schooner Owasco lost foresail and foreboom.

Schooner J. D. Case lost some canvas, and tug Smith broke steering gear in gale outside Buffalo.

Schooner Winnie Wing lost most of her canvas in gale on Lake Michigan.

25.—Schooner Wells Burt went ashore on Saint Helena Reef, Straits of Mackinaw; released.

Coasting schooner Rival was struck by ice and sunk outside Bay City.

26.—Propeller Milwaukee ran on the beach at Milwaukee; released.

Schooner Sunshine, lumber, was towed into Erie, waterlogged.

Schooner Jos. Paige was damaged in canvas and spars in gale on Lake Huron.

Schooner Warren drifted ashore at Bailey's Harbor; total wreck.

28.—Steamer Keweenaw went ashore in a fog near Colchester; released.

Schooner Mary Collins, coal, went ashore on Point au Sauble; released.

Schooner Montcalm was dismasted in gale on Lake Erie.

Steam-barge A. A. Turner and four barges ran ashore on Turtle Island, Lake Erie; released.

29.—Schooner Florida lost an anchor off Cheboygan.

Schooner Jno. Wesley lost a mast and 10,000 feet of lumber in gale on Lake Erie.

Schooner Delos De Wolf, pig iron, sprang a leak on Lake Michigan.

Schooner Industry sprang a leak and lost nearly all canvas in gale on Lake Erie.

30.—Steam-barge Olean broke crank-pin on Lake Erie.

DECEMBER, 1879.

2.—Schooner L. C. Butts, corn, went ashore in snow-storm near Alpena; released, leaking badly.

11.—Propeller St. Paul struck on a rock at Limekiln Crossing and sprang a leak.

Schooner A. G. Morey arrived at Escanaba with bulwarks gone and canvas down.

13.—Schooner Free Democrat dragged anchors and went ashore in gale at Bailey's Harbor; total wreck.

14.—Scow brig Hill was cut through by ice outside Chicago; sunk in harbor.

15.—Schooner Vanderbilt ran aground in Detroit River.

16.—Schooner Liberty went ashore on south point of Milwaukee Bay in gale; total loss.

17.—Steam-barge Edwards ran aground near Port Huron.

18.—Barge H. & G. was cut through by ice and sunk near Sandusky; total wreck; value, $3,500.

19.—Steam-barge Norman was cut through by ice and sunk at Milwaukee; raised.

21.—Tugs Siskiwit and Amethyst ran on a reef in Lake Superior in a snow-storm; latter a total wreck; George Harris, one of the crew, was lost.

Steamer City of Toledo went ashore in a snow-storm at Hamlin, Mich.; total wreck; value $12,000; miscellaneous cargo, worth $20,000, also lost.

22.—Scow Gladiator lost part of deck load in gale near Milwaukee.

JANUARY, 1880.

5.—Schooner Belle Laurie, wheat, arrived at Milwaukee, leaking.

11.—Steamer Garden City was disabled by damage to machinery on Lake Michigan.

MARCH, 1880.

12.—Steamer Alpena damaged her stem by running against the pier at Milwaukee during a snow-storm.

13.—Propeller Faxton got stuck in the ice in Lake Michigan; released after seven days.

Schooner Ontario, malt, sprang a leak on Lake Ontario.

14.—Chas. Lamont, captain, Chas. Lamont and Palmer Hill, firemen, were drowned by the capsizing of the tug Lamont, outside Ludington, during a snow storm; vessel righted and went ashore.

18.—Schooner Camelia Amsden lost center boom in a gale on Lake Erie.

19.—Tug Jno. A. Griffin ran aground on the reef at the mouth of Niagara River; released.

20.—Scow Laurina arrived at Racine leaking.

25.—Steam-barge Lewis Gilbert, lumber, sprang a leak in a gale on Lake Michigan.

26.—Steam-barge Lothair and consort Corisande ran aground on Colchester Reef in a fog; released.

Propeller Chicago and barge Dictator ran aground on north side of Kelly's Island; both released leaking.

27.—Barge Brunette, in tow, ran aground at the Limekiln Crossing; released without damage.

28.—Schooner Jenny Lind put into Chicago leaking.

Schooner L. M. Mason put into Milwaukee with broken rudder.

Schooner Josephine Lawrence arrived at Chicago leaking.

Scows S. P. Wilson and Granger went on the beach at Michigan City in trying to enter the harbor during a gale. Granger a total loss; value, $1,200; Wilson released slightly damaged.

Two boys were carried adrift in a scow at Toronto, during a gale, and frozen to death.

31.—Tug Castle ran aground in the channel at Bay City; released.

APRIL, 1880.

2.—The propeller Conestoga ran aground in channel at Chicago.

Schooner Julia B. Merrill ran ashore in a fog near Chicago; released.

3.—Schooner Nellie Hammond lost bowsprit in collision with steam-barge Kershaw in a fog off Manistee.

Schooner Selkirk, wheat, went ashore on Long Point, Lake Erie; released.

Barge Norway, lumber, sprang a leak during a gale on Lake Erie.

5.—Steam-barge Mary E. Pringle ran aground at Limekiln Crossing; released.

6.—Steam-barge Inter-Ocean and consort ran aground in the Saginaw River; released.

Fred'k Cook, seaman on the schooner Gosshawk, was knocked overboard in a gale on Lake Michigan and drowned.

Schooner Heatherbell was blown against a dock during a squall at Toledo, making a large hole in her bow.

Schooner Geo. M. Neelon lost jibboom and head gear in a gale on Lake Ontario.

9.—Schooner Swallow was cut through by ice on the Straits of Mackinaw and driven ashore; released.

10.—Schooner D. E. Bailey, corn, went ashore in gale in the Straits of Mackinaw; released.

Schooner E. Fitzgerald damaged by ice in the Straits of Mackinaw during a gale.

10.—Schooners Sunrise and Winslow damaged in spars during a gale in the Straits of Mackinaw.

Schooner Home, salt, went ashore in a gale at Sand Beach; released.

Tow-barge J. H. Rutter ran aground at Saint Clair Flats; released.

During a gale on Lake Michigan, schooner Manzanilla sprang a leak and lost main boom; schooner Bertie Calkins lost portion of deck load; schooner Hellen Blood lost anchor and chain; schooner Genl. Worth lost anchor and chain; schooner Willerd had canvas damaged; propeller Commodore broke rudder, shoe and wheel; schooner Geo. H. Warmington lost nearly all canvas and sprang a leak.

Schooner Porter lost jibboom and some canvas in a gale on Lake Erie.

Schooner Montauk, coal, went ashore above Sand Beach; released.

Schooner D. Andrews, rye, went ashore near Oswego; total loss; value, $10,000.

Oliver A. Dahl, first mate of schooner Elizabeth Jones, was lost overboard during a gale on Saginaw Bay.

11.—Schooners Fellowcraft and W. Y. Emory were blown ashore at Leamington during a gale; released.

Schooner C. A. Kingwen ashore in a gale at Racine; released.

Schooner Annie Thorine went ashore at Manitowoc; total loss; value, $3,000.

Schooner A. J. Rodgers was disabled by loss of canvas in gale on Lake Michigan.

Schooner Ida Keith, corn, went ashore during a gale on North Manitou Island; released.

Schooner W. B. Allen went ashore in a gale at South Manitou; released. Sunk afterwards during a gale while being towed on Lake Michigan. Total loss; value, $13,000.

Barge Hamlet was cut through by ice and sunk in the Straits of Mackinaw; total loss.

Schooners T. Y. Avery and I. N. Foster disabled by loss of canvas and leaking in a gale on Lake Michigan.

Schooner Red, White and Blue lost anchor and chain in the Straits of Mackinaw.

Schooner Hattie Johnson, coal, ran ashore on Goose Island, Straits of Mackinaw; total loss; value, $15,000.

Schooner Belle, lumber, capsized during a gale on Lake Erie; rescued.

Schooners Unadilla and Anna Maria were disabled by breaking steering gear on Lake Michigan.

Propeller Nebraska had a hole broken in her bow by ice in the Straits of Mackinaw.

12.—Schooner J. A. Foster, corn, was towed into Milwaukee disabled by loss of canvas.

Propeller Colorado had a hole made in her bow by ice and sank in the Straits of Mackinaw; raised.

13.—Scow I. M. Hill struck on rock and sank at Manitowoc; raised.

Schooner Truman Moss sprang a leak during a gale on Lake Michigan.

Scow Mocking Bird went ashore at Manitowoc; released, leaking badly.

14.—Schooners J. Kelderhouse and Saveland arrived at Detroit disabled by loss of steering gear.

Schooners Annie Vought and Fred. A. Morse were damaged in canvas and spars during a gale in the Straits of Mackinaw.

Propeller Buffalo lost anchor and chain in gale in South Manitou Harbor.

Propeller Granite State had bulwarks broken in by heavy seas on Lake Erie.

15.—Schooner Cape Horn went ashore on Point Saint Ignace, Straits of Mackinaw; released.

Schooner William Jones went ashore in a gale at Horn's Pier; released.

Schooner W. H. Hawkins, lost mainsail and forestaysail in a gale on Lake Michigan.

Steam barge Antelope had a hole broken in her bow by ice during a gale in the Straits of Mackinaw; jettisoned 3,000 bushels oats.

Barge O. J. Hale lost yawl and 40,000 feet of lumber in gale on Lake Erie.

Schooner Criss Grover went ashore near Au Sable Light, Lake Huron; released, very much damaged.

Schooner Maria Martin, coal, went ashore in a gale near Beaver Island; released.

Schooner Erastus Corning had center-board sprung and lost two jibs during a gale on Lake Michigan.

Schooner Sam. Flint lost large anchor and chain in gale on Lake Michigan.

Scow Marion Dixon sprang a bad leak in gale on Lake Michigan.

Barge Brunette lost foremast, anchor and chain, and suffered damage in canvas during gale on Lake Michigan.

Peter Peterson, captain of schooner Garibaldi, was swept overboard and drowned during a gale on Lake Michigan; vessel dismasted.

Schooner Lotus was seriously damaged in canvas and sprang a leak in gale on Lake Michigan.

Schooner Northman, barley, capsized during gale on Lake Erie; entire crew, eight persons, lost; value, $16,200.

16 —Scow Evergreen went ashore at Milwaukee in a gale; total loss.

Schooner Cuba broke jibboom against the pier entering Milwaukee during a gale.

Stephen Jones was drowned by the capsizing of a boat at Buffalo.

Two boys named Grishaw were drowned by the capsizing of a boat at Bay City.

Schooner Geo. S. Hazard passed Detroit with both anchors gone.

Schooner Exchange, lumber, water-logged in gale on Lake Michigan; rescued.

Schooner H. D. Root ran ashore at Oscoda, Mich., in a gale; released.

Barge Athenian had stern knocked off against dock during a gale at Oscoda, Mich.; sunk; total wreck; value, $5,000.

Propeller Nashua ran aground in Saint Clair River; released.

Schooner Great Western, lumber, was damaged in canvas in gale on Lake Ontario.

Schooner Guido Pfister lost foreboom and gaff and had canvas damaged during gale on Lake Erie.

Steam barge Araxes lost rudder and broke her shoe in gale on Lake Erie.

Schooner O. M. Bond arrived at Toronto with broken shoe and canvas gone.

Tug Prince Alfred was disabled by loss of rudder in Georgian Bay.

Schooner Reed Case had her bow crushed in by ice in the Straits of Mackinaw.

Schooner Jennie Graham, wheat, struck on Duck Island Shoal, Georgian Bay, and sank; total loss; value, $13,500.

17—Schooner New Dominion ran into a pier and sank during a gale at Buffalo; released.

Schooner Saveland was damaged by collision with pier at Buffalo.

Schooners Minnie Slauson and C. C. Barnes were damaged by collision in gale at Buffalo.

Steam-barge Mary Jarecki, struck by ice in Straits of Mackinaw, causing a leak.

18.—The first mate of schooner Gracie M. Filer was lost overboard during gale on Lake Michigan.

Steamer Passport sunk near Lachine, Ont.

Schooner Stockbridge lost her bulwarks and shifted cargo during a gale on Lake Michigan.

19.—Schooner Geo. D. Russell arrived at Detroit, leaking badly.

Schooner Mary E. Perew, corn, went ashore during gale on Long Point Cut, Lake Erie; released.

Schooner Jas. Couch lost most of her canvas in gale on Lake Huron.

Schooner G. C. Trumpf, wheat, went ashore in gale at Long Point Cut, Lake Erie; released.

Schooner Rich'd Winslow lost jigger mast in gale on Lake Erie.

Schooner E. W. Rathbun had rudder-post, rudder, and stearing gear broken in a gale on Lake Erie.

Scow Glasgow dragged anchor and went ashore in gale at Belleville.

20.—Schooner Josephine dragged her anchor and went ashore during a gale at Kingsville.

21.—Schooner B. F. Bruce reached Chicago disabled by loss of canvas.

22.—Schooner Stampede struck the bar at entrance to Sheboygan Harbor and went ashore during gale; released.

Life-boat, going to assistance of vessel ashore at Sheboygan, capsized; rescued.

Yacht Lottie Blair was dismasted in squall on Lake Erie.

23.—Robert Morrison, William Sayers, Dennis Dugan, James Pottinger, Walter Petherbridge, and James Nantau, members of the life-saving crew at Huron City, were drowned in attempting to rescue the crew of a stranded vessel.

Scow J. H. McGruder sprang a leak and went ashore near Huron City; released.

Propeller Wissahickon ran aground in Saint Clair River at the head of Harson's Island; released.

Schooner West Side arrived at Chicago with anchor and yawl gone.

Schooner Grace Murray, grain, sprang a leak during gale on Lake Erie.

24.—Schooner M. A. Hall lost most of her canvas in gale on Lake Erie.

Scow Mary E. Packard struck on a reef near Racine, causing a serious leak.

Schooner General Worth sprang a leak and water-logged on Lake Michigan.

25.—Schooner Truman Moss was towed into Chicago water-logged.

26.—Schooner Lone Star was struck by a squall and dragged her anchor at Oakville, Ont.; lost anchor, chain, staysail, and foresail.

27.—Barge Minnehaha, iron ore, ran ashore on Beaver Island in a fog; released.

Schooner A. H. Moss went ashore on Peninsula Point, outside Erie; released.

29.—Propeller Chicago ran aground in Saint Clair River, abreast of Port Huron; released.

Schooner Venus, limestone, ran ashore on North Manitou during a snow-storm; released.

30. Schooner Prince Alfred dragged anchor and went ashore at Collingwood, Ont.; released.

MAY, 1880.

6.—Bark Alexander was towed into Amherstburg leaking badly.
7.—Propeller City of Winnipeg had rudder twisted by ice and lost smoke-stack in gale on Lake Superior.
Schooner Margaret A. Muir was dismasted during a gale on Lake Michigan.
8.—Tug Livingstone, with tow of barges, ran ashore near Rocine; released.
10.—Schooner Harvest Queen, wheat, ran on a shoal entering Kingston in a fog; released.
11.—Tug Alpena disabled by breaking the main bearing of shaft in Lake Erie.
12.—Schooner Zach. Chandler ran aground near Grosse Point, Lake Saint Clair; released.
13.—Schooner Mary Hattie was towed into Sand Beach in a sinking condition.
Steamer City of Cleveland ran on Fighting Island, Detroit River; released.
Schooner Gladstone, wood, arrived at Detroit leaking badly.
Schooner Selkirk lost foremast head in squall on Lake Huron.
Steam barge Florence sprang a bad leak on Lake Saint Clair.
14.—Steam barge Trader was disabled in machinery on Lake Michigan.
Schooner Augusta, corn, ran aground on North Harbor Reef, Lake Erie; released.
15.—Tug Martin Green was towed into Chicago disabled in machinery.
18.—Schooner Rising Star was towed on reef near Port Hope, Mich., during smoky weather; released.
Scow Milton lost foretopmast in a squall on Lake Michigan.
19.—Schooner Margaret Ann sprang a leak and lost some canvas during a squall on Lake Erie.
Scow Alvina lost fore and main mast and jib-boom in squall on Lake Huron.
Schooner C. J. King ran ashore on Gull Island during thick weather; released.
Schooner Golden Fleece ran ashore during heavy fog at Mackinaw City; released.
20.—Schooner Helvetia ran aground in Lake Saint Clair; released.
Steam barge Graves, coal, ran aground in Detroit River near Sugar Island; released.
Schooner Fame, lumber, ran hard aground on Point Mouilloux Reef, Detroit River; released.
Schooner Emma C. Hutchinson, iron ore, sprang a leak during a gale on Lake Huron.
Propeller Alaska and barge Scott, in tow, ran aground on Shickluna Reef, Lake Erie; released.
21.—Barge Almeda, lumber, went ashore during a gale below Amherstburg, Ont.; total wreck.
Steamer City of Winnipeg ran ashore on Griffith Island near Presque Isle, Ont.; released.
Barge Joseph sprang a leak and water-logged in gale on Lake Erie.
26.—Schooner Wm. Sturgis ran ashore on Plum Island, Lake Michigan, during a dense fog; released.
27.—Sloop Trio, laden with stone, sprang a leak and sank at Belleville, Ont.; raised.
28.—Schooner Trinidad, coal, struck upon reef near Silver Islet Harbor, Lake Superior, causing a bad leak. Sunk at dock; raised.
29.—Schooner C. S. Davis sprang a bad leak north of Milwaukee and was run ashore to keep her from sinking; released.
Schooner Monitor lost mainsail in a blow in the Straits of Mackinaw.
30.—Schooner Guelph, ore, struck the pier in entering Fairport, O., in a storm and sank; raised.
Scow Wona was dismasted in a squall on Lake Huron.
Scow Planet sprang a bad leak in a gale on Lake Michigan.
Schooner Sligo, lumber, struck on the Magnetic Shoals, Lake Huron, and sank; raised.
31.—Schooners Erie Queen and Erie Stewart, in tow, were seriously damaged by collision in a gale on Lake Erie.
Schooner Eagle Wing lost her boom in a gale on Lake Erie.

JUNE, 1880.

2.—Schooner Kate Winslow, in tow, was driven upon the river bank during a squall at Milwaukee and had her jib-boom broken.
3.—Scow D. Kelly struck on a snag near Turtle Light and foundered. Louis Barfield, one of the crew, was drowned.
Schooner Cornelia Amsden sprang a leak on Lake Erie.
4.—Schooner Porter lost mainmast, foremast, and mizzen topmast, and most of her canvas during a violent squall off Milwaukee.
Schooner Jas. Garrett was dismasted in a violent squall near Milwaukee.

5.—Schooner Annie O. Hanson lost a jib in a squall on Lake Michigan.
Steam barge Havana rolled her smoke-stack out crossing Saginaw Bay in a gale.
Schooner Resumption was damaged slightly by collision with schooner Columbia in a fog on Lake Michigan.

6.—Schooner D. A. Van Valkenberg was completely dismasted and sprang a bad leak in a gale on Lake Michigan.
Barge D. K. Klint struck on the Limekiln Crossing, causing a serious leak.
Schooner Kate Richmond lost foretopmast in a gale on Lake Erie.
Schooner Mary L. Higgie lost mainmast, foretopmast, and a large portion of her canvas in a squall off Milwaukee.
Barge Wolverine water-logged and lost 20,000 feet of lumber in a gale on Lake Erie.
Barge Carney lost mainmast in a gale on Lake Erie.
Schooner J. M. Forrest was blown against a pier at Sturgeon Bay and had her side crushed in.
Schooner J. I. Case lost jibboom in a gale on Lake Erie.

7.—Schooner Joseph Page arrived at Chicago with broken center-board.
Schooner M. C. West lost foremast and maintopmast in a squall on Detroit River.

8.—Schooner Laura arrived at Chicago damaged in spars and canvas.
Schooner G. D. Morris arrived at Chicago minus some canvas.
Schooner J. P. Tracy put into Frankfort, Mich., leaking badly.

11.—Schooner Coral was run into by propeller Favorite in a fog on Lake Michigan.
Schooner Nellie Hammond was struck by a squall and capsized in Lake Huron; righted.

12.—Schooner Eliza Quinlan ran ashore near Oswego in a fog; released.

14.—Schooner Milwaukee Belle damaged steam-barge Brittain by collision in a gale at Chicago.
Schooner Wm. Jones lost some canvas in squall on Lake Michigan.
Schooner Mary Anne Dixon was capsized in a gale off Kenosha. Drifted ashore and proved a total loss; value, $600.

16.—Schooner C. S. Davis, tan bark, was found in a waterlogged condition outside Milwaukee.

21.—Scow Louisa waterlogged off Middle Bass Island, Lake Erie.
Tug Bislayne broke loose at Put-in-Bay and ran ashore; released.

23.—Schooner Milwaukee Belle went ashore near Escanaba.

24.—Tug Laketon went ashore at Elm Creek on Lake Huron; released.
Tug Hunter ran aground at East Saginaw. In releasing her she was pulled over, causing her to fill and sink; raised.
Schooner Ebenezer, stone, sprang a leak on Lake Huron.

25.—Schooner David Vance lost fore and main masts in a squall on Lake Erie.
Barge Genesee Chief struck on a reef near Tonawanda and sprang a leak.

27.—Schooner Chas. Hinkley was damaged in canvas in squall on Lake Michigan.
Steam-barge Huron City ran aground in Saint Clair River; released.
Schooner A. J. Rogers was damaged in canvas in gale on Lake Michigan.
Schooner Naiad arrived at Chicago with square-sail yard broken.
Schooner Dan Hayes arrived at Chicago with foretopmast gone.

29.—Barge Hannah B. lost anchor and chain at Gibraltar.

30.—Schooner Florida lost maintopmast in a blow on Lake Ontario.
Schooner Fame lost masts, jibboom, and rigging in a squall on Lake Huron.

RECAPITULATION.

Nature of casualty.	1879.						1880.						
	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Aground	18	18	19	16	20	2	0	0	5	5	10	1	114
Ashore	3	8	17	33	90	6	2	0	2	32	6	4	203
Capsized	0	1	0	1	3	0	0	0	1	3	0	2	11
Damage, miscellaneous	13	8	18	12	30	3	0	0	1	32	0	18	144
Damage by lightning	5	2	0	0	0	0	0	0	0	1	1	0	9
Disabled	1	0	1	2	11	1	0	0	2	10	5	2	35
Dismasted	3	3	6	5	5	0	0	0	0	2	4	9	37
Lives lost	1	0	2	0	61	3	0	0	5	17	0	0	89
Sprang a leak	8	5	11	7	12	1	0	0	5	7	3	7	66
Sunk	2	4	3	4	19	3	0	0	0	6	3	0	44
Waterlogged	1	6	2	1	5	0	0	0	0	3	1	3	22

WM. FINN,
Sergeant Signal Corps, U. S. A.

PAPER 47.

List of places for which stations have been requested but not established on June 30, 1880.

Place.	Applicant.	Date.
Huron City, Mich	Board of Trade, Toledo	Jan. 27, 1871
	Board of Trade, Cleveland	Feb. 19, 1871
	Board of Trade, Detroit	Feb. 19, 1871
Richmond, Va	W. G. Turpin	April 3, 1871
Body Island, N. C.	Board of Trade, Norfolk, and resolution of general assembly of Virginia.	April 17, 1871
The Parks of Colorado	E. J. Mallett, late consul-general	May 24, 1871
Staten Island	C. Kentgen, jr	June 9, 1871
	do	June 20, 1871
Chambersburgh, Pa	Hon. J. Scott, United States Senate	June 12, 1871
	Hon. Simon Cameron, United States Senate	June 12, 1871
Watertown, N. Y	L. L. Pratt	June 21, 1871
	Common council, forwarded by mayor	June 21, 1873
	Fred. D. Hills	Mar. 9, 1876
Xenia, Ohio	C. E. Case	June 30, 1871
Port Hope	Board of Trade, Detroit	July 22, 1871
Niles, Mich	J. B. Fitzgerald, secretary of Berrien County Agricultural Society.	July 27, 1871
Louisiana, Mo	W. Stark and R. E. Pleasant	Aug. 3, 1871
Hot Springs, Ark	J. H. Morton, M. D	Aug. 2, 1871
	B. F. Kelley, superintendent	Dec. 10, 1877
Janesville, Wis	J. B. Whiting, M. D., and Rock County Agricultural Society.	Aug. 7, 1871
Hillsdale, Mich	Prof. G. McMillan, secretary of Hillsdale College, Hillsdale County Agricultural Society.	Aug. 6, 1871
Metamora, Ill	Edward Kipp, secretary of Woodford County Agricultural Society.	Aug. 8, 1871
Mount Pleasant, Pa. (Mount Pleasant Academy).	W. H. McCreery, acting principal	Aug. 11, 1871
Nebraska City, Nebr	H. K. Raymond, secretary Otoe County Farmers' Club	Aug. 14, 1871
Peoria, Ill	L. J. Colton	Aug. 11, 1871
	W. H. Herron, J. C. Proctor, and 80 others	Mar. 7, 1876
	Web. M. Samuel, chairman meteorological committee, Merchants' Exchange, Saint Louis.	Mar. 8, 1880
	Hon. E. Wells, M. C., Alex. Smith, and 51 others	April 9, 1880
Princeton, Ill	L. J. Colton	Aug. 11. 1871
Mount Moosilauk, N. H.	Prof. C. H. Hitchcock, A. F. Clough	Aug. 16, 1871
Catasauqua, Pa	Hon. E. McPherson, Clerk United States House of Representatives.	Sept. 11, 1871
Galena, Ill	D. Wilmot Scott, publisher Galena Commercial Advertiser.	Sept. 14, 1871
Columbus, Nebr	J. O. Shannon, secretary Platte County Agricultural Society.	Sept. 5, 1871
Springfield, Mo	John E. Werth, for Greene County Agricultural and Mechanical Society.	Sept. 18, 1871
	A. Milton Lapham	April 6. 1877
Mason City, Iowa	T. G. Emsley, secretary Cerro Gordo County, Agricultural Society.	Oct. 6, 1871
Orono, Me. (State Agricultural College).	M. C. Fernald, Maine State College of Agriculture	Oct. 19, 1871
	L. Libbey, postmaster	Feb. 17, 1873
Balize, La.; Fort Morgan, Ala., and Waco, Tex.	Agents and captains of Morgan Steamship Company	Oct. 31, 1871
Fort Randall, Dak	R. J. Percy, for Missouri Valley Telegraph Company	Nov. 9, 1871
Ann Arbor, Mich. (University of Michigan).	Prof. G. B. Merriman	Nov. 28, 1871
Fountain, Colo	R. F. Long, editor of El Paso Ranchman	Dec. 4, 1871
Vineyard Haven, Mass	Prof. J. E. Hilgard, United States Coast Survey, Daniel W. Stevens, and Rev. Thomas Hill.	Dec. 18, 1871
Cape Ann, Mass	Hon. B. F. Butler, M. C	Dec. 19, 1871
Iowa City, Iowa (State University).	John P. Irish	Dec. 14, 1871
	S. J. Kirkwood	Jan. 6, 1873
	A. D. Schenck, first lieutenant, Second United States Artillery.	July 3, 1875
Manassas, Va	G. C. Round	Dec. 27, 1871
Quincy, Ill	A. H. Hill, secretary National Board of Trade	Jan. 4, 1872
	Hon. J. A. Logan, United States Senate, and 51 others	July 25, 1879
	Hon. J. A. Logan, United States Senate, and J. H. Ralston	Dec. 3, 1879
Dover Point, N. H	John B. Stivens, mayor	Jan. 13, 1872
Wilmington, Del	Board of Trade of Wilmington	Jan. 24, 1872
Additional stations on eastern shore of Lake Michigan.	Hon. H. H. Holt, Michigan legislature	Feb. 11, 1871
Additional stations on mountains of Virginia.	G. C. Wedderburn, secretary Virginia Telegraph Company; L. A. Gobright, Associated Press.	May 17, 1871
Additional stations on western slope of Mississippi Valley.	George P. Plant, W. H. Scudder, R. P. Handy, committee of the Merchants' Exchange, Saint Louis.	July 16, 1871
Monomoy Point, Cape Cod Light, Massachusetts.	R. B. Forbes	Nov. 29, 1871

List of places for which stations have been requested, &c.—Continued.

Place.	Applicant.	Date.
Southwest Pass, Louisiana (Pass à L'Outre).	Thornton A. Jenkins, rear admiral, U. S. N	Mar. 20, 1871
Staunton, Va.; Christianburg, Va.; Bristol, Tenn.; Easton, Pa.; Harrisburgh, Pa.; Winchester, Va.	Jed. Hotchkiss, secretary of the Augusta County Fair, Virginia.	Aug. 15, 1871
Towanda, Kans	M. D. Ellis	Feb. 12, 1872
Black Dome, N. C. (Black Mountain).	William Cain	Feb. 12, 1872
Gallitzin and Altoona, on Pennsylvania Central Railroad.	David Peelor	Feb. 17, 1872
Minneapolis, Minn. (University of Minnesota).	William W. Folwell, president	Feb. 21, 1872
Each of the State agricultural colleges.	J. B. Bowman, regent of Kentucky University, and others.	Feb. 29, 1872
Northfield, Vt. (Norwich University).	Capt. C. A. Curtis	Mar. 15, 1872
Grand Tower, Ill	A. R. Harris, secretary Mutual Aid and Improvement Society, Saint Louis, Mo.	Mar. 21, 1872
Iuka, Miss	Rev. J. T. Freeman (through Hon. George E. Harris, M. C.)	Mar. 25, 1872
Great Natihalee (Bald Mountain, N. C.)	Charles W. Jenks	April 1, 1872
Deposit, N. Y	G. W. Hanford	April 1, 1872
Heilman Dale, Pa	S. P. Heilman	April 1, 1872
Fort Wayne and New Albany, Ind.	F. C. Johnson, chairman meteorological committee, Indiana State Board of Agriculture.	April 12, 1872
Maryland Agricultural College.	A. R. Davis, president of board of trustees	April 19, 1872
	do	June 21, 1872
Auburn, Ala. (Agricultural and Mechanical College of Alabama).	William C. Stubbs, John B. Read, W. H. Jennison	May 14, 1872
Ogdensburgh, N. Y	Hon. W. A, Wheeler, M. C	May 25, 1872
Plattsburgh, N. Y	Hon. John Rogers, M. C	May 28, 1872
Sewanee, Tenn. (University of the South).	John L. Cooper (through Prof. Joseph Henry, Smithsonian Institution).	June 10, 1872
	Hon. W. C. Whitthorne, Right Rev. Alexander Gregg, bishop of Texas, faculty of college, and others.	June 26, 1877
Newark, Del. (Delaware College).	William D. Mackey (secretary of faculty)	June 11, 1872
Beaver City, Utah	Daniel Tyler	July 8, 1872
New Ulm, Minn	Dr. Alfred Muller	July 10, 1872
Aiken, S. C	Hon. F. A. Sawyer, United States Senate, and 16 citizens.	July 16, 1872
	John C. Derby	Sept. 2, 1872
	James Whitall	Mar. 31, 1875
Winona, Miss	A. M. Rafter	July 20, 1872
Eutaw, Ala	W. S. Bird	July 20, 1872
Belfast, Me	George E. Brackett	Aug. 6, 1872
Ithaca, N. Y. (Cornell University).	A. D. White, president, and petition of 75 citizens	Aug. 8, 1872
	Farmers' Club of Ithaca	Nov. 18, 1872
	A. D. White, president of faculty of Cornell University.	Nov. 22, 1872
	Hon. Roscoe Conkling, United States Senate	Jan. 25, 1873
	P. B. Crandell, corresponding secretary Farmers' Club	Feb. 3, 1875
	E. A. Fuertes, department of engineering	Mar. 17, 1875
	E. A. Fuertes, dean	April 17, 1878
	Z. Hazzard Potter	May 7, 1878
	Wm. C. Russell, acting president	Aug. 8, 1878
Carthage, Ill	L. F. M. Easterday and petition of 105 citizens	Sept. 2, 1872
Kutztown, Pa. (Keystone State Normal School).	A. R. Horne, principal	Sept. 13, 1872
Gainesville, Ga	M. J. Stephenson	Nov. 5, 1872
Some point between Leavenworth and Shreveport.	Steamboatmen's convention assembled at Cairo, Ill	Nov. 17, 1872
On plains of Western Kansas and regions to southward and southwestward.	Kansas State Horticultural Society	Dec. 21, 1872
Dallas, Tex	W. A. Jones & Co., W. C. Connor, and 133 others	Dec. 26, 1872
	G. T. Atkins and 242 others	Nov. 25, 1878
	G. T. Atkins	Feb. 28, 1880
	Hon. Olin Wellborn, M. C	Mar. 10, 1880
Parker's Landing, on the Allegheny River.	Resolution of select council of Pittsburgh, transmitting and approving petition of 46 citizens of Pittsburgh.	Dec. 28, 1872
Greensborough, on the Monongahela River.	do	Jan. 10, 1873
Lawrence, Kans (University of Kansas.)	John Frazer, chancellor	Jan. 16, 1873
	Hon. Stephen A. Cobb, M. C., inclosing petition of Alfred Gray, secretary of State Board of Agriculture.	May 6, 1873
Manchester, N. H	Hon. S. N. Bell, M. C., inclosing resolution of New Hampshire State Agricultural Society.	Jan. 21, 1873
Sandwich, Ill	N. E. Ballou (through Commissioner of Agriculture)	Jan. 22, 1873
Detroit, Minn	Daniel Cony	Feb. 2, 1873

List of places for which stations have been requested, &c.—Continued.

Place.	Applicant.	Date.
Dayton, Ohio (National Soldiers' Home).	Hon. Isaac Strohen	Feb. 11, 1873
	Thomas L. Neal, president, and Thomas D. Davis, secretary, Montgomery County Medical Society.	Feb. 1, 1875
Palatka, Fla	J. F. Stone (through Secretary of the Navy)	Feb. 17, 1873
Put-in-Bay, Ohio	H. B. West	Mar. 3, 1873
	H. D. Cooke, governor of District of Columbia	July 17, 1873
	Hon. Charles Foster, M. C., G. W. Dane, and citizens, farmers, and shipowners of the vicinity.	Feb. 21, 1878
Emporia, Kans	Robert Milliken	Mar. 6, 1873
North and west of Galveston, Texas.	Chamber of Commerce (through Hon. John Hancock).	Mar. 6, 1873
Charlottesville, Va. (University of Virginia).	Hon. R. T. W. Duke, M. C	Mar. 2, 1873
Raleigh, N. C	Cotton Exchange, New Orleans	Mar. 30, 1873
Columbia, S. C	do	Mar. 30, 1873
	Hon. John Alexander, mayor, transmitting resolution of city council.	June 11, 1873
	Hon. F. A. Sawyer and petition of 58 citizens, and resolution of city council.	Aug. 5, 1873
Pierce City, Mo	E. P. Lingee, president of board of education	April 9, 1873
Columbus, Miss	Cotton Exchange, New Orleans	Mar. 30, 1873
	Hon H. L. Muldrow, M. C., and 3 others	June 4, 1880
Neshanic Mountain, Somerset County, New Jersey.	J. V. D. Pumyea	April 12, 1873
Vincennes, Ind	W. Hays	June 15, 1873
Salina, Kans	Freeman Kingman, secretary of Patrons of Husbandry and Farmers' Club.	July 17, 1873
	Hon. W. A. Phillips, M. C	April 2, 1877
Alleghanies in North Carolina.	George Warren, jr	July 26, 1873
Carthage, Mo	E. P. Searle and 174 others	Aug. 15, 1873
New Berne, N. C	G. W. Nason, jr	Sept. 13, 1873
Port Townsend, Wash	J. W. Sweeney, general superintendent of Puget Sound Telegraph Company.	Sept. 30, 1873
	Maj. William G. Morris, special agent Treasury Department.	Mar. 8, 1878
	Thomas P. Minor, president of the Puget Sound Telegraph Company.	Dec. 16, 1878
	G. A. Weed, mayor of Seattle	Dec. 17, 1878
	Maj. G. L. Gillespie, Corps of Engineers	Mar. 5, 1880
Mineral Point, Wis	Hon. T. O. Howe, United States Senate; M. M. Strong	Dec. 16, 1873
Latitude 40° 30′, longitude 74° 42′; Somerset County, New Jersey.	Hon. F. T. Frelinghuysen, United States Senate; citizens of Somerset, Hunterdon, and Middlesex Counties.	Dec. 22, 1873
Carlton, Wis	Edward Bach, farmers and shipowners of the district	Jan. 10, 1874
	Hon. Philetus Sawyer, M. C.; Edward Bach	Jan. 26, 1874
Fernandina, Fla	Henry Hazen, collector; W. S. Simmons, first lieutenant, U. S. Revenue Marine.	Jan. 17, 1874
	Hon. S B. Conover, United States Senate; G. Stark, mayor; Isaiah Winch, president of council, and 22 others.	Jan. 19, 1874
	D. L. Yulee	Feb. 7, 1874
	Hon. D. L. Yulee (through Lieut. J. McClellan, A. S. O., and inspecting officer.	Mar. 2, 1880
Oakland, Cal. (University of California).	J. West Martin, secretary of board of regents	Feb. 12, 1874
Fayetteville, Ark. (Arkansas Industrial University).	Hon. A. S. Prather, trustee	Feb. 17, 1874
Beatrice, Nebr	Hon. P. W. Hitchcock, United States Senate; A. S. Paddock.	Mar. 3, 1874
One or more stations in Arizona.	Charles Denison, M. D	Mar. 16, 1874
Manistee, Mich	Hon. J. A. Hubbell, M. C.; L. T. Estis	Mar. 18, 1874
	T. J. Ramsdell, deputy collector	April 4, 1879
	M. Engelmann	Mar. 8, 1880
Gorham, N. H	Elias S. Mason	Mar. 30, 1874
Mason City, Mo	J. F. Benjamin, Brown and Sheppard, E. B. Van Vent, and 33 others.	Mar. 30, 1874
Rome, Ga	Thomas J. Perry, chairman meteorological committee Rome Agricultural, Horticultural, and Mechanical Fair Association.	April 24, 1874
	do	Jan. 21, 1875
	do	Dec. 4, 1875
	Hon. W. H. Felton, M. C	Mar. 31, 1876
	Henry A. Hills, secretary Chamber of Commerce, Rome, Ga.	Mar. 16, 1877
	Thomas J. Perry, secretary, and H. Harpold, president Chamber of Commerce, Rome, Ga.	July 19, 1878
Kansas City, Mo	Thomas S. Case, P. M	May 1, 1874
Syracuse, N. Y	N. Graves, mayor; William Kirkpatrick, J. R. Whitlock, and J. B. Hill.	May 9, 1874
	Hon. R. H. Duell, M. C	May 11, 1874

List of places for which stations have been requested, &c.—Continued.

Place.	Applicant.	Date.
Bakersfield, Cal	A. C. Bratton, M. D.; P. D. McClanohon, M. D	May 14, 1874
Palmyra, Wis	John C. Minton	May 19, 1874
Crawfordsville, Ind. (Wabash College).	Col. H. B. Carrington, U. S. A., chairman military science, Wabash College.	June 6, 1874
Calais, Me	Hon. Eugene Hale, M. C.; Boardman Brothers	June 16, 1874
Fort Thompson, Dak	Col. D. S. Stanley	June 18, 1874
Chatawa, Miss. (College of the Redemptionist Fathers).	Alexander W. Gordon	July 13, 1874
Ellsworth, Kans	Hon. W. A. Phillips, M. C	July 14, 1874
	M. W. Henry	July 21, 1874
Mount Lake or Bald Knob, Giles County, Virginia.	Mrs. H. Haupt	July 21, 1874
Camden, N. J. (the River Iron Works).	Wood, Dialogue & Co	July 29, 1874
Bloomington and Decatur, Ill.	E. A. Gastman, chairman meteorological committee, Macon County Fruit Growers' Association.	Aug. 30, 1874
Mount Kearsarge, Warner, N. H.	John Eaton, Commissioner; Hon. N. G. Ordway; Hon. W. E. Chandler.	Oct. 28, 1874
Ceredo, W. Va	S. A. Forbes	Nov. 21, 1874
	Frank Hereford	June 10, 1876
Astoria, Org	Hon. J. H. Mitchell, United States Senate	Nov. 29, 1874
	do	Jan. 18, 1878
	do	Mar. 30, 1878
	Aug. C. Kinney, secretary of Chamber of Commerce	July 20, 1878
	do	April 2, 1879
	Hon. James H. Slater, United States Senate; E. C. Holden, secretary of Chamber of Commerce, Astoria.	Feb. 6, 1880
	Aug. C. Kinney, chairman meteorological committee, Astoria Chamber of Commerce.	Mar. 4, 1880
Fond du Lac, Wis	Hon. C. A. Eldridge, M. C.; J. W. Carney	Dec. 15, 1874
Corpus Christi, Tex	H. Taylor, postmaster	Jan. 4, 1875
	do	Jan. 15, 1875
	Hon. G. Schleicher, M. C.; William Headon, mayor; R. I. Denney, secretary of city; J. P. Rodney, and 3 others.	Aug. 24, 1876
Lansing, Mich. (Michigan State Agricultural College).	R. C. Kedzie, professor of chemistry, &c	Jan. 12, 1875
Pana, Ill.	E. C. Reese, postmaster	Jan. 17, 1875
Columbus, Ga	Hon. H. R. Harris, M. C	Jan. 19, 1875
	do	Jan. 20, 1876
Salisbury, N. C	Hon. W. M. Robbins, M. C	Jan. 20, 1875
Hartford, Conn	G. H. Kingsbury, chairman meteorological committee, Tolland County Agricultural Society.	Jan. 21, 1875
Oshkosh, Wis	T. Floyd Woodworth, M. D	Jan. 22, 1875
Ames, Iowa (Iowa State Agricultural Society).	J. K. Macomber, professor of physics	Jan. 23, 1875
Mount Anthony, Bennington, Vt.	G. W. Robinson	Jan. 27, 1875
Fortress Monroe, Va	Hon. James H. Platt, jr., M. C.; —— Phœbus, —— Watkins, and —— Wright.	Feb. 8, 1875
Afton, Iowa	Hon. James W. McDill, M. C.; N. W. Rowell, W. R. Roberts, and 12 others.	Feb. 17, 1875
Mount Pisgah, Bradford County, Pennsylvania.	R. Reddington	Mar. 2, 1875
Jacksonville, Ill	Hon. John A. Logan, United States Senate; G. V. Black, Samuel H. Martin, and H. G. Whitlock.	Mar. 15, 1875
Ironton, Ohio	Albert Lawson, W. T. McQuigg, and 24 others	Mar. 25, 1875
Isles of Shoals, New Hampshire.	John R. Poor, J. Albert Walker, John Walker, and 7 others	Mar. 25, 1875
	Dr. H. I. Bowditch, member of National Board of Health	Sept. 10, 1879
Saint Augustine, Fla	James Whitall	Mar. 31, 1875
	Hon. C. W. Jones, United States Senate; Lieut. Col. F. T. Dent, and 17 others.	Mar. 5, 1880
Abingdon, Ill. (Abingdon College).	D. S. Harris, professor of natural sciences	April 1, 1875
Hingham, Wis	Charles Rogers and F. A. Balch, meteorological committee, Farmers' Club of Hingham.	April 19, 1875
Three or four additional stations in the interior of Florida.	John P. Wall, M. D	May 6, 1875
Lake Charles, La	William Meyer, assistant postmaster	June 12, 1875
	D. H. Reese, postmaster	Oct. 15, 1877
Tallahassee, Fla	Hon. S. B. Conover, United States Senate, and 41 others	June 12, 1875
Franklin, Idaho	J. Richardson	July 23, 1875
Lenoir, N. C	Clinton A. Cilley (late brevet lieutenant-colonel and acting assistant quartermaster, U. S. A.)	July 28, 1875
Fort Dodge, Iowa	Frederick Hess	Nov. 4, 1875
Friendsville, Ala	James Pool	Nov. 6, 1875
Greencastle, Ind. (Asbury University).	Alexander Martin, president	Nov. 18, 1875
	Hon. O. P. Morton, United States Senate; Alexander Martin, D. D., president of university.	Mar. 7, 1876
Danville, Va	J. R. Winston	Dec. 13, 1875
	A. M. Wheeler, postmaster	July 15, 1879

List of places for which stations have been requested, &c.—Continued.

Place.	Applicant.	Date.
Cape Henlopen, Del	J. E. Jouett, captain, U. S. N	Dec. 22, 1875
Fulton, Ark	Jay Guy Lewis	Dec. 28, 1875
	Hon. J. B. Elam, M. C.; D. B. Martin, and 24 others	Dec. 21, 1879
Silver City, Idaho; Walla Walla, Wash., and Baker City, Oreg.	Hon. T. W. Bennett, delegate from Idaho	Feb. 9, 1876
Carson City, Nev	Hon. John P. Jones, United States Senate; Hon. William Sharon, United States Senate; Hon. William Woodburn, M. C.; the governor and numerous other State officials of Nevada.	Mar. 6, 1876
Paw Paw, Mich	E. E. Rowland	April 3, 1876
Carlisle, Pa	William H. Cooke	May 4, 1876
Fairbury, Nebr	Will W. Watson, civil engineer	May 12, 1876
Sault Ste. Marie, Mich	Samuel B. W. Covell	May 20, 1876
	Hon. J. A. Hubbell, M. C.; Guy H. Carleton, deputy collector of customs, and 3 others.	April 22, 1880
Kelly's Island, Ohio	D. K. Huntington, deputy collector of customs	May 25, 1876
	James Monroe, M. C.; R. K. Winslow, and 102 others	Dec. 17, 1879
Three Rivers, Mich	John Anable	May 30, 1876
Moffat, Tenn	John Francis	June 29, 1876
University of Missouri	Colonel Rollins (through Hon. J. Eaton, Commissioner of Education).	July 17, 1876
Bald Knob, Giles County, Virginia.	William Terry; Mrs. H. Haupt	Dec. 22, 1876
Stowe, Vt	A. C. Stickney, civil engineer	Dec. 22, 1876
Alfred Centre, N. Y. (Alfred University).	H. E. Coon	Jan. 12, 1877
Anchorage, Ky. (Forest Academy).	Col. J. H. Current	Mar. 31, 1877
Monticello, Iowa	M. M. Moulton, city marshal; F. I. Tryon, mayor; M. W. Herrick, city attorney.	April 15, 1877
Reed's Landing, Minn	T. B. Wilson & Co	June 25, 1877
Ocracoke, N. C	Thomas L. Tilton, M. F. Nelson, and 17 others, shipmasters, pilots, &c.	June 29, 1877
Ripon, Wis. (Ripon College).	Hon. P. Sawyer, C. A. Kenaston, secretary	July 21, 1877
	Prof. C. A. Kenaston	Feb. 5, 1878
	do	Feb. 29, 1878
Cheyenne Wells, Cal	L. M. McLane	July 27, 1877
Judsonia, Ark. (Judson University).	Hon. A. H. Garland, Prof. Hubert M. Skinner	Aug. 18, 1877
	J. H. Wymer, voluntary observer	July 6, 1878
Statesville, N. C	William M. Robbins, M. C.	Nov. 17, 1877
	do	Jan. 29, 1879
Bar of Saint John's River, Fla.	F. Jordan, chairman meteorological committee, Merchants' Union.	Jan. 28, 1878
"The Vista," N. Y. (Catskill Mountains).	Prof. Samuel E. Rusk	Feb. 6, 1878
Algona, Iowa	P. Dorweiler	Feb. 14, 1878
South Pass ("The Jetties"), Mississippi River.	Thomas C. Anderson, acting collector of customs, New Orleans, La.	Mar. 4, 1878
Thomasville, Ga	D. S. Brandon	Mar. 18, 1878
	Dr. John T. Metcalf	July 16, 1878
Amherst, Mass. (Massachusetts State Agricultural College).	Lieut. C. A. L. Totten, Fourth Artillery, acting signal officer.	Mar. 30, 1878
	W. S. Clarke, president	Mar. 30, 1878
Ahnapee, Wis	C. H. Haskins, superintendent Northwestern Telegraph Company.	April 12, 1878
	Hon. T. O. Howe, United States Senate; W. H. Syemour, Charles D. Robinson, and 28 others.	May 23, 1878
	Hon. T. O. Howe, United States Senate, and 24 others	Aug. 5, 1878
Eagle River (north side of Point Keeweenow), Lake Superior.	J. T. Whiting, general agent, Lake Superior Transit Company.	May 1, 1878
	Leopold and Austrian, proprietors Lake Superior People's Line of Steamers.	May 2, 1878
"The Jetties," Mississippi River.	J. B. Eustis, United States Senate, James J. Stewart	May 21, 1878
Grayville, Ill	R. W. Townshend, M. C.; J. G. Stokes, M. D	June 7, 1878
Starkey, N. Y	H. L. Jennison	Aug. 8, 1878
Roan Mountain, N. C	J. M. Thornburgh, M. C.	July 19, 1878
Mount Mitchell, N. C	R. B. Vance, M. C.	Aug, 29, 1878
Carbondale, Ill. (Southern Illinois Normal University).	Robert Allyn, principal; Capt. T. J. Spencer, U. S. A.	Oct. 1, 1878
	Hon. J. A. Logan, James Robarts, secretary, and G. F. Foster, professor of physics.	Oct. 2, 1878
Seattle, Wash	G. A. Weed, mayor, and 22 others	Oct. 26, 1878
Doboy Island, Ga	E. F. Bryan, superintendent Savannah Cotton Exchange	Jan. 25, 1879
South Saint George, Me	Hon. S. D. Lindsey, M. C., Franklin Trussell	Feb. 6, 1879
Beaufort, N. C	Hon. A. M. Waddell, M. C., John D. Davis, D. S. Boone, and 87 others, citizens of Beaufort.	Feb. 10, 1879
Overlook Mountain, N. Y.	James Smith	Mar. 7, 1879
Fargo, Dak	Hon. G. E. Spencer, United States Senate; Hon. E. Tyler; and A. W. Edwards, proprietor Fargo Republican.	Mar. 3, 1879
Whitehall, Mich	Francis Smith, C. C. Thompson, postmaster, and 41 others	Mar. 29, 1879
	C. C. Thompson, postmaster	Oct. 6, 1879

List of places for which stations have been requested, &c.—Continued.

Place.	Applicant.	Date.
LaFayette, Ind. (Purdee University).	Hon. G. S. Orth, M. C.	Apr. 14, 1879
Ogden, Utah	George B. Prescott, electrician, Western Union Telegraph Company; W. B. Hibbard.	Apr. 26, 1879
Flagstaff Hill, Mass	N. Bearse, W. W. Hallett, and 109 others	May 2, 1879
Elliott's Knob, Va	Jed. Hotchkiss	May 23, 1879
Northfield, Minn. (Carleton College).	Hon. William Windom, United States Senate	May 28, 1879
Belton, Tex	Hon. S. B. Maxey, United States Senate, Hon. Richard Coke, United States Senate, S. C. Alexander, and 67 others	May 28, 1879
Hummelstown, Pa	Hon. J. W. Killinger, M. C.	June 10, 1879
Swansborough, N. C	D. J. Sanders, W. W. Dennis, and 31 others	Sept. 4, 1879
Butte, Mont	Henry Jacobs, mayor, and 70 others	Oct. 11, 1879
Berkshire Hills, Pittsfield, Mass.	W. T. Bacon	Dec. 20, 1879
Gaylord, Kans	Hon. J. A. Anderson, M. C., T. W. McBride, and 15 others.	Dec. 27, 1879
Summit, Colo., Rio Grande County.	John M. Walker, director Iowa and Colorado Consolidated Mining Company.	Jan. 7, 1880
Leadville, Colo	Hon. J. A. Logan, United States Senate, W. S. Green, W. A. C. Camplin, James L. Clark, and 191 others.	Jan. 17, 1880
Glasgow, Mo	Web. M. Samuel, chairman meteorological committee, Merchants' Exchange, Saint Louis.	Mar. 8, 1880
Winston, N. C	W. O. Shelburn	Mar. 17, 1880
North Fair Haven, N. Y	James G. Knapp, superintendent Southern Central Railroad.	Mar. 30, 1880
Palestine, Tex	Hon. John H. Reagan, M. C., H. M. Hoxie, general superintendent International and Great Northern Railroad, and 2 others.	Apr. 5, 1880
Florence, Ala	Hon. William M. Lowe, M. C	Apr. 20, 1880
Au Sable, Mich	Hon. R. G. Horr, M. C.; Hon. J. W. Glennie, collector of customs, and 33 others.	Apr. 21, 1880
Rolla, Mo. (Missouri School of Mines).	Hon. G. P. Vest, United States Senate, Charles E. Wait, director.	May 5, 1880
Suspension Bridge, N. Y. (Seminary of Our Lady of Angels).	Rev. C. Wotruba, C. M., professor of physics and astronomy.	May 14, 1880
Martha's Vineyard, Mass	Hon. W. W. Crapo, M. C	June 23, 1880

PAPER No. 48.

REPORTS AND OBSERVATIONS UPON THE TOTAL ECLIPSE OF THE SUN, JULY 29, 1878, AS FILED IN THE OFFICE OF THE CHIEF SIGNAL OFFICER OF THE ARMY.

PREFACE.

A collation of miscellaneous reports and observations upon the Total Solar Eclipse of July 29, 1878, was begun August 13, 1878, by order of the late Brig. Gen. Albert J. Myer, Chief Signal Officer, U. S. A. (see special instructions O. C. S. O., No. 70, August 13, 1878), but this work was stopped by his telegraphic order of October 17, 1878.

The work was resumed September 20, 1880, by order of Brig. Gen. R. C. Drum, Adjutant-General and Acting Chief Signal Officer, and was extended to include all data relating to the Signal Service Pike's Peak Expedition, the general report upon which is given precedence in the present volume.

LETTER OF TRANSMITTAL.

OFFICE CHIEF SIGNAL OFFICER,
November 21, 1880.

Brig. Gen. R. C. DRUM,
Adjutant-General, and Acting Chief Signal Officer, U. S. A.:

GENERAL: In obedience to your orders, verbally communicated September 20, 1880, I have the honor to present the accompanying "Collection of Reports and Observations upon the Total Solar Eclipse of July 29, 1878," including therein my Report upon the special Pike's Peak Expedition of the Signal Service.

Very respectfully, yours,

CLEVELAND ABBE,
Professor and Assistant O. C. S. O.

GENERAL REPORT.

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No. 52.—Colorado: Summit Station, C. E. Robins and assistants 871
No. 53.—Dakota: Bismarck, D. T. Flannery 872
No. 54.—Florida: Key West, M. J. Shanefelter 872
No. 55.—Indiana: Indianapolis, C. P. R. Wappenhaus 873
No. 56.—Indiana: Vevay, C. G. Boerner 873
No. 57.—Indiana: Vevay, C. G. Boerner 873
No. 58.—Indian Territory: Fort Sill, John M'Cann 874
No. 59.—Indian Territory: Fort Sill, John M'Cann 875
No. 60.—Indian Territory: Fort Sill, John M'Cann 875
No. 61.—Iowa: Boonesborough, J. R. Lincoln 876
No. 62.—Iowa: Boonesborough, J. R. Lincoln 876
No. 63.—Kansas: Dodge City, W. H. Clendenen 876
No. 64.—Kansas: Empire City, Dr. A. Woodworth 876
No. 65.—Kansas: Fort Leavenworth, B. E. Fryer 876
No. 66.—Kansas: Fort Leavenworth, J. R. Williams 877
No. 67.—Kentucky: Louisville, L. E. Sebree 877
No. 68.—Louisiana: Lake Charles, Wm. Meyer 877
No. 69.—Michigan: Detroit, T. V. Van Heusen 878
No. 70.—Missouri: Frankford, Mrs. M. G. Vermillion 878
No. 71.—Montana: Virginia City, E. McGovern and assistants 878
No. 72.—Montana: Virginia City, E. McGovern and assistants 879
No. 73.—Montana: Virginia City, Dr. I. C. Smith 885
No. 74.— ———: ———, Prof. E. C. Pickering 885
No. 75 —Nebraska: Clear Creek, A. F. Bryant 886
No. 76.—Nebraska: Clear Creek, A. F. Bryant 886
No. 77.—Nebraska: Emerson, Wm. Dunn 886
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2. Virginia City, Mont ... A. J. Bennet.
3. Virginia City, Mont ... F. Kellegher.
4. Coalville, Utah ... T. Bullock.
5. Denver, Colo ... J. M. Bagley.
6. Little Sandy, Wyo ... W. H. Holmes.
7. Pike's Peak, Colo ... H. T. Crosby.
8. Pike's Peak, Colo ... H. H. C. Dunwoody.
9. Lake House, Colo ... C. Abbe.
10. Lake House, Colo ... W. Wiley.
11. Manitou, Colo ... W. W. Nichols.
12. Colorado Springs, Colo ... J. H. Kerr.
13. Colorado Springs, Colo ... A. R. Byrd.
14. Colorado Springs, Colo ... A. Stewart.
15. Colorado Springs, Colo ... L. Ratliff.
16. Colorado Springs, Colo ... E. Curtis.
17. South Pueblo, Colo ... E. S. Nettleton.
18. Clear Creek, Nebr ... A. F. Bryant.
19. Fort Sill, Ind. T ... S. R. Whitall.
20. Henrietta, Tex ... J. J. Mullen.
21. Henrietta, Tex ... J. D. Harston.
22. Henrietta, Tex ... M. Harrold.
23. Jacksboro, Tex ... P. M. Wilson.
24. Graham, Tex ... A. B. Grant.
25. Pilot Point, Tex ... C. F. Reeves.
26. Belmont Farm, Tex ... T. M. Scott.
27. Corsicana, Tex ... N. Cumming.
28. Havana, Cuba ... C. Hasselbrink.

CHAPTER I.

GENERAL HISTORICAL INTRODUCTION.

The knowledge that a total eclipse of the sun would occur on July 29, 1878, and would be visible throughout the United States from Alaska to Cuba, aroused a very general interest in this subject.

A letter of inquiry from Rear Admiral John Rodgers, Superintendent of the United States Naval Observatory, relative to the chances of fair observing weather, and Professor Abbe's report thereon (O. C. S. O., 300 Misc., 1878), dated February 16, 1878, was followed by several verbal discussions, and finally by his report on the instruments needed for the special observations that it would be proper for the Signal Service to undertake at the summit of Pike's Peak on this occasion. This report (O. C. S. O., 357, Misc., 1878), dated February 23, 1878, is appended hereto. (See Chap. II, Document No. 1.)

In pursuance of the matter of selecting localities at which the astronomers of the country could locate themselves with the least chance of being interfered with by clouds and rain, and with General Myer's permission, Professor Abbe made a more detailed study of the past weather record (see his report of April 18, 1878, O. C. S. O., 644, Misc., 1878), an abstract of which is herewith appended, as it is interesting to compare the anticipation with subsequent experience. (See Documents Nos. I and II.)

It having been decided by General Myer that whatever was practicable to be undertaken by the Signal Service observers, without interfering with other imperative duties, should be done, Professor Abbe drew up the instructions that were, with some modifications by General Myer, issued on the 15th April, 1878, to seventeen regular Signal Service stations (see appended copy of order of Lieut. C. E. Kilbourne). (Doc. No. III.)

Subsequently, also, a brief circular (see letter of Professor Abbe, May 29, O. C. S. O., 871, Misc., 1878) was sent by General Myer to all Signal Service stations and correspondents in the neighborhood of the path of totality, a copy of which is herewith appended (see Document No. IV).

The printed instructions of the Nautical Almanac Office were distributed June 5, (see letters sent, vol. 32, page 358—Obs.), and on July 11 those just received from the Naval Observatory were issued and did good service although rather late. A special expedition to Pike's Peak was organized, full details of which will be found in chapter II of this volume.

The orders and requests referred to above as having been sent to regular and voluntary observers of the Signal Service resulted in numerous and interesting replies, a collection of which was, in accordance with General Myer's order of August 13, 1878, made by Professor Abbe in the intervals of his regular official duties between August 13 and October 20, 1878; this work has recently been revised by him, and constitutes the greater part of the present volume.

Although these reports constitute but a small portion of the material that is supposed to exist relative to this eclipse, it is nevertheless considered proper to present in chapter IV some of the general results, while the complete index that concludes the volume will facilitate further studies on the part of those interested in the subject.

[Document No. I.]

OFFICE CHIEF SIGNAL OFFICER, *April* 18, 1878.

GENERAL: I have the honor to submit the accompanying chart and table. The former shows the path of totality during the approaching solar eclipse of July 29, as also the relation thereto of all those stations from which we have received any meteorological reports.

The table shows the number of unfavorable days that may be expected in one month (and the favorable chances for the day of the eclipse) for each station from which the Signal Office has on hand any July or August reports. Those stations from which we have no reports for those months are also included in the table, in order that by a glance you may perceive from which posts we may expect observations of the eclipse, and to which posts instructions should be sent.

I would recommend that sufficient (100) copies be requested of any "instructions" that may be published by the Naval Observatory or the Nautical Almanac Office for the use of amateur observers without telescopes, and that copies be sent to such of our observers at the stations in or near the path of totality as are marked with * or ** in the accompanying table.

Very respectfully, yours,

CLEVELAND ABBE.
A. O. C. S. O.

To the CHIEF SIGNAL OFFICER.

[Document No. II.]

[CIRCULAR.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF SIGNAL OFFICER,
Washington, D. C., April 22, 1878.

The enclosed data, exhibiting the chances of weather conditions favorable for the observations of the total eclipse of the sun on July 29, proximo, at the stations and places named, as deduced from the data collected at this office, are published for the information of all concerned. The list embraces those United States, stations and posts within, or very near, the path of totality. The total number of such points within the path of totality is 36. The total number near the path of totality is 31.

I am, very respectfully, your obedient servant,

ALBERT J. MYER,
Brig. Gen. (*Bvt. Assgd.*), *Chief Signal Officer of the Army.*

Probable chances of fair observing weather at the Signal-Service stations within or bordering upon the path of totality of the solar eclipse, July 29, 1878.

[× indicates station near path of totality; × × indicates station in path of totality; S. S. indicates Signal Service stations; A. M. P. indicates army military posts; Vol. indicates voluntary observers; * indicates abandoned stations.]

Office No.	Stations.	Service.	Latitude.	Longitude.	Altitude.	Number of months examined.	Average number of unfavorable days per month.	Station in totality.	Station near totality.	Percentages of chances of conditions favorable for observations at the time of eclipse.	Abandoned stations.
	WASHINGTON TERRITORY.		° ′	° ′	*Feet.*						
	Olympia	S. S.	47 2	122 56	36	2	3.8	......	....	87	....
I	Fort Colville	A. M. P.	48 40	117 55	1,800	8	5.6	× ×	....	81	....
II	Fort Canby, Cape Disappointment	do.	46 10	124 3	30	8	12.3	......	....	59	....
III	Townsend	do.	48 5	122 46	135	7	6.9	....	....	77	....
IV	Walla Walla	do.	46 6	118	865	4	3.0	......	....	90	....
1	Neah Bay, Port Townsend	Vol.	48 21	124 31	30	2	5.5	......	....	81	*
2	Cathlamette	do.	46 14	123 20	40	6	6.1	......	....	80	*
3	Whatcom	do.	48 45	122 30	100	1	3.0	......	....	90	*
4	Walla Walla	do.	46 3	118 4	870	2	2.2	......	....	93	....
5	Seattle, Port Blakely	do.	47 32	122 32	20	2	16.8	......	....	44	....
	OREGON.										
	Portland	S. S.	45 30	122 28	97	9	8.2	......	....	73	....
	Roseburg	do.	43 10	123 16	537	1	4.5	......	....	85	....
I	Fort Stevens	A. M. P.	46 12	124 1	....	8	8.3	......	....	73	....
II	Camp Warner	do.	42 50	120 10	6,500	1	1.0	......	....	97	*
III	Fort Klamath	do.	42 59	121 43	4,200	7	2.6	......	....	91	....
IV	Camp Harney	do.	....	....	....	6	3.8	......	....	87	....
1	Astoria	Vol.	46 11	123 50	52	5	12.8	......	....	57	*
2	Eola	do.	44 57	123 55	500	6	5.9	......	....	80	....
3	Port Orford	do.	42 4	124 29	....	...	......	......	....	....	*
	IDAHO.										
	Boise City	S. S.	43 40	116 6	2,877	2	2.5	......	....	92	....
I	Fort Boise	A. M. P.	43 37	116 5	2,880	8	2.0	......	....	93	....
II	Fort Hall	do.	43 7	112 30	4,700	4	4.0	......	×	87	*
III	Fort Lapwai	do.	46 20	116 50	....	7	5.0	......	×	83	....
	MONTANA.										
	Fort Benton	S. S.	47 52	110 30	2,845?	7	7.5	......	....	75	*
	Virginia City	do.	45 20	112 3	5,480?	9	8.7	× ×	....	71	....
I	Fort Benton	A. M. P.	48	110 36	2,663	8	7.1	......	....	76	....
II	Fort Shaw	do.	47 30	111 48	....	8	3.9	......	×	87	....
III	Fort Ellis	do.	45 45	110 56	5,800	8	5.3	× ×	....	82	....
IV	Camp Baker	do.	47	111	6,000	8	6.4	×	...	79	....
V	Cantonment Tongue River, or Fort Keogh	do.	46 20	105 40	2,500	2	0.0	......	....	100	....
1	Missoula	Vol.	46 45	113 45	3,300	2	4.0	× ×	....	87	*
2	Fort Sheridan, Muscle Shell	do.	47 25	108 10	2,500	....	......	......	....	......	*
3	Carroll, 20 miles west of Muscle Shell	do.	....	....	....	3	6.7	......	....	78	*
4	Bozeman	do.	45 30	111	....	....	......	× ×	....	......	....
	UTAH.										
	Corinne	S. S.	41 30	112 18	4,240	2	2.8	......	....	91	*
	Salt Lake City	do.	41 10	112	4,362	8	6.1	......	....	80	....
I	Camp Douglas	A. M. P.	40 46	111 53	4,800	7	3.5	......	....	88	....
1	Kanab	Vol.	37 3	112 32	5,500	7	4.0	......	....	87	....
2	Coalville	do.	40 50	111	5,630	3	4.2	......	....	86	....
3	Mount Carmel	do.	37 29	112 15	5,215	3	2.3	......	....	92	....
4	Spring Lake	do.	35 45	116 15	....	1	7.0	......	....	77	*

Probable chances of fair observing weather, &c.—Continued.

Office No.	Stations.	Service.	Latitude.	Longitude.	Altitude.	Number of months examined.	Average number of unfavorable days per month.	Station in totality.	Station near totality.	Percentages of chances of conditions favorable for observations at the time of eclipse.	Abandoned stations.
	WYOMING.		° ′	° ′	*Feet.*						
	Cheyenne	S. S.	41 12	104 42	6,057	10	13.5	......	×	55	....
I	Fort Sanders	A. M. P.	41 13	105 40	7,163	8	8.3	× ×	....	72	....
II	Fort Fred Steele	do.	41 48	107 9	6,640	6	6.4	× ×	....	79	....
III	Camp Brown	do.	42 59	108 52	5,462	7	2.7	× ×	....	91	....
IV	Fort Laramie	do.	42 12	104 30	4,470	5	4.3	......	....	86	*
V	Fort D. A. Russell	do.	41 12	104 50	6,062	4	6.2	......	×	79	*
VI	Fort Bridger	do.	41 18	110 32	7,010	8	4.1	......	×	86	*
VII	Fort Fetterman	do.	42	105 37	5,250	8	4.4	......	....	85	....
VIII	Camp Stambaugh	do.	42 30	109	8,000	8	5.3	× ×	....	82	....
	COLORADO.										
	Denver	S. S.	39 45	105 4	5,269	10	11.9	× ×	....	60	....
	Pike's Peak	do.	38 48	104 59	14,151	8	17.0	× ×	....	43	....
	Colorado Springs	do.	38 55	104 58	....	5	17.8	× ×	....	41	....
I	Fort Lyon	A. M. P.	38 8	103 3	3,800	8	4.6	......	×	85	....
II	Fort Garland	do.	37 22	105 23	8,365	7	5.1	× ×	....	83	....
1	Fountain El Paso	Vol.	38 40	103 40	5,400	1	5.0	× ×	....	83	*
2	Golden City	do.	39 44	105 11	5,593	2	8.5	× ×	....	72	*
3	Fort Collins	do.	40 55	105	5,000	2	8.5	× ×	....	72	*
4	South Pueblo	do.	38 17	104 51	4,630	3	8.0	× ×	....	73	....
5	Hot Sulphur Springs	do.	40 4	....	7,600	4	10.9	× ×	....	64	*
6	Hutchinson	do.	39 32	105 16	8,066	2	22.5	× ×	....	25	*
7	Ula	do.	38 10	105 31	8,017	....	......	......	×	......	*
8	Hermosa, Animas Valley	do.	37 23	107 44	6,715	6	9.3	× ×	....	69	....
9	Silverton	do.	37 46	107 46	9,876	1	3.0	× ×	....	90	*
10	Fort Garland	do.	37 22	105 23	8,365	....	......	......	×	......	*
11	Golden	do.	39 45	105 8	5,618	2	6.2	× ×	....	79	....
12	Estes Park, Longmont Postoffice	do.	40 20	105 20	7,500	....	......	× ×	....	......	*
13	Summit	do.	37 28	106 30	11,300	3	18.2	......	×	39	....
14	Colorado Springs	do.	38 50	104 50	6,000	....	......	× ×	....	......	....
15	Dudley, Park County	do.	39	105	10,500	....	......	× ×	....	......	....
	NEBRASKA.										
	North Platte	S. S	41 8	100 53	2,838	6	10.6	......	....	65	....
	Omaha	do.	41 16	96 00	1,055	10	11.9	......	....	60	....
I	Fort McPherson	A. M. P.	41 33	100 38	2,770	8	5.4	......	...	82	....
II	Sidney Barracks	do.	41	103	....	8	6.8	......	....	77	....
III	Fort Hartsuff	do.	41 40	99 2	2,600	4	8.1	......	....	73	....
IV	Camp Sheridan	do.	42 50	101 45	....	3	3.8	......	....	87	....
1	Emerson	Vol.	40 40	96 10	1,300	5	7.7	......	....	74	....
2	Norfolk	do.	41 55	97 40	....	6	5.3	......	....	82	....
3	Bellevue	do.	41 8	95 50	950	2	6.5	......	....	78	*
4	Santee Indian agency	do.	42 55	97 58	....	4	7.0	......	....	77	*
5	Plattsmouth	do.	41 00	95 53	1,028	7	8.5	......	....	72	....
6	De Soto	do.	41 50	96	1,256	8	10.6	......	....	65	....
7	Clear Creek	do.	41 15	96 24	1,200	7	9.9	......	....	67	....
8	Nebraska City	do.	40 40	95 55	1,000	2	8.5	......	....	72	*
9	Red Cloud	do.	40 5	98 33	1,650	2	6.0	......	....	80	*
10	Howard	do.	40 28	96 3	....	6	6.4	......	....	79	*
11	Richmond	do.	40	100	....	4	7.4	......	....	75	*
12	Genoa	do.	41 27	97 43	....	4	8.4	......	....	72	....
	KANSAS.										
	Dodge City	S. S.	37 39	100 8	2,486	6	9.3	......	×	69	....
	Leavenworth	do.	39 19	94 58	813	10	9.2	......	....	69	....
	Manhattan	do.	39 41	96 32	....	1	8.0	......	....	73	....
I	Fort Hays	A. M. P.	38 50	99	....	8	4.9	......	....	84	....
II	Fort Larned	do.	38 10	99 5	1,932	8	4.9	......	....	84	....
III	Fort Wallace	do.	38 55	101 20	3,318	8	6.3	......	×	79	....
IV	Fort Leavenworth	do.	39 20	95 5	....	6	6.3	......	....	79	....

Probable chances of fair observing weather, &c.—Continued.

Office No.	Stations.	Service.	Latitude.	Longitude.	Altitude.	Number of months examined.	Average number of unfavorable days per month.	Station in totality.	Station near totality.	Percentages of chances of conditions favorable for observations at the time of eclipse.	Abandoned stations.
	KANSAS—Continued.										
			° '	° '	*Feet.*						
V	Fort Riley	A. M. P.	39	96 45	1,300	4	3.1	......	....	90	*
1	Chanute	Vol.	36	96	975	1	3.0	......	....	90	*
2	Lawrence	do.	38 58	95 17	1,025	....	......	......	....	......	*
3	Holton	do.	39 37	95 10	1,172	3	6.8	......	....	77	....
4	Council Grove	do.	38 42	96 32	1,000	1	6.0	......	....	80	*
5	Oakwood	do.	35 15	100 20	....	1	7.0	......	×	77	*
6	Manhattan	do.	39 12	96 40	1,200	3	7.3	......	....	76	....
7	Holden	do.	38	98 10	....	1	5.5	......	....	82	*
8	Belleville, or Centre Mound	do.	39 54	97 40	....	7	4.9	......	....	84	....
9	Burlingame	do.	38 42	95 45	800	5	9.8	......	....	67	*
10	Medicine Lodge, Valley City	do.	37 19	98 41	1,550	....	......	......	....	......	*
12	Le Roy	do.	38 6	95 27	....	4	8.5	......	....	72	*
13	Baxter Springs	do.	37 3	94 37	817	7	6.4	......	....	78	....
14	Atchison	do.	39 32	95 12	1,000	4	8.9	......	....	70	*
15	Independence	do.	37 20	95 40	1,000	3	7.7	......	....	74	....
16	Lawrence	do.	38 58	95 16	884	6	8.0	......	....	73	....
17	Atlanta	do.	38 20	98 18	1,656	5	5.3	......	....	82	*
18	Lawrence	do.	38 58	95 16	884	1	5.0	......	....	83	*
19	Arkansas City	do.	37 4	97 0	....	2	4.0	......	....	87	....
20	Near Pontiac	do.	39	96	....	2	9.0	......	....	70	*
21	Marquette	do.	38 20	97 40	....	0	......	......	....	......	*
22	Belleville	do.	39	97 34	....	1	12.0	......	....	60	*
23	Tonganoxie	do.	39 7	95 10	....	0	......	......	....	......	*
24	Ellinwood	do.	38 22	98 39	1,845?	4	8.8	......	....	71	....
25	Creswell	do.	38 20	97 00	....	4	7.5	......	....	75	....
26	Topeka	do.	39 4	95 40	....	3	7.0	......	....	77	....
27	Stanley	do.	38 45	94 45	....	3	9.0	......	....	70	....
28	Sedgewick	do.	37 50	97 30	1,400	2	8.0	......	....	73	*
29	Burlingame	do.	38 45	95 53	....	2	5.5	......	....	82	....
30	Independence	do.	37 8	95 37	800	2	3.8	......	....	87	....
31	Empire City	do.	37 20	94 30	900	....	......	......	....	......	....
32	Kinsley	do.	37 58	99 46	2,226	....	......	......	....	......	....
	NEW MEXICO.										
	Santa Fé	S. S.	35 41	106 10	6,851	10	12.8	......	....	57	....
	Albuquerque	do.	35 2	106 40	....	....	......	......	....	......	....
	Belen	do.	......	......	....	....	......	......	....	......	....
	La Mesilla	do.	32 17	106 48	....	....	......	......	....	......	....
	Fort Craig	do.	33 42	107 8	....	....	......	......	....	......	....
	Contadero	do.	......	......	....	....	......	......	....	......	....
	Socorro	do.	......	......	....	....	......	......	....	......	....
	Silver City	do.	......	......	....	....	......	......	....	......	....
	Central City, or Fort Bayard	do.	......	......	....	....	......	......	....	......	....
I	Fort Craig	A. M. P.	33 38	107	4,576	8	7.9	......	....	74	....
II	Fort McRae	do.	33 1	107 8	4,500	2	9.0	......	....	70	*
III	Fort Bayard	do.	32 40	108 25	6,000	8	10.3	......	....	66	....
IV	Fort Selden	do.	32 27	106 53	4,250	6	6.4	......	....	79	....
V	Fort Wingate	do.	35 18	108	6,800	8	7.4	......	....	75	....
VI	Fort Union	do.	35 54	104 51	6,835	8	9.8	......	×	67	*
VII	Fort Tularose	do.	33 54	108 30	6,264	2	12.0	......	....	60	....
VIII	Fort Stanton	do.	33 30	105 30	....	....	......	......	....	......	*
1	Las Vegas	Vol.	35 30	105 15	....	2	4.8	......	....	84	*
	INDIAN TERRITORY.										
	Fort Sill	S. S.	34 40	98 30	....	2	3.5	× ×	....	88	....
	Fort Gibson	do.	35 43	95 16	511	10	9.1	......	....	70	....
I	Fort Sill	A. M. P.	34 45	98 40	....	8	4.2	× ×	....	86	....
II	Camp Supply	do.	36 30	99 20	....	4	4.5	......	×	85	*
III	Fort Gibson	do.	35 48	95 20	600	4	9.5	......	....	68	*

Probable chances of fair observing weather, &c.—Continued.

Office No.	Stations.	Service.	Latitude.	Longitude.	Altitude.	Number of months examined.	Average number of unfavorable days per month.	Station in totality.	Station near totality.	Percentages of chances of conditions favorable for observations at the time of eclipse.	Abandoned stations.
	ARKANSAS.										
			° ′	° ′	*Feet.*						
1	Helena	Vol.	34 38	90 12		0					
2	Mount Ida	..do.	34 35	93 40		6	5.3			82	
3	Durham	..do.	36 10	93 43		4	7.6			75	*
4	Hot Springs	..do.	34 30	93 9		2	7.5			75	*
5	Monticello	..do.	33 45	92		2	8.0			73	
6	Hot Springs	..do.	34 30	93 9		0					*
7	Judsonia	..do.	35 12	91 30		0					
	LOUISIANA.										
	Shreveport	S. S.	32 30	93 45	205	10	12.6		×	58	
	New Orleans	..do.	29 58	90 7		10	14.4			52	
I	Baton Rouge	A. M. P.	30 30	91 5		8	9.6		×	68	
1	Point Pleasant	Vol.	32 8	91 3	128	7	7.1			76	
2	Olive Branch	..do.	29 55	91 32	15			× ×			*
3	New Orleans	..do.	29 55	90 5		7	9.4		×	69	
4	Delhi	..do.				1	4.0			87	*
5	Baton Rouge	..do.	30 30	91 10					×		*
6	Shreveport	..do.	32 30	93 45	228				×		*
7	Near Washington	..do.	30 37	92 9					×		*
8	Lake Charles	..do.	30 15	93 15				× ×			*
9	Okaloosa	..do.	32 14	92 14							
	TEXAS.										
	Corsicana	S. S.	32 5	96 30	445	6	7.6			75	
	Galveston	..do.	29 18	94 50	41	9	11.6		×	61	
	Indianola	..do.	28 32	96 38	25	10	7.2			76	
	Boerne	..do.	29 48	98 39	1,333	1	5.0			83	
	Brackettsville	..do.	29 17	100 25	1,026?	2	6.5			78	
	Brownsville	..do.	26 0	97 30		1	7.5			75	
	Cambridge	..do.	33 42	98 0		0					*
	Castroville	..do.	29 25	98 50	676	1	1.0			97	
	Concho	..do.	31 22	100 20	1,750	1	3.0			90	
	Decatur	..do.	33 10	97 30		0		× ×			
	Denison	..do.	33 50	96 40		5	8.7			71	
	Eagle Pass	..do.	28 40	100 15		1	9.0			70	
	Edinburg	..do.	26 3	98 3		0					
	Fredericksburg	..do.	30 20	98 40		0					
	Graham	..do.	33 1	98 27		0					
	Griffin	..do.	32 53	99 21		0					
	Jacksboro	..do.	33 10	98 0		1	2.5	× ×		92	
	Fort Laredo	..do.	27 32	99 26	325	2	3.0			90	
	Mason	..do.	30 42	99 2	1,800	1	4.0			87	
	Fort McKavett	..do.	30 48	99 58		0					
	Pilot Point	..do.	33 20	96 56		0					
	Rio Grande City	..do.	26 22	98 45		3	4.7			84	
	San Antonio	..do.	29 28	98 22		1	4.0			87	
	Stockton	..do.	30 50	102 50	3,000?	1	3.0			90	
	Uvalde	..do.	29 13	99 40		0					
	Henrietta	..do.	33 42	98 0		0					
I	Fort McKavett	A. M. P.	30 50	100	2,060	8	3.1			90	
II	Fort Concho	..do.	31 25	100 17	1,950	7	3.1			90	
III	Post of Austin	..do.	30 18	97 40	465	3	4.7			84	*
IV	Ringgold Barracks	..do.	26 23	98 47		8	4.1			86	
V	Fort Bliss	..do.	31 46	106 41	3,800	6	4.2			86	*
VI	Fort Griffin	..do.	32 50	99 1		8	3.0		×	90	
VII	Fort Richardson	..do.	33 15	98 15	1,800	8	3.8	× ×		87	
VIII	Fort Duncan	..do.	28 50	100 30		8	2.6			91	
IX	Fort Stockton	..do.	30 50	102 55	4,952	8	6.2			79	
X	Fort Brown	..do.	25 53	97 56	50	8	1.9			84	
XI	Fort McIntosh	..do.	27 45	99 50	380	3	2.3			92	*

Probable chances of fair observing weather, &c.—Continued.

Office No.	Stations.	Service.	Latitude.	Longitude.	Altitude.	Number of months examined.	Average number of unfavorable days per month.	Station in totality.	Station near totality.	Percentages of chances of conditions favorable for observations at the time of eclipse.	Abandoned stations.
	TEXAS—Continued.		° ′	° ′	*Feet.*						
XII	Fort Clark	....do....	29 17	100 25	....	7	1.7	......	....	94	....
XIII	Fort Davis	....do....	30 26	106 26	5,234	1	1.0	......	....	97	....
1	Bluff Settlement	Vol.	30	97	....	2	4.0	......	....	87	*
2	Clarksville	..do......	33 37	95 3	343	8	5.4	......	×	82	....
3	Belmont Farm, near Melissa	..do.....	33 8	96 31	722	7	5.8	× ×	....	81	....
4	Mesquite	..do......	32 30	96 30	553	8	3.7	× ×	....	88	....
5	New Ulm	..do......	30 0	96 23	300	8	5.9	......	×	80	....
6	Houston	..do......	29 55	95 6	20	2	7.0	......	×	73	*
7	Eleven miles west of Gilmer	..do......	32 48	94 51	950	8	6.4	......	×	79	....
8	Columbus	..do......	29 43	96 37	....	3	10.5	......	×	65	*
9	Austin	..do......	30 29	97 46	650	3	3.3	......	×	89	*
10	Terrell	..do......	32 30	96 20	....	....	......	× ×	....	......	*
11	Austin	..do......	30 29	97 46	650	3	5.8	......	×	81	....
12	Mesquite	..do......	32 30	96 45	580	....	......	× ×	....	......	*
13	Flatonia, Fayette County	..do......	....	....	....	....	......	......	....	......	....

[Document No. III.]

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL OFFICER,
DIVISION OF TELEGRAMS AND REPORTS FOR THE
BENEFIT OF COMMERCE AND AGRICULTURE,
Washington, D. C., April 15, 1878.

SERGEANT: The accompanying instructions for taking observations during a transit of the planet Mercury, which will occur on the 6th of May, and the solar eclipse, which will occur on the 29th of July, 1878, are furnished for your information and guidance.

You will commence the preliminary practice immediately upon the receipt of the instructions, as specified therein, and continue them until the 7th day of May.

Washington time will be sent to your station at 12 o'clock, noon, from the 1st to the 10th of May, and at 6 p. m. on May 6th, the day of the transit. The observations of the solar eclipse will be taken as directed in the instructions herewith.

You are authorized to hire an assistant on the 5th, 6th, and 7th of May, and 29th, 30th, and 31st of July, if there is none on duty at your station.

Very respectfully,

CHAS. E. KILBOURNE,
First Lieutenant, Second U. S. Artillery, A. S. O. and Assistant.

INSTRUCTIONS RELATIVE TO OBSERVATIONS OF THE SUN, THE TRANSIT OF MERCURY, &c.

1. You will at once choose, or if necessary, prepare a place where the signal service telescope can be so set up as to command a clear view of the east and west and southern sky, or at least those portions occupied by the sun in its daily course from sunrise to sunset.

2. The screw for supporting the telescope must be screwed into a piece of solid woodwork as a post, a door or window frame, or other firm beam, and several places should be available at different points, and on different sides, north, east, south, and west, so that if need be the position of the telescope may be shifted to suit various circumstances, or a small stand may be made by a carpenter, great care being taken to prevent vibration if the wind is blowing, or from any cause, and that the telescope can

be steadily moved to follow the sun in the progress of the phenomenon. To determine these points is essential.

3. The leather straps and caps are to be removed from the telescope and, if possible, a light frame attached to it, as shown in the accompanying figure, after which the tube will be placed in the clamp so as to be nearly balanced, namely, so that neither object-end nor eye-end will have much tendency to settle downward.

4. When firmly clamped at its universal spherical joint, the telescope is to be pointed towards the sun, which may be done without sighting through or along the tube, but simply by observing its shadow as cast upon a sheet of white paper. The tube will be accurately pointed upon the sun when its shadow is a perfect circle, in which position there will also appear upon the same sheet of paper a larger, somewhat brighter circle, which is a magnified image of the field of view, and if the paper be about a foot from the eye-end, there will also be a third very bright circle from two to four inches in diameter, which is an image of the sun's disk. The larger circle, or the field of view, is best seen when the paper is shaded from the direct sunlight by the hand or otherwise.

5. Fasten the sheet of white paper perpendicular to the telescope tube and about one foot back of or behind the eye-end of the telescope, for which purpose the accompanying light frame is provided, to which the paper is fastened by elastic bands so that it can easily be put on and taken off. If you fail to receive this frame, or devise a substitute, the paper will have to be held in the hand. Now slowly shorten or lengthen the telescope by slipping one of its sliding tubes in or out until by careful adjustment you obtain on the paper a very sharply defined image of the sun, namely, one in which the circular edge of the sun appears as clear and sharp as possible and free from blurs or colors. If any small black spots are visible on the sun's disk, then the clearness with which they stand out will indicate the success of this adjustment for focus.

6. The apparatus is now in working order, and arranged about as follows (see figure 1): (Omitted.)

T is the post.

W is the screw and clamp.

O, the object-glass.

E, the eye-end.

F F F′ F′ is the light frame attached firmly to the telescope by wire or string wound around at F′ F′.

F F, the flat plate on which the sheet of white paper or smooth cardboard is held by several elastic bands.

A B represents the lightly illuminated circle having a blue or red border, which is the image of the field of view of the telescope.

C D represents the very bright sharply defined circle which is the image of the sun's disk.

7. The telescope being fixed, the sun's diurnal motion will therefore in a few seconds carry the sun from X to Y, and its image at C D will rapidly traverse entirely across the circle A B and pass away out of sight; but the image may at any time be brought back to the center of the field of view by a slight motion of the telescope tube, in moving which it is best generally to grasp it firmly with both hands, one above and one below the clamp.

PRELIMINARY.

8. As preliminary practice, you will, from this date forward, daily, unless prevented by clouds, at some convenient hour, especially about 10 a. m. and 5.30 p. m., Washington time, make a drawing of the solar disk and of such spots as you may see thereon and forward these weekly to this Office. In making these drawings observe the following rules:

9. Prepare sheets of drawing paper or smooth cardboard by drawing in the middle of each a circle whose diameter is very closely the same as that of the sun's image observed on the paper as before described in section 5.

10. Fasten the paper in its place on the frame, turn the telescope upon the sun, bring the sun's image so as to be concentric with the circle, adjust carefully for focus, see that the sun's sharp edge almost exactly coincides with the circumference of the circle, and if the image is sensibly larger or smaller than the circle note that fact.

11. Allow the telescope and paper to stand still while the sun's image passes across the latter and mark the point P, Fig. 2, (omitted), where the image last touches the circle. This point, P, we shall call the preceding point, and the line S P, drawn from the center of the circle through it, will indicate the direction towards which the sun is advancing. A line, S N, at right angles to this one, and on its north side, points towards the north point of the sun.

12. Move the telescope so as to restore the sun to the center of the circle and by dots and figures indicate the positions, shapes, &c., of each spot then visible, numbering them in succession from the preceding point northward or around the circle. During this

operation the sun's image must be kept central over the circle by moving the telescope with the hand that is not employed in drawing.

13. Again bring the sun to the center and allow it to pass across, and again note the point P, but designate it as P′ (P prime).

14. Write the word north or N. on that side of the sheet of paper which is to the north of the sun's image while the paper is still in its frame.

15. Slip on a fresh piece of paper with inscribed circle, and make an entirely new and independent determination of the points P and N and the solar spots.

16. Enter on each sheet the station, the observer, date, hour, and minute of putting on and taking off sheet and its number, which number should run along continuously, day after day.

TRANSIT OF MERCURY.

17. A transit of Mercury will occur on the 6th of May, beginning at about $10^h\ 4^m$ a. m., and ending about $5^h\ 38^m$ p. m. (Washington civil time), which times, allowing for longitude, will, at your station, become $—^h\ —^m$ a. m., and $—^h\ —^m$ p. m., respectively. Some general instructions in reference to this transit will be found in the accompanying pamphlet (that published by the Naval Observatory), and on this occasion you will execute the following observations:

18. You will determine the correction of your watch, chronometer, or clock, on Washington time by comparison with the time signals telegraphed from Washington at 12 noon of the 5th and 12 noon of the 6th of May, or at such other time as the Western Union Telegraph Company undertakes to give time for the purpose of these observations. This comparison must be made to the nearest second, if your watch has a good second hand, otherwise to the nearest tenth of a minute. Thus: if at the moment you hear the click of the telegraph instrument indicating a given hour, minute, and second, Washington time, the minute hand of your watch is observed at the point intermediate between any two minute marks, you must by the eye subdivide this one minute space into tenths and record the click as received—for instance, as follows:

Washington time, 11^h, 5^m, 0^s, p. m., received by watch at Denver at 9^h, 57.3^m, p. m. This estimation by tenths is easy to acquire by remembering that when the minute hand is midway between two minute marks it is at five-tenths; when at a little less than a quarter it is at two-tenths; when a little more than three-quarters is eight-tenths; a little less than a third is three-tenths; a little more than two-thirds is seven-tenths, &c. If you have no good watch, but can arrange to have the use of a good clock, conveniently situated, then, if possible, arrange with an assistant so that when you at the telegraph instrument or at the telescope call out "time," he will, standing at the clock, observe the corresponding second, minute and hour.

19. At least five minutes before the time the transit is expected to begin you will be in place at your telescope, prepared with pencils, paper, &c., and at least a half dozen sheets of paper with the proper circle drawn on each for observing this, and one sheet of paper, already in place, with the sun's image accurately focused upon it.

20. Five minutes before the expected time of the first contact of Mercury and the sun, you will begin to practice the regular daily operation of determining the point P, towards which the image of the sun moves (see section 11). Make, however, no marks on the paper, but closely watch that portion of the edge of the sun's disk which is midway between the points N and P, where the first contact is expected to take place. The moment that you distinctly perceive that a small, dark, round, planetary spot has begun to indent the sun's disk, note the exact time. It is well to do this as follows: the observer at the glass calls "time," when the assistant accurately notes and records the watch, making a note at the same time with pencil what occurrence the time is for. This indenting is called the first contact, and it is important to observe it as soon after it has commenced as possible. If you have no assistant (one will be secured if possible), you must have your watch conveniently placed directly in front of you; record first the seconds or tenths of minutes, then the minutes and hours, and then a sketch or statement showing how much of an indentation was visible at the recorded moment of time. Resume watching the sun's image until you see that the second contact has taken place, or, in other words, that the round spot is just wholly upon the bright solar disk, the outer edge of it seeming to touch exactly the edge of the sun's disk, and again record the exact time.

21. During all this time the sun's image should have been kept, as near as possible, coincident with the circle you have previously drawn upon the paper, and the place where the first and second contacts appear to occur should have been indicated by pencil marks upon the circumference of the circle; but immediately after recording the second contact you will restore the sun's image to its concentric position, which is when the sun's image on the paper exactly fills the circle you have before drawn thereon; then let the telescope stand still and determine the point P in the regular manner.

22. Inscribe N near the north point as usual, remove the paper, date and number it in regular succession of sun pictures.

23. Insert a new sheet of paper and take a solar picture in the regular manner, showing all visible spots, and including the planet Mercury.

24. Allow this paper to remain in its place, and at such times as may be convenient make a succession of observations showing the points passed over by the planet in its progress across the sun. Each point should be indicated by a small circle drawn around the image of the planet, or by a dot, and should be numbered, and the corresponding moment of time be recorded thus:

Planet at I at 10^h 40.3^m
Planet at II at 10^h 57.1^m
Planet at III at 11^h 30.4^m, etc.

25. If the planet is seen to pass close by, to touch, or to cross any well-defined solar spot, the exact time should be recorded of these contacts.

26. About ten minutes before the third contact—that is, when the front or advancing edge of the planet exactly touches the inner edge of the sun's disk before the planet begins to pass out or off from the sun's disk—note the point P on the sheet of paper containing the path of the planet, remove that paper, number it, and substitute another, on which observe the third and fourth contacts, recording both their times and the place where they occur and the points P and N, precisely, as for the first and second contacts. The fourth contact is when the rear edge of the planet just touches the edge of the sun's disk, the planet having passed from the disk.

27. At 6 p. m. of the 6th inst. compare your watch or clock with Washington time and then send the originals of all these observations to the Chief Signal Officer, retaining carefully prepared duplicates at your station to provide against accident to or loss of the originals.

SOLAR ECLIPSE.

28. A solar eclipse will occur on the afternoon of July 29. The extent and time are given in the accompanying circular and map (published by the Nautical Almanac Office), on which occasion you will make a series of observations. Washington time will be telegraphed to you on the preceding and following nights, and you will determine the correction to your watch on Washington time, the moment and place of the first and fourth contacts of the edge of the sun and moon, as also the contacts between the moon and well-defined solar spots. If the eclipse is total at your station you will also observe the beginning and end of the totality or the so-called second and third contacts. Note also through the glass looking directly at the sun the aureola or "glory" which surrounds the sun and moon; particularly its color, which describe; also whether there are distinct striæ or lines in it, and its shape as a whole, which sketch, showing the round disk in the center and in proportionate size. When the totality is complete take the eye away from the telescope for a minute; note again the aureola, its shape, which sketch, how far it extends from the disk of the sun, stating this by diameter of the sun, as 1½ or other greater or less number; whether there are lines or striæ visible in it, and describe them. Then return to the glass and note the fourth contact or end of eclipse.

29. Particular attention will be given to whatever phenomena can be seen during the few minutes of total obscuration. It is possible that at this time red spots or flames will appear at some portion of the otherwise dark edge of the moon. Note whether the flames are sharp and distinct and the red prominence, as it is called, steady in position, and whether straight striæ or lines extending up from the moon's disk are noticed in any or all of them. Note also whether any of them waver, or flicker, as it is called. These flames are the red prominences to be read of in books of astronomy. Note also whether any of these prominences seem to be separated from the moon's disk by a perceptible space; sketch as many of these as possible, and their different appearance at different times during or after the eclipse. Let no time elapse, but do it on the spot, as the memory may be treacherous. These should be rapidly sketched in their proper places.

Especial attention should be given to searching all around the sun, as far as the field of view will allow, for any figures or markings, rays, cones of light, bright stars, or other phenomena, that can be seen in the darkness; whatever is seen or suspected should be drawn in its proper proportion, lettered or numbered, and fully described in notes to be written subsequently.

30. Further contribution to our knowledge may be secured by inducing such photographic artists as are in the path of totality to point their cameras directly at the sun and draw upon the plate of ground glass such views of the corona as may be depicted thereon during the total obscuration. Photographs are not recommended.

31. The regular daily practice in drawing sun spots will be continued until further orders.

Predicted times of first and fourth contacts, or beginning and ending of the transit of Mercury, May 6, 1878.

Station.	Latitude.	Longitude from Washington.		Washington time of—		Local time of—	
		Arc.	Time.	Ingress, A. M.	Egress, P. M.	Ingress, A. M.	Egress, P. M.
	° ′	° ′	h. m. s.	h. m. s.	h. m. s.	h. m. s.	h. m. s.
Virginia City	45 20	+35 0	+ 2 20 0	10 4 9	5 37 18	7 44 9	3 17 18
Fort Sill	34 40	+21 29	+ 1 25 56				
Denver	39 45	+28 1	+ 1 52 4	10 4 11	5 37 19	8 12 7	3 45 15
Corsicana	32 5	+19 29	+ 1 17 56				
Pike's Peak	38 48	+27 58	+ 1 51 52	10 4 11	5 37 21	8 12 19	3 45 29
Graham	33 1	+21 26	+ 1 25 44				
Fort Richardson	33 12	+21 7	+ 1 24 28				
Henrietta	33 43	+21 14	+ 1 24 56	10 4 15	5 37 24	8 39 47	4 12 56
Fort Decatur	33 10	+20 27	+ 1 21 48				
Havana	23 9.4	+ 5 21	+ 0 21 24	10 4 16	5 37 23	8 42 28	4 15 38
Key West	24 32	+ 4 47	+ 0 19 8				
Thatcher's Island	42 56	− 6 29	− 0 25 56	10 4 31	5 38 52	10 30 27	6 4 48
Sandy Hook	40 28	− 3 2	− 0 12 8	10 4 29	5 38 51	10 16 37	5 50 59
Cape May	38 56	− 2 5	− 0 8 20	10 4 29	5 38 49	10 12 49	5 47 9
Washington, D. C.	38 54	0 0	0 0 0	10 4 32	5 38 49	10 4 32	5 38 49
Cape Henry	36 56	− 1 3	− 0 4 12	10 4 29	5 38 47	10 8 41	5 42 59
Cape Lookout	34 36	− 0 33	− 0 2 12	10 4 30	5 38 47	10 6 42	5 40 59
Tybee Island	32 0	+ 3 49	+ 0 15 16	10 4 36	5 38 44	9 49 20	5 23 28
Barnegat	39 48	− 2 54	− 0 11 36	10 4 29	5 38 50	10 16 5	5 50 26
Atlantic City	39 22	− 2 38	− 0 10 32	10 4 29	5 38 50	10 15 1	5 50 22
Baltimore	39 18	− 0 25	− 0 1 40	10 4 31	5 38 50	10 6 11	5 40 30
Norfolk	36 51	− 0 44	− 0 2 56	10 4 29	5 38 47	10 7 25	5 41 43
Kittyhawk	36 0	− 1 40	− 0 6 40	10 4 29	5 38 47	10 11 9	5 45 27
Cape Hatteras	35 14	− 1 33	− 0 6 12	10 4 28	5 38 47	10 10 40	5 44 59
Wilmington	34 11	+ 1 7	+ 0 4 28	10 4 31	5 38 46	10 0 3	5 34 18
Smithville	33 55	+ 0 58	+ 0 3 52	10 4 31	5 38 46	10 0 39	5 34 44

POINTS OF FIRST AND LAST CONTACTS.

IN THE MORNING.

The point on the circumference of the sun's disk where the first contact will be looked for is, for all these stations, about midway between the north and the east point of the sun's disk, as shown in this diagram. (Diagram omitted.)

IN THE AFTERNOON.

The point where the last contact will take place is about 10° south of the west point of the sun, as shown in this diagram. (Diagram omitted).

TOTAL ECLIPSE.

Approximate times of contacts from chart in American Nautical Almanac for 1878.

Station.	Washington time.					Local time.			
	Eclipse begins, p. m.	Totality begins, p. m.	Totality ends, p. m.	Eclipse ends, p. m.	Duration of totality.	Eclipse begins, p. m.	Totality begins, p. m.	Totality ends, p. m.	Eclipse ends, p. m.
	h. m.	h. m.	h. m.	h. m.	m. s.	m. s.	h. m.	h. m.	h. m.
Virginia City	3 57	5 6	5 9	6 13	3 3	1 37	2 46	2 49	3 53
Fort Sill	4 23	5 35	....	....	2 36	2 57	....	....	....
Denver	4 8	5 22	5 25	6 23	2 51	2 16	3 30	3 33	4 31
Corsicana	4 26	5 40	....	....	2 31	3 7	....	....	....
Pike's Peak	4 9	5 24	5 27	6 24	2 50	2 17	3 32	3 35	4 32
Graham	4 25	5 40	....	....	2 30	2 59	....	....	....
Fort Richardson	4 24	5 38	5 40	6 37	2 34	3 0	4 14	4 16	5 13
Henrietta	4 24	5 36	....	....	2 35	2 59	....	....	....
Fort Decatur	4 29	5 38	5 41	6 38	2 32	3 3	4 16	4 19	5 16
Havana	4 55	5 50	....	....	2 0	4 33	....	....	....

Approximate times of contact, &c.—Continued.

Station.	Washington time.					Local time.			
	Eclipse begins, p. m.	Totality begins, p. m.	Totality ends, p. m.	Eclipse ends, p. m.	Duration of totality.	Eclipse begins, p. m.	Totality begins, p. m.	Totality ends, p. m.	Eclipse ends, p. m.
	h. m.	*h. m.*	*h. m.*	*h. m.*	*m. s.*	*m. s.*	*h. m.*	*h. m.*	*h. m.*
Key West	4 55	5 50	....	....	2 0	4 36	....	....	....
Washington, D. C	4 36	....	....	6 25	....	4 36	....	....	6 25
Thatcher's Island	4 28	....	....	6 15	....	4 54	....	....	6 41
Tybee Island	4 40	....	....	6 37	....	4 25	....	....	6 22
Sandy Hook	4 33	....	....	6 22	....	4 45	....	....	6 34
Cape May	4 34	....	....	6 25	....	4 42	....	....	6 33
Cape Henry	4 37	....	....	6 28	....	4 41	....	....	6 32
Cape Lookout	4 38	....	....	6 32	....	4 40	....	....	6 34
Barnegat	4 34	....	....	6 23	....	4 46	....	....	6 35
Atlantic City	4 35	....	....	6 23	....	4 46	....	....	6 34
Baltimore	4 35	....	....	6 24	....	4 37	....	....	6 26
Norfolk	4 37	....	....	6 27	....	4 40	....	....	6 30
Kittyhawk	4 37	....	....	6 29	....	4 44	....	....	6 36
Cape Hatteras	4 38	....	....	6 31	....	4 44	....	....	6 37
Wilmington	4 39	....	....	6 33	....	4 35	....	....	6 29
Smithville	4 39	....	....	6 33	....	4 35	....	....	6 29

Observations will be commenced ten minutes before eclipse begins. The latitude and longitude (arc and time) will be found in the preceding table.

[Document No. IV.]

[CIRCULAR.]

OFFICE OF THE CHIEF SIGNAL OFFICER,
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF
COMMERCE AND AGRICULTURE,
Washington, D. C., June 5, 1878.

It is expected that on the afternoon of July 29th the sun will be, for a few minutes (or possibly, at your station only a few seconds), totally eclipsed, and the Chief Signal Officer has the honor to request that you will on that occasion make such observations as may be in your power, and report the results promptly, by mail, to the Chief Signal Officer of the Army, Washington, D. C.

Among the observations that may be taken, even without a telescope (although a small spy-glass, marine binocular or opera glass, is very desirable), are the following, which are specially commended to your attention:

I.—DURATION OF TOTALITY.

By watching the sun through a piece of smoked glass while a friend closely watches the second hand of a clock or watch, you can determine to the second just when the last bit of the bright body of the sun disappeared and when it reappeared. Record these times, take the difference, and you have "the duration of the totality" quite independent of the error of your watch. If you have carefully determined the difference between your watch and the Washington time, as telegraphed to your nearest telegraph office, then by communicating this difference, some additional value is given to the observation. Do not let the interesting phenomena of the corona cause you to forget to be ready to observe the reappearance of the sun as carefully as you observed its disappearance.

II.

During the few minutes of total obscuration of the sun, there will probably be seen red flames or protuberances very close to the edges of the moon and sun, and bright white rays extending much further from the edge. Be prepared with pencil and paper to make a sketch of the appearance of these and other phenomena. Have a circle drawn on your paper to represent the sun, and two lines crossing at right angles. Draw several circles, concentric with the sun but larger than it, to serve as a scale by which to draw in the protuberances and the corona with approximate accuracy. A good size for the circle will be 1 inch radius for the sun, and 1¼, 1½, 1¾, 2, &c., for the outer circles. The radius of the sun on that day will be 15′ 45″, or 945″ of arc. The sheet of paper should be large enough to take in a region 4 inches from the sun on all sides on the scale just given. Hold the paper, or have it supported, so that one line shall be horizontal, and mark it N. and S. at the two ends that respectively point to the north and south. Hold the paper so that the other line shall be vertical, and mark that end Z. which points up toward the zenith. Draw first the general appearance, then sketch in details, and after the totality is over write down such notes as you can. Before the totality ends, stop sketching and writing, and prepare to observe the exact moment of reappearance of the sun.

ALBERT J. MYER,
Brig. Gen. (Bvt. Assgd.), Chief Signal Officer, U. S. A).

CHAPTER II.

SIGNAL SERVICE EXPEDITION TO PIKE'S PEAK, COLORADO.

A.—General Historical Introduction.

The observations made by General Myer from the summit of White Top, near Abingdon, Va., on the occasion of the total eclipse of August 8, 1869, appear to have especially inclined him to desire to confirm them by observations from other mountain tops. When, therefore, in February, 1878, he ascertained that the path of totality for July 29, 1878, passed nearly centrally over Pike's Peak, he at once expressed the interest that he would take in having that locality occupied by an observer, if only there was a reasonable chance for fair observing weather, and requested Professor Abbe to report what observations should be undertaken and what instruments would be needed. His report dated February 23, 1878 (O. C. S. O. 357, Misc. 1878), is appended. (Doc. No. 1.)

Application having been made by Prof. S. P. Langley, of Allegheny Observatory, for permission to locate his instruments upon the Pike's Peak military reservation (see O. C. S. O. 957, Misc. 1878), he was, on June 13, informed that the peak would be occupied by a party from the Signal Office and that the hospitalities of the service were extended to him. (See copy of letter to S. P. Langley (Doc. No. 2.) and his reply June 15, accepting (Doc. No. 3), O. C. S. O. 987, Misc. 1878.)

Preparations for the Signal Service expedition to the summit of Pike's Peak were immediately begun, (see Professor Abbe's letter of June 14, O. C. S. O. 979, Misc. 1878, copy herewith), and orders were sent June 19 to the sergeant in charge of the station at Colorado Springs to the effect that no unauthorized visitors were to be allowed at the summit during the eclipse. (Letters sent obs., vol. 33, p. 376.)

A fine five-inch equatorial was kindly loaned by the Naval Observatory and promptly forwarded to Colorado Springs, where, however, it arrived at a rather late day.

Certain possible subjects of observation having suggested themselves to General Myer as to the practicability of which there might be some doubt, Professor Abbe was ordered to repair to Princeton, N. J., to consult with the eminent spectroscopist, Prof. C. A. Young, the result of which interview will be found in Professor Abbe's report of June 19 (O. C. S. O. 1015, Misc. 1878, appended herewith). Special instructions were sent July 11 and 16 to Sergeant William Black, at Colorado Springs. (See vol. 34, p. 298, and vol. 35, p. 3.)

Finally, on the 11th of July, Professor Abbe was ordered to proceed in person to Pike's Peak. (See copy of Special Order 97, § 10, July 11, 1878, herewith appended.) General Myer at the same time stated that he thought it possible that he might himself follow shortly after.

The reports sent at 9 p. m. of each day, by Professor Abbe, as ordered by the Chief Signal Officer, show the progress of the preparatory work. (See communications filed as Nos. 1180, 1171, 1176, 1184, 1197, dated respectively, July 21, 24, 25, 26, and 27, and hereto appended as Documents Nos. 7–11.)

These show that the weather was rather more than usually unpropitious, and that the adjustments of the instruments and the preparatory drill were almost totally prevented. There was, however, a steady improvement during Sunday, the 28th, and by 6 p. m. the sky had cleared away permanently and became marvelously clear and pure.

On the 23d, General Myer, having decided to take charge in person of the observations at Pike's Peak, left Washington for that point, being accompanied by Lieut. H. H. C. Dunwoody, Acting Signal Officer and Assistant, and by Mr. H. T. Crosby, chief clerk of the War Department. (See Special Order 105, § 6, July 23, 1878.) This party reached the summit of the peak at about 5 p. m. of Sunday the 28th. The rapid change from the exhausting heat of the Mississippi Valley to the cool rarefied air of the summit produced the usual suffering, and especially in the case of General Myer, who, however, instead of returning below, as he would have been perfectly justified in doing, with characteristic resolution decided to stay at the telescope and to send below Professor Abbe, whom he had found resting in his tent, and whose condition was pronounced by all present as being quite critical. The latter was, therefore, immediately borne on a stretcher to the Lake House, where a physician and two nurses, summoned by General Myer from Colorado Springs, met him at about 1 a. m. of the 29th. His bearers returned to the summit in the early morning, and his own letter carried back by them from the Lake House promising observations from his new location is herewith given. (See O. C. S. O. 2054, Misc. 1880.)

The morning of the 29th was spent by General Myer and party in such preparations for the eclipse as could then be made; the highly favorable change in the weather having afforded every facility for adjusting the instruments and giving every promise of success.

Of the observations made by General Myer himself with the five-inch equatorial, we have unfortunately only a collection of notes in his own handwriting, evidently intended as a first draft of a portion of his report. (O. C. S. O. 2054, Misc. 1880.) These have been edited as carefully as possible, and it is believed that they will be found, even under these unsatisfactory circumstances, to add to our knowledge of the coronal phenomena.

The assistants who officially waited upon General Myer at the summit were Lieut. H. H. C. Dunwoody, Acting Signal Officer; William Black, sergeant Signal Corps, and Rufus Choate, corporal, whose individual reports are herewith published.

Among the many who kindly volunteered their services in carrying out upon the summit any observations that General Myer desired were the following: Mr. H. T. Crosby, chief clerk War Department; Prof. S. P. Langley, director Allegheny Observatory; Prof. John W. Langley, University of Michigan; Mr. E. V. McCandless, of Pittsburgh; General Edward Hatch, U. S. A.; Col. Charles B. Lamborn, of Manitou, Colo.; Mrs. A. H. Smith, of Philadelphia, Pa.; Mr. C. O. Shields, of Colorado Springs, Colo.

From all of these special reports have been received, which are herewith given in full, and with them is also given a report from an unknown observer on Mount Lincoln, relating to a subject in which General Myer took special interest.

At the Lake House observations were made by Professor Abbe, whose report is herewith also given in full (O. C. S. O. 1287 and 1722, Misc. 1878). He remained for a few days at Colorado Springs to supervise the packing and shipping of the apparatus to Washington.

APPENDED DOCUMENTS.

PIKE'S PEAK EXPEDITION.

No. 1.

Letter relative to instruments proposed for use on the summit of Pike's Peak.

OFFICE CHIEF SIGNAL OFFICER,
February 23, 1878.

GENERAL: In response to your inquiry relative to instruments to be used at Pike's Peak in observing the solar eclipse of July 29, 1878, I would respectfully report as follows:

I. Accurate observations of times of contact, &c., require corresponding accurate determinations of latitude and longitude, and should only be undertaken by an experienced observer. The instruments needed for this are indicated in the accompanying List I.

II. General observations upon the appearance of the solar corona or halo as it appears to the naked eye need only the previously prepared diagrams and other assistance indicated in List II.

III. Anything that relates to the temperature, absorption, currents, spots, flames, &c., and other phenomena of the solar surface has a direct interest to the meteorologist. I would therefore recommend that an attempt be made to observe the following phenomena:

1. Solar spots and faculæ at or near the edges of the solar disk;
2. Flames at the edges of the sun's disk;
3. Absorption lines in the chromosphere or the corona;
4. Bright lines in the photosphere or the corona;
5. Absorption lines in the earth's atmosphere;
6. Polarization of the coronal light;

—but these should only be attempted under the direction of Professor Young or other expert.

IV. The most interesting field of work practicable for us would, I presume, be the simple drawing, on prepared diagrams, of the corona as seen by various persons through various telescopes at the summit and the base of the mountain. I would put at the summit, at the Lake House, and at Colorado Springs, each, three observers (or nine in all), having respectively a large and a small telescope and good opera or field glass, and require each to record, with all possible care, all that he saw of coronal or other rays about the sun during totality. We thus should learn how much these appearances may be modified by our own atmosphere or by the power of the telescope.

By concentrating attention upon one feature during the few minutes of totality we may hope to add something to our knowledge of this phenomenon. I would furnish similar diagrams and instructions to all our observers in the path of totality.

Very respectfully, yours,

CLEVELAND ABBE,
Asst. O. C. S. O.

List 1.

1. Transit instrument of 2 or 3 inches aperture, reversible, with level, and so arranged as to be easily turned into and used in or near the prime vertical for observing latitude.
2. Two marine chronometers, set respectively to mean and sidereal time.

List 2.

1. One 6-inch telescope, equatorially mounted and with a glass-ruled micrometer.
2. One 2-inch telescope or spy-glass, roughly mounted equatorially.
3. One 2-inch field glass or opera glass or binocular.
4. Diagrams of the sun encircled by circles and crossed by lines to assist in entering the estimated positions of object.
5. Seats and stand for supporting the drawing board in front of the observer and near the line of sight of the sun.
6. The observer with the binocular might be advantageously supplied with a camera-obscura especially adapted to this work. Probably a simple photographer's camera and a set of ground-glass plates would be the very best thing possible, if mounted equatorially.

C. A.

No. 2.

PIKE'S PEAK EXPEDITION.

Letter extending the hospitalities of the Signal Service station on Pike's Peak to Prof. S. P. Langley.

OFFICE OF THE CHIEF SIGNAL OFFICER,
Washington, D. C., June 13, 1878.

SIR: I am directed by the Chief Signal Officer to say, in reply to your communication of 11th instant, addressed to Prof. C. Abbe at this office, that it is expected a party from the Signal Office will occupy Pike's Peak on the occasion in question, and that he takes pleasure in offering you the hospitality of the signal station at the summit for such time as you may need.

Very respectfully,

H. H. C. DUNWOODY,
First Lieutenant Fourth Artillery, Acting Signal Officer and Assistant.

Prof. S. P. LANGLEY,
Allegheny Observatory, Allegheny City, Pa.

3.

PIKE'S PEAK EXPEDITION.

Letter of Prof. S. P. Langley, dated Allegheny Observatory, June 15, 1878 (O. C. S. O. 987, Misc. 1878).

SIR: I have received through Acting Signal Officer Lieutenant Dunwoody your very kind invitation to accept the hospitalities of the Pike's Peak station on the occasion of the eclipse. My special observations require a stay on the summit with an assistant for one or two weeks, and if this be not too heavy a tax on the facilities of the station I shall take great pleasure in accepting your obliging offer.

Your obedient servant,

S. P. LANGLEY,
Director of the Allegheny Observatory.

General A. J. MYER,
Chief Signal Officer.

No. 4.

PIKE'S PEAK EXPEDITION.

Letter of Prof. Cleveland Abbe, dated June 14, 1878, *Washington, D. C.* (*O. C. S. O.* 979, *Misc.* 1878).

GENERAL: In reference to the observations of solar eclipse phenomena I would recommend that the loan of the observatory (5-inch) equatorial be obtained for a definite period; that one Private somewhat familiar with exact observations and handy in mechanical matters be detailed to assist; and that the order go into effect as soon as possible, and include the authority to make such necessary preparations and special apparatus as may be proper. It will not be necessary to leave here before July 15, although the sergeant at Pike's Peak should be notified at once, in order that he may report, if need be, any additional preparation he may have to make before he can find bed and food for two weeks for the proposed addition to his family.

C. A.

No. 5.

PIKE'S PEAK EXPEDITION.

Report of an interview with Prof. C. A. Young, of Princeton, N. J. (*O. C. S. O.* 1015, *Misc.* 1878).

OFFICE OF THE CHIEF SIGNAL OFFICER, *June* 19, 1878.

GENERAL: I have the honor to report that my interview with Prof. C. A. Young, at Princeton, was very satisfactory, but lead to somewhat different conclusions than we could have hoped, viz:

1. It was incumbent on me to compare my own and other notes on the brightness of atmospheric aqueous lines with his own experience as to the brightness of solar coronal lines, and thus without particularly explaining to him the important object you had suggested, I soon became convinced that if vapor of water exists, as it doubtless does high up or above the solar corona, then the lines of absorption due to it are, and must be, invisible on account of their faintness; moreover, if they were visible to an observer outside of the earth's atmosphere they would to us always be exactly overlaid by and confounded with the aqueous lines due to our own atmosphere.

2. If an aqueous cloud of cooled and precipitated vapor or mist exists in the solar corona it can be best and only seen by simple telescopic vision, but will not thus be directly distinguishable from clouds formed of any other condensing vapor. We have reason to know that in the solar atmosphere there exist glowing oxygen and cooling absorbing vapors of iron, sodium, &c. We as yet know nothing of the presence there of vapors belonging to such compounds as water, and it is considered probable that the coronæ that have thus far been observed, and especially the clouds that I described in Silliman's Journal, May, 1872, must have been constituted of these heavy metallic vapors. Aqueous clouds must be still higher up from the sun, and therefore far fainter than those; and should we see any such clouds, the question as to whether they are aqueous or not can probably be afterwards settled by computing (or observing) the temperature and pressure at which they exist.

3. To determine this important point, we need telescopes of much light, large fields of view, and movable oculars, so that we can take a rapid survey of a large region about the sun, and with all possible conveniences for accurately sketching in whatever is seen.

4. The light by which we see these cloud-like forms, being simply sunlight reflected from globules of vapor, must show all the Fraunhofer lines precisely as our own clouds do, and therefore the spectroscope alone would reveal nothing concerning them.

5. The fact that light is polarized, when reflected or refracted, suggests that by looking at the corona through a polarizing apparatus some information can be obtained, but the interpretation of the results will be influenced by the polarized condition of the light of our own atmosphere, which will therefore have to be examined at the same time.

6. The view of the corona through absorbing plates or films that cut off unnecessary light turns out to be useless as all the media that we could try were found to cut off so much that the gain is more than counterbalanced by the loss.

7. The attempt to increase the brightness of the coronal image by allowing it to fall upon fluorescent bodies is more promising of success. All the feeble ultra-violet rays that may come from the corona are invisible to the naked eye, and therefore contribute nothing to reveal its presence and structure, but when they fall upon fluorescent bodies these rays become visible and, may be, just so much help us to see the corona. Concerning all such fluorescent bodies, Professor Morton, of Stevens Institute, Hoboken, N. J., is an eminent authority, and I therefore visited him after leaving Princeton and obtained sufficient for our purposes of the necessary chemicals, including the most remarkable fluorescent body as yet known, discovered a few weeks ago and named by him "Uraneme."

8. The question as to the existence of numerous bright lines in the lower portion of the corona can be elucidated by a simple spectroscopic observation that Professor Young somewhat strongly urged and intends himself to make a trial of. This observation consists in placing a large prism in front of a good opera-glass; any one can, without much training, draw and describe what he sees, and which will consist essentially of a series of circular images of the sun, side by side, each in a different color. The observer should note the relative distances of the rings, their colors and brightness; each of them is produced by the light proceeding from the corona corresponding to the bright lines in the coronal spectrum. These observations, however, appear to relate directly to questions that do not immediately interest this office; necessary apparatus will probably cost about $25.

9. The apparatus, especially applicable to such study of the corona as is most advisable for us, would therefore be as follows: 1st, small telescopes or photographer's cameras [the S. S. 2-inch glasses mounted as in the transit of Mercury] without ocular and showing the picture of the corona on a sheet of paper smeared with some fluorescent substance. The corona is to be traced as rapidly as possible, and especially as far from the sun as it is visible; 2d, a larger telescope with a plain glass reflecting solar eye-piece, a total reflecting eye-piece, a micrometer ruled in black on glass, a Kellner-ocular and a camera-lucida, the whole adapted for drawing all the details visible at a magnifying power of 100 or 200. The telescope should, if practicable, be under cover; the drawings should be in colored crayon or pastile on blackened card-board, previously ruled to correspond with the micrometer; they are made without taking the eye from the telescope.

10. Of observations to be made during the rest of the stay on Pike's Peak, the first rank would be given to the study of atmospheric moisture and the spectroscopic rain-bands, but Professor Young's experience at Sherman, Wyo., in 1872 (altitude 8,000 feet), showed that the dryness of the air in that climate is such that the vapor bands are very feebly developed, and that Mount Washington offers much greater inducements than Pike's Peak.

11. The general question as to how much our atmosphere injuriously affects astronomical observations, and questions as to the advantage of elevation above sea-level as increasing the visibility of stars, can be elucidated by the search for the detection of new faint stars, &c., and I propose as a proper object for this purpose, and as a slight contribution to the connection between astronomy and meteorology, to examine the regions about the stars, Alpha Lyræ and Alpha Cygni, Beta Cephei and Alpha Pegasi, and also to search for Encke's comet, an ephemeris of which has recently been published by Van Asten.

12. The question as to rendering the corona visible at any time without the aid of a solar eclipse, is apparently settled in the negative by the experience of Professor Young, who tells me that he has frequently tried to trace the corona by means of the line K 1474, but has always found its light so faint that it could be seen only a short distance away from the sun, and never far enough to give any idea of the form of the corona; it can apparently only be studied during a total eclipse.

Very respectfully, yours,

CLEVELAND ABBE,
Asst. O. C. S. O.

[Prof. George P. Bond in 1851 endeavored to obtain a view of the solar corona by standing in the valleys of Switzerland and allowing the sun to be hidden by the sharply defined distant cliffs and mountains; he was, however, unsuccessful.—C. A., 1880.]

No. 6.

PIKE'S PEAK EXPEDITION.

Special order sending Professor Abbe to Pike's Peak.

[Special Orders, No. 97.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF SIGNAL OFFICER,
Washington, D. C., July 11, 1878.

[Extract.]

* * * * * * *

10. Cleveland Abbe, Assistant, Office of the Chief Signal Officer, will proceed with as little delay as practicable from this city to the summit of Pike's Peak, Colorado, and carry out, at that place, the special instructions received by him from the Chief Signal Officer of the Army in reference to an observation of the total eclipse of the sun on July 29, 1878. Having completed this duty Assistant Abbe will return to this office.

By order of the Chief Signal Officer of the Army.

H. H. C. DUNWOODY,
First Lieutenant Fourth Artillery, Acting Signal Officer and Assistant.

No. 7.

PIKE'S PEAK EXPEDITION.

Letter of Prof. Cleveland Abbe (O. C. S. O. 1180, *Misc.* 1878).

COLORADO SPRINGS, *July* 21, 1878.

GENERAL: I arrived here yesterday morning, July 20, having been delayed by missing connections. I find that the Signal Service instruments arrived on the 19th, and box of stationery on the 20th, 5 p. m. I have made up a train of about twelve mules or burros, and shall get off for the summit to-morrow, July 22. I expect to arrive there on the evening of July 23. Sergeant Black received your telegrams on July 16 and 17, and came down immediately (from the summit) and found Professor Langley here waiting. However, by dint of hard work, Sergeant Black got Professor Langley and his instruments off in three trains, one with tents and supplies on the 18th, and the other two on the 19th; so that Professor Langley reached the summit on the afternoon of the 20th, a few hours after I arrived at Colorado Springs. As the fourth train went up on the 20th, after my arrival, the fifth and last train, which is the largest of all, will leave to-morrow, the 22d, although a storm may occur to raise the mountain streams and hinder our progress.

I have arranged for some corresponding observations to be made by Prof. F. H. Loud, who is our voluntary observer at Colorado Springs. Everything promises well except the cumulus clouds which are hanging over the summit three-fourths of the time.

Notwithstanding the cloudiness, yet when we do have clear sky the advantages of the vision are wonderful, and my earnest hope is that you will find it compatible with other duties to seize upon this unique occasion to add to our knowledge of the atmosphere of the sun and the general relations between celestial and terrestrial phenomena by securing from the Secretary of the Navy the permission to retain our telescope up here until you can provide one to permanently take its place.

With regard to special meteorological problems, nothing is more important than atmospheric moisture, and that can be studied here as it can be nowhere else.

Other problems, such as atmospheric electricity, local rains, and thunder-storms, polarization of the atmospheric light, aqueous bands of the solar spectrum, the absorption of heat, &c., are waiting for us to investigate them; and I shall be glad to have you order me, or some other competent physicist to spend a year in such highly-important work.

I earnestly hope that you will be able to carry out your suggestions of visiting us at the summit on July 29, and that your health may have been preserved during the oppressive heat that has, I see, been prevailing in the Middle Atlantic States during the past week.

Very respectfully, yours,

CLEVELAND ABBE,
A. O. C. S. O.

No. 8.

PIKE'S PEAK EXPEDITION.

Copy of telegram (*O. C. S. O.* 1171, *Misc.* 1878).

PIKE'S PEAK, COL., *July* 24, 1878.

The CHIEF SIGNAL OFFICER:

Cold rain all this afternoon, but work makes progress. Dew-point apparatus and telescopes are in place. Tourists have been warned not to disturb us. All of us suffering from "Pike's Peak fever." Langley sends compliments. Send us a pair of telephones.

CLEVELAND ABBE,
Assistant O. C. S. O.

No. 9.

PIKE'S PEAK EXPEDITION.

Copy of telegram (*O. C. S. O.* 1176, *Misc.* 1878).

PIKE'S PEAK, *July* 25, 1878.

The CHIEF SIGNAL OFFICER:

Rather disagreeable weather, but tents all up and both parties provided for. Dew-point observations successful. The prevailing weather thus far has been—temperature 45, cloudy, foggy, and hailing.

CLEVELAND ABBE,
Assistant O. C. S. O.

No. 10.

PIKE'S PEAK EXPEDITION.

Copy of telegram (*O. C. S. O.* 1184, *Misc.* 1878).

PIKE'S PEAK, *July* 26, 1878.

The CHIEF SIGNAL OFFICER:

Occasional glimpses of the sun, but mostly snow, fog, and clouds, seriously delaying all fine adjustment. Night observations prevented by frost on object-glass. Equatorial driving-band broken, but will manage without it. Mountain fever severe, but diminishing.

CLEVELAND ABBE,
Assistant.

No. 11.

PIKE'S PEAK EXPEDITION.

Copy of telegram (*O. C. S. O.* 1197, *Misc.* 1878).

PIKE'S PEAK, *July* 27, 1878.

The CHIEF SIGNAL OFFICER:

Two snow-storms with gales, endangering tents and instruments. No satisfactory glimpse of sun to-day. Very little progress in preparing for Monday. * * *

CLEVELAND ABBE,
Assistant.

No. 12.

PIKE'S PEAK EXPEDITION.

Letter of Prof. Cleveland Abbe, dated Lake House, Pike's Peak, July 29, 1878. (See *O. C. S. O.* 2054, *Misc.* 1880.)

MY DEAR GENERAL: I am most devoutly thankful to you for the good care that you have taken of me, and Dr. Hart, of Colorado Springs, whom you have summoned, seems decidedly of the opinion that you have done wisely.

I must not oppose my own will to reason and your orders. I will therefore stay here to-day and organize some sort of a system of observing the eclipse, so that you shall have a report from the Lake House as well as the summit.

Dr. Hart seems to think that any return to the summit would be a mistake, and that I must go below to-morrow, where I will see to the shipping of the instruments and write up my report.

If Lieutenant Dunwoody is able to manage the dew-point apparatus and get a few good observations in this dry air before the thermometers are packed up and brought down, it will eke out the series that I had begun to make.

While I have to record the hearty and numerous kindnesses shown me by so many, yet I think especially worthy of mention Private Choate, who, for his ability in every way, deserves commendation and promotion, and but for whom I should last night have been left above here at the timber-line.

I trust that you will not yourself suffer from the "Pike's Peak fever."

I remain, yours truly,

CLEVELAND ABBE.

No. 13.

PIKE'S PEAK EXPEDITION.

Order sending Lieutenant Dunwoody to Pike's Peak.

[Special Orders No. 114.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF SIGNAL OFFICER,
Washington, D. C., August 13, 1878.

[Extract.]

* * * * * * *

2. The verbal instructions of the Chief Signal Officer of the Army of date July 23, 1878, directing First Lieut. H. H. C. Dunwoody, Fourth Artillery, Acting Signal Officer and Assistant, to proceed without delay from this city to Pike's Peak, Colorado * * * and to carry out at that station such special instructions as he may have received from the Chief Signal Officer * * * are hereby confirmed.

By order of the Chief Signal Officer of the Army.

H. H. C. DUNWOODY,
First Lieutenant Fourth Artillery, Acting Signal Officer and Assistant.

B.—REPORTS OF OBSERVATIONS.

INTRODUCTION.

It was apparently the intention of the late Chief Signal Officer to compile a review of the observations made on Pike's Peak, especially of those relating to "iris colors" and other matters in which he was especially interested and upon which he had requested that special attention might be concentrated by those who had had no experience in delicate instrumental work. His untimely death has prevented the consummation of this project and has left to the present editor the very delicate task of deciding what should be published. In general all reports are published among the documents appended to this chapter, in the words and forms in which they were originally communicated to the Chief Signal Officer. Only in the case of General Myer's observations has it been deemed proper to arrange the papers in that order which it was supposed was intended by him; in the case of the notes of Mr. H. T. Crosby it has been necessary to compile a report, in doing which assistance has been derived from recent personal conversations.

[Document No. 14.]

PIKE'S PEAK SUMMIT.

Notes and observations of the solar eclipse, July 29, 1878, by Brig. Gen. Albert J. Myer, Chief Signal Officer, U. S. A. (*O. C. S. O.* 2054, *Misc.* 1880).

The telescope used for observation was an equatorial of 5 inches aperture, described in Assistant Abbe's report herewith, and which had been carefully located and mounted by him. The early day of the 29th was exceptionally clear. The low barometer, southerly wind, and frequent showers of the preceding day had given place to a northerly wind, the area of disturbance having passed eastward. The atmosphere was steady, cool, dry, and clear. The early part of the day and part of the time after the commencement of the eclipse had passed, were occupied with the necessary preparations for the observing of the eclipse at its totality.

The duration of totality had been roughly counted upon as to be for 150 seconds. A sergeant stationed at the chronometer calling "total," "50 seconds," "100 seconds," and so on. It was planned to devote the first and last periods of fifty seconds to telescopic observations, the middle period of fifty seconds to observations with the naked eye. [It is believed that an ocular of comparatively high magnifying power and small field of view was employed by General Myer. I do not know how to reconcile the discrepancies between the following headings and the text.—C. A.]

TELESCOPIC OBSERVATIONS DURING THE FIRST PERIOD.

At the moment of totality the following telescopic observations were noted: Extending beyond the whole circuit of the moon's disk, within the field of my telescope, there appeared to be a thin continuous almost level layer of a pink or rose-colored hue, not dense or striated, almost homogeneous in structure, yet conveying a sense of mistiness, but of a mist so dense and differing so much in density from any ordinary fluid as to have its upper surface level. The layer was pierced at one point and evidently from below, as related to the sun's surface, by one small jet or prominence, the sides of which rose sharply and perpendicularly from the upper level of the layer, which seemed to consist of the same substance as that layer;—was of the same color—gave to me as clearly as in 1869 the idea of a striated structure, the striæ nearly or quite perpendicular to the level upper surface of the rose-colored layer, and recalled perfectly the popular picturing of the flash which springs from the muzzle of a gun at the instant of the explosion of a charge. This jet was constant, so far as I could judge, until the close of totality. There was no noticeable tumescence of the rose-colored layer about the base of the jet. The upper extremity of the jet was of a well-defined shape, with an appearance of separate rays or parts showing clearly in contrast with the luminous white misty light by which it seemed to be surrounded. The resemblance suggested was that of a jet thrown sharply up by a violent and continuous force acting through a circumscribed opening. There was an appearance of thickening at the sides somewhat similar to that which appears in a water-spout or other translucent tube when the point of view enables the observer to see through it against the light. The height of the prominence appeared to be but little greater, not more than equal to one and one-half the thickness of the rose-colored layer from the upper surface of which it sprang. There was no appearance of detached red clouds anywhere above the layer or the prominence. Above the rose-colored layer and the prominence thus described, appeared everywhere, and filling the field of the glass, a bright whitish light with some appearance of radiation; this, so far as I could judge, was concentric with the sun, but with no clearly described structure or motion so far as noticed. My attention being very closely given to the red layer and the single prominence upon it, I did not so carefully examine other phenomena. There was, however, no blending of red and white color, or shading off of the red into the white, the red layer and the prominence showing their colors clear and distinct against the white as if of different material and wholly separate from it. I have never been able to trace with the telescope any blending of the red or rose color with other colors. With the unassisted eye this color becomes to me always more diffused.

NAKED EYE OBSERVATIONS DURING THE MIDDLE PERIOD OF FIFTY SECONDS.

Removing the eye from the telescope at the call "100 seconds," the first impression was one of disappointment. The eclipse was marked by "a white eclipse." The diffused rose color which had beautified the eclipse of 1869 was absent. The silvery rays projecting on all sides in that eclipse surrounding the lunar disk as the rays of a "glory" projecting farthest at the four angles of a rough quadrilateral figure, were now less than one-half as numerous and differently dispersed. Closely surrounding the black disk of the moon in its whole extent as showing clear against the illuminated but still blue color of the sky, was spread a continuous corona of sheet-like white light to a distance which might be one-quarter of the apparent diameter of the disk, the outer edge of this corona giving some appearance of fine rays or points, as if of a radiation, the inner portion brightening in the intensity of its light, but not changing the character, unless by a possible slight tinge of yellow, deepening slightly as it reached close to the moon. The massive silvery rays, so markedly visible at all points of the coronal circumference in 1869, were in this eclipse not visible, except at the northwestern and southeastern quadrants. They appeared here seemingly less in length and less massive than in the eclipse referred to. They appeared, however, exhibiting the same character of silvery light and of distinct separation, each from the other, then noted. These rays did not seem to shine through the sheet corona or corona proper, or to be separated from it. They seemed to emerge from and to be continuous with it, though not concentric with its apparent center of radiation, the coronal radiation seeming concentric with the seeming center. The radiation of the rays was not concentric with the center, nor did they convey the impression of being concentric. The rays projecting beyond the corona at the northwestern quadrant were not straight, but marked incurved for the outer half of their apparent length toward each other. The rays projecting beyond the corona proper at the southeastern quadrant were, so far as could be noted, straight, arranged in two pyramidal aigulets or bundles, which, joining each other at the outer edge of the corona, were separate at their extremities by a distance estimated equal to a lunar diameter. The whole phenomenon was not inaptly likened, in appearance, by numerous observers, as to its outline, to a wind-vane, of which the center was formed by the black lunar disk with the surrounding continuous corona, the head and wings by these appended rays extending at the northeast portion a distance roughly estimated at one diameter, the inward rays forming the head, and at the southwestern portion, a greater distance, possibly one and one-half diameter, to the apices of the two aigulets or bundles which formed the wings. The character and color of the light exhibited by these rays were closely scrutinized. It seemed to be similar, though of greater intensity, than the whole corona. It was not unlike the light of the stars which were visible; it resembled so closely as not to admit of difference of description the white silver light described as the *silver* moon when the moon is seen vertical in winter through a clear dry air. The light which lighted up the Peak during the totality was described by observers who noted the appearance from Colorado Springs, a distance of six miles, as like and equal to the light of a quarter moon at its first quarter. The rays seemed immovable while under observation. My eyes had been wearied at the glass, and while this * * * * * *

TELESCOPIC OBSERVATIONS DURING THE THIRD PERIOD OF FIFTY SECONDS.

There was yet a thin bright line as of a border of sunshine, very narrow, appearing beyond the anterior edge of the black disk of the moon, and contrasted very strongly with it and the color of the sky beyond, when I called "Stop." My attention being given wholly to the corona, I did not note for how much longer the moon thus observed was visible, nor for how much longer or how far it could be traced. I am impressed with the idea that with a dark chamber in which the head of the observer might be wholly placed, and with a movable tube of diameter sufficient only to permit the moon's disk to be observed, that disk might, from elevated stations, such as Pike's Peak, be profitably studied in all cases of total eclipse, and valuable information so gained as to the extent of the true corona and its character. The silver rays or bars were not all visible to me after the totality had ceased. A radiated structure of the corona, the radiation apparently concentric with the sun, was clearly visible.

OBSERVATIONS WITH THE NAKED EYE AFTER TOTALITY.

At the instant of the end of totality with the first appearance of sunlight, the silvery bars disappeared (they were not at any time visible in my telescope). Shutting off the now exposed and bright disk of the sun with the tube of the telescope, so managing the instrument as to keep the anterior edge of that tube just resting on the yet black disk of the moon, as it moved on its course, the moon remained distinctly visible as it passed over the corona now clearly presenting an appearance as of short golden rays showing on a dark ground plainly distinct from each other and visible not only in front of the moon, for part of the length as it passed off the sun, but at the side of the moon. These rays might be characterized as fine rays, not in any way by location, center of radiation, or appearance like the massive silvery rays visible during the totality. The moon was thus apparently passing over a luminous background for a period of — seconds. At the close of this period the golden rays at the side of the moon had been lost in the growing brightness of the sun, or shut off by the tube of the telescope as it was carried along to follow the moon in its course.

It had been one of the objects of the observations to fix the extent of the corona and coronal appendages, or to establish at least a limit to which it certainly did extend.

The assistants were carefully instructed upon this point, and Mr. Crosby (with much ingenuity) devised and constructed a rough instrument for his own use. His instructions had been to consider as of the corona any notable appearances in the vicinity of the disk, and to give the extent in apparent diameters. Determining by a simple experiment the apparent area of the moon's disk at a distance of 3½ feet from the eye he arranged in a strip of pasteboard, vertically placed, from which strip the eye was fixed always at a distance of 3½ feet by means of a vertical wire, along which the head could be moved in a plane vertical to the earth's surface, circular openings with diameters 1, 2, 3, and 4 times that of the apparent lunar diameter, at which frequent examinations were made by him during the period of totality. It was found that the corona then examined with its appendages, the rays, extended far beyond the limits of the largest circular opening, and then, failing other means of comparison, that the whole width of the pasteboard strip (at its top), brought to bear transversely upon the lunar disk and corona in the largest diameter of the latter, was overpassed by the corona and rays visible to the unassisted eye. The measurement made possible by this observation gives the corona at the distance of the sun.

The observations of Mr. Crosby have an added value, that his eye had not been wearied at the telescope, and that he devoted himself with assiduity and intelligence to this special observation.

The corona of illumination was doubtless more brilliant at some parts than at others. Part of this I have considered due to the illumination of the atmosphere by *direct* rays of the sun *passing* directly the lunar disk or the moon itself, and part to sunlight reflected from the distant *surface of the moon;* parts of this illumination would, therefore, be brighter than other parts as sunlight was reflected from parts reflecting more or less upon the moon's surface, or as the rays reflected might be more or less cut off from parts by obstacles, or as the rays, either direct or reflected, might fall upon ice particles or other matter in our upper atmosphere. I did not, however, trust my eyes for studies of this kind—both because they had been tired and the subject of corona extent, &c., was in other hands.

COLORS ATTENDING THE SHADOW.

At the eclipse of 1869 attention was directed to the colors of the cloud which the elevated station, "the summit of White Top," permitted to be observed as on a screen, and especially by the bands of color noted there and afterward reported upon in writing by myself. The thought at that time suggested itself that rings of color bands due to the dispersion of light, possibly closely surrounded the column of moon shadow, and that in observations made from elevated stations such rings might be visible on extended and low-lying cloud screens or other extended plane surfaces visible. It was considered that if such rings or bands were found to exist, the fact would, to some extent, account for the "flickering light," the moving spots or blotches of color noticed on the earth, and the changes of sky color reported as closely preceding the instant of totality. The grand plain and greatly extended view had from Pike's Peak, particularly the plain southeastward, extending almost without a peak, with hardly a clump of trees visible, to a horizon 150 miles distant, offered a ground perhaps never to be surpassed and rarely equaled.

The attention of Assistants Crosby and Dunwoody had been carefully directed before arriving at the station to the observation of such color bands, if any there might be, on the surfaces of cloud, and to the appearance of any column of shadow, if such might be in the air. The arrival of General Edward Hatch, of the U. S. Army, with a party of friends, admitted within the cordon of the station just before the commencement of the eclipse, permitted the force of the observatory to be increased for the purpose of observing from a chosen point the earth's surface in the direction of the expected shadow, moving from NW. to SE. toward the Peak. These observations were made by Mrs. Aubrey H. Smith, of Philadelphia, Col. C. B. Lamborn, of Manitou, and others. Mr. McCandless, of Philadelphia, who was present assisting Prof. S. P. Langley, had so located himself as to be able to observe the departing shadow moving southeast over the great plains.

Assistants Lieutenant Dunwoody and Mr. Crosby were so located that their plane of view was limited by the horizontal plane of the summit of the Peak. They could see nothing below this plane. The atmosphere was so exceptionally clear that there were no clouds to serve as screens. One small cloud lying below and a little to the north of the sun was observed to exhibit prismatic hues while the eclipse was yet but partial. At the moment before totality, however, there were no cloud screens, and neither of the gentlemen, though alert and watchful, were able to detect any appearance of any shadow column in the air.

It seems doubtful whether such shadow columns will ever be visible in the air, viewed at great elevation and in such line of sight as to be there free from particles of visible vapor, smoke, dust, or other impurities which rising reflect the light and exhibit the shadow.

The parties stationed at the edge of the summit had a different spectacle. At the approach of totality, looking northwestward, each observer distinctly saw the approaching column, near the earth's surface below, and each, though not before instructed what to see, noted bands of color visible (on the earth) accompanying the moving column.

At the close of totality, Mr. McCandless, looking southeastward, found the shadow easily visible on and near the earth, noticed a band or bands of color, and saw them on the great screen of yellowish prairie grass, following and encompassing the round shadow, assuming a circular shape so far as they were visible in doing so.

The narratives of these observers are given in their own words as written in descriptive letters which are hereto appended.

[The following additional disconnected notes are found in the handwriting of General Myer among his eclipse papers, and may contain some additional information:]

1. Rays of the corona seen behind the moon were straight, concentric, golden, and fine.
2. Silver rays were long and silver.
3. Corona close to sun were silver, or rays seen without sunlight were silver; with sunlight, golden.
4. No red color in corona; absence of prominences.
5. No shadow in the upper air; none seen by Dunwoody or Crosby.
6. Condition of exterior atmosphere rough, &c., thrown up in wave projections or movements.
7. The red layer was distinctly not striated. It seemed divisible, partly at least, into two very thin layers with a thin vaporous or cloudy connection. The prominence or jet projecting through it gave the idea of striation, as if the matter of the layer were divided up.
8. *Memorandum.*—Color bands must appear in one order *approaching*, and in reverse order as shadow leaves; in red eclipses they may differ from bands in white eclipses; may vary with conditions of lower atmosphere.

[Document No. 15.]

PIKE'S PEAK SUMMIT.

Special report of Lieut. H. H. C. Dunwoody, Acting Signal Officer and Assistant (*O. C. S. O.* 1748, *Misc.* 1878, *filed October* 18, 1878).

The general appearance of the eclipse, as seen from the summit of Pike's Peak, is given by the accompanying sketch (Fig. No. 8).

During totality the sky was almost free from clouds, those visible being cumulus near the horizon in the direction of Mount Lincoln.

At an observation taken a few moments before the commencement of the eclipse, the wet-bulb thermometer read 30°, which was 16° below the reading of the exposed thermometer.

The moment that totality commenced the moon presented the appearance of a black disk, without indentation, surrounded by a narrow ring of orange-yellow light, the ring not being concentric, but wider on the right-hand side, as viewed by the observer. The sun was completely surrounded by bright silver-colored rays, those in the upper left-hand quadrant extending to 2½ and 3 diameters, and those in the lower left-hand quadrant extending to 3 and 4 diameters; the longer rays taken together presenting a fish-tail appearance, the angle of inclination with the vertical being 40°. A very slight break was observed at the lowest point, but this was exceedingly small and scarcely visible, giving off no colored light.

H. H. C. D.

[Document No. 16.]

PIKE'S PEAK SUMMIT.

Special report of William Black, Sergeant Signal Corps (*O. C. S. O.* 4,782, *Obs.* 1878).

Observations on an ordinary thermometer exposed to the sun, and on the maximum and minimum thermometers in the thermometer shelter. Other duties interfered with the regularity of the series and no readings could be made during totality.

Time.	Maximum.	Minimum.	Solar thermometer.	Time.	Maximum.	Minimum.	Solar thermometer.
h. m.	°	°	°	*h. m.*	°	°	°
2 00	58	58	94	3 30	51	51	72
2 20	57	57	92	3 45	48	48	52
2 30	58	58	93	4 00	51	51	68
2 45	59	59	93.5	4 15	52	52	76
3 00	54	54	80	4 30	53	53	78
3 15	52	52	76				

[Document No. 17.]

Pike's Peak Summit.

Extract from letter of William Black, Sergeant Signal Corps (*O. C. S. O.* 4,900, *Obs.* 1878).

I am unable to give the time as taken from the General's watch. It will be remembered that I merely called the time for Professor Langley, who noted it in his records. On the day following the eclipse I requested this time record from Professor Langley by direction of General Myer, but he replied that the papers were packed up.

[Document No. 18.]

Pike's Peak Summit.

Extract from the abstract of the journal for July, of Signal Service Station, as compiled by William Black, Sergeant Signal Corps, and Rufus Choate, Private Signal Corps.

July 29.—At noon the sky was perfectly clear. General A. J. Myer, Chief Signal Officer, and Lieut. H. H. C. Dunwoody, Assistant Signal Officer, take charge of Professor Abbe's telescope; Sergeant Black takes thermometrical readings of solar radiation and temperature; Private Choate does spectroscopic work.

1 p. m. Slight haze on the plains.

2 p. m. Scrupulously clear sky.

First contact called at $2^{h}\ 22^{m}$.

3 p. m. Still clear; sunlight greatly diminished; all objects seem to be surrounded by a peculiar glow of crimson.

Three minutes before totality on the plains to the NE. (NW. ? C. A.) the shadow was seen approaching with enormous velocity. Gray's, Long's, and Torrey's Peaks and a portion of South Park first fell in the shadow, and as sudden as magic our mountain was without a single ray, and totality was called by Professor Langley. The "Snowy Range" lay as in moonlight, while far away on the plains to the south the sun's rays are throwing bright light.

To the east and northeast a broad zone of orange is visible, resembling a cloud-sea of orange tint. By radiation it is growing colder. Gray's Peak is in sunlight. The light is advancing; suddenly the shadow passes and totality is over. The signal is given by Professor Langley. The duration of totality is 2 minutes 58 seconds (thus in MSS. journal, C. A.), as noted by Sergeant Black, by means of General Myer's stop-watch, eight seconds longer than was predicted. Following totality the shadow was traced southward for hundreds of miles.

Among the visitors were General Hatch, Colonel Lamborn, &c., to the number of over one hundred.

[Document No. 19.]

Pike's Peak Summit.

Observations by H. T. Crosby, Esq., Chief Clerk of the War Department (*O. C. S. O.* 2054 *Misc.* 1880).

The originals of the observations by Mr. H. T. Crosby were placed in General Myer's hands at the request of the latter immediately after the close of the eclipse, and thus a formal detailed report from Mr. Crosby was rendered impossible. The care with which Mr. Crosby's observations were taken renders it very regrettable that their author should not have been able to promptly prepare a definite report of his observations. The following, however, has his sanction:

As filed in this office, Mr. Crosby's notes consist of his original pencil sketches and memoranda, his card-board scale of circular apertures, and a finished sketch of the corona (see O. C. S. O. 2054, Misc. 1880). This latter sketch is published as No. 7 of the collection of engravings accompanying this volume.

It appears that Mr. Crosby devised and prepared a light frame, supported by a handle, such that the observer's eye was kept at a distance of 42 inches from the plane of a strip of card-board, which latter was pierced with five holes through which the sun and corona could be seen. These holes were numbered from 0 to 4, the largest being at the top, and above it a semicircle was drawn of a still larger diameter, but was not cut through, as it was not anticipated that the corona would extend so far from the sun. As it happened, however, the entire width of the card-board strip was not sufficient to cover the coronal streamers. The dimensions of the card board and holes, as recently measured by me at the Signal Office, are as follows:

	Inches.	Angle subtended at 42 inches distance.		Height of circles above solar surface.	
		In minutes of arc.	In solar diameters.	In minutes of arc.	In solar diameters.
Width of card-board at top	2.70	241	7.5	104	3¼
Diameter of semicircle No. 5	1.64	137	4.2	52	1½
Diameter of aperture No. 4	1.21	103	3.2	36	1⅛
Diameter of aperture No. 3	1.00	79	2.5	24	¾
Diameter of aperture No. 2	0.78	67	2.0	18	½
Diameter of aperture No. 1	0.59	48	1.5	8	¼
Diameter of aperture No. 0	0.42	34	1.0	1	0

By examining the corona through these holes, keeping the sun as nearly as possible in the center, it was possible to gauge the apparent extent of the corona and its symmetry.

Mr. Crosby, of course, observed with the unaided eye, and his record shows that with the above device he saw that the circle of bright golden light consisting of fine rays radiating from the sun extended on all sides to about the limits of the "1¼" circle, by which we are to understand circle No. 1, whose diameter was 48′, thus fixing the limit of the golden corona at about one-fourth of the sun's diameter or 8′, above the solar surface; it was, however, seen to have a greater extension or bulging in the upper left-hand and lower right-hand quadrant as shown in the sketch No. 6.

Beyond this circle of golden rays there extended two long streamers of silver light respectively to the left above and to the right below the sun, and whose axes appeared to coincide with a straight line inclined about 50° to the vertical, as shown in the accompanying sketch, No. 6. These silver rays were traced from the sun's center to a distance such that they could not be brought within the circle "1.4" or No. 5 of the above table, and it was estimated that they extended to a distance of more than 2 inches or five solar diameters from the sun's limb, corresponding to an apparent angular distance of more than 160′ from the surface, or 3° from the sun's center.

The general appearance is given in the accompanying sketch, No. 6.

C. A.

[Document No. 20.]

PIKE'S PEAK SUMMIT.

Special Report of Prof. S. P. Langley, of Allegheny Observatory (*O. C. S. O.* 1,324, *Misc.* 1878).

Owing to the absence of Professor Abbe, who was to attend to the chronometer, no observations of precision in the usual sense were taken. A few moments before totality I was requested by the Chief Signal Officer to call "total" when it occurred, and I observed him hand his watch to Sergeant William Black. I announced the beginning and end of totality as requested, and immediately after the sergeant informed me that the interval was 158 seconds.

Directly after totality General Myer informed me that he still saw the corona, and when it ceased to be visible to him the Sergeant stated in my hearing that the watch give 420 seconds from the beginning of totality. The corona was visible 410 seconds to myself.

[The spot occupied by Professor Langley's telescope was about 200 feet west of the stone monument erected by J. T. Gardner, in 1873, for his primary triangulation.—C. A.]

[Document No. 21.]

PIKE'S PEAK SUMMIT.

Special report of Mr. E. V. McCandless, dated October 10, 1878 (*O. C. S. O.* 1691, *Misc.* 1878).

To the CHIEF SIGNAL OFFICER, U. S. ARMY,
Washington, D. C.

DEAR SIR: At your request I send the following memorandum of the appearance of the total eclipse of the sun, July 29, 1878, as it appeared to me, a non-professional, from the top of Pike's Peak, Colorado.

The duty had been assigned me of assisting Dr. John W. Langley at the heliostat.

Upon the approach of totality, I lay down on the rocks with my hand and eyes on the instrument. Glancing toward the northwest I saw that the most distant of three or four ranges of white clouds, which lay just above the horizon and apparently far beyond Mount Lincoln (distant probably 60 to 70 miles), had become an inky blue-black. Each range of clouds in turn lost its white hue and became of the blue-black color in rapid succession, and a moment afterward Mount Lincoln and the Snowy Range dropped out of sight, as the shadow of total eclipse swept over them.

For the following minute or more my entire attention was devoted to the instrument and the making of a hasty sketch of the sun for Prof. S. P. Langley, as requested.

Having now about one and a half minutes before the end of totality, I hastily walked over the very rough rocky top of the peak to its northern edge. The light was quite strong, but of a peculiar yellowish-green hue. I looked at my watch and could see not only the minute and hour hands but the second hand distinctly.

Upon arriving at the edge of the northern side of the peak I looked down on the mountains lying from three to five thousand feet below, and the valley in which was Manitou Springs. The plains stretched off to the east with the town of Colorado Springs ten [8?] thousand lower than the peak and thirteen miles distant in an air-line, clearly in view.

What impressed me at the first sight of the mountains below was that there were no shadows to them, and that they were bathed in a strange yellowish-green light, which seemed to surround them equally on all sides. While each mountain or range could be distinctly seen, they seemed like "ghosts" of mountains.

Expecting the period of totality to be about over, I turned towards Mount Lincoln, where I could now distinctly see the range with its patches of snow, and far beyond the belts of clouds, still of a dark hue, but much lighter than they had looked at the beginning of totality, owing doubtless to my eyes having become accustomed to the light.

While looking at the clouds, the most distant sprang into light, followed in quick succession by each succeeding range, and instantly afterwards the Snowy Range seemed to rise up into the heavens, as the shadow passed off it. While lost in surprise, a moment later Prof. S. P. Langley announced "over," and we were in sunlight.

Looking down toward Colorado Springs the town became bright, and the great shadow swept off for one hundred and twenty-five or fifty miles southeasterly, like a great black ball with a bright zone of light fading from bright yellow into a pale pea-green surrounding it. I saw none of the rainbow hues spoken of by others. To my eyes it was an almost black shadow distinctly rounded, with bright orange-yellow next to it, shading off through light yellow into the greenish hue of the plains. I saw no colors in the clouds to the northwest, as some described them.

Trusting this hasty sketch, made shortly after the event, will be of use,

I am, respectfully,

E. V. McCANDLESS.

PITTSBURGH, *October* 10, 1878.

[Document No. 22.]

PIKE'S PEAK SUMMIT.

Special report of Edward Hatch, Brevet Major-General, U. S. A. (*O. C. S. O.* 2054, *Misc.* 1880).

MANITOU, *July* 31, 1878.

GENERAL: Thanking you kindly for the attention extended our party at the peak on the 29th, I must thank you doubly for so seating our company at the northern edge of the mountain. We were spectators of a phenomenon so wonderful it will remain forever with us, and I regret you were so engaged with the eclipse it escaped you. Scarcely had the dark shadows swept in their marvelous beauty over mountain and valley, as we were cloaked with the weird light of the darkening twilight with its winter chilly air penetrating our wrappings, that peculiar ghastliness of the scene becoming oppressive, when exclamations of astonishment broke from all, at the apparition of an angry black cloud of inky blackness at the base, fading gradually into softer prismatic colors of the rainbow, not as well or clearly defined; the red particularly dull, the upper edges of this cloud of wavy orange. This cloud had a fearful exhibition of power, advancing with startling rapidity as though bent on destroying all before it—a huge wave of darkness—when in a moment fading into colors it disappeared in the sunlight breaking over the western mountains. We were, of course, prepared for the rapidly-advancing moon shadows, but what this wonderful apparition of cloud and color were there for, and by what freak created, is beyond the ken of ordinary mortals, and can only be within the knowledge of wonderful Probabilities himself.

With many thanks for your attention, I remain yours, truly,

EDWARD HATCH,
Brevet Major-General.

[Document No. 23.]

PIKE'S PEAK SUMMIT.

Special report of Col. Charles B. Lamborn (*O. C. S. O.* 1368, *Misc.* 1878).

There was no haze or mist to cloud the view in any direction. The most remarkable phenomenon observable from the summit was the approach of the shadow of totality from the north, its swift passage, and the sudden burst of sunlight which followed. My station was on the northern side of the summit. Without the aid of a glass the eye could at this time distinctly note the shimmering of the bright sunlight on the mountains more than one hundred miles northward. Suddenly I observed them to disappear and a great wall of darkness, stretching out on either side as far as the eye could reach, concealed them from us. With inconceivable rapidity the shadow swept toward us; its front was a clean black line bordered with a fringe of yellow. It hid from sight range after range of the more distant mountains, and quickly covered with a ghastly pall the peaks and foot-hills and plains close beneath us. When the shadow reached and enveloped us, the eye could dimly outline the nearer mountains and could single out with strange distinctness the houses and farms in the valley below. The sky overhead seemed heavy and leaden, and every visible object was pallid and ghastly. The very shadow seemed tangible and to weigh upon us, but the horizon all around us was brightly illumined by flashing rays of red and yellow lights like those of the aurora.

While we on the peak were still enveloped in the depth of the shadow, its upper line passed over the far-off range to the northward and the clear sunlight struck the mountains and away beyond and through the darkness they burst suddenly into view.

In an instant other and nearer mountains appeared and the shadow rushed past us. There was one peculiar phenomenon of color connected with the approach and disappearance of the shadow. It was observed that along both lines of the shadow and especially along its departing edge, perhaps more distinctly than its advance line, there was a well-defined strip of yellow color shading off into orange and bright red. This appearance was well defined and bordered the dark lines like a fringe. These lines of color were noted by three or four persons who all agree as to their appearance.

The preceding report was inclosed in the following letter (O. C. S. O. 1368, Misc. 1878), which also gives additional information:

COLORADO SPRINGS, *August* 20, 1878.

MY DEAR GENERAL: On my return from observing the eclipse of the sun, of 29th ultimo, from the summit of Pike's Peak, you requested me to note down any observations of the prismatic colors which preceded and followed the shadow of totality. A pressure of business has heretofore prevented my doing this, but I beg to enclose herewith a short article written by me on the 30th ultimo, which was published in the Daily Gazette here, and was also sent by me to the Philadelphia Press (see above). In this paper I have endeavored briefly to describe one noticeable feature of the eclipse as seen from the summit of the mountain, which could not be seen from a lower altitude, viz, the approach and effect of the shadow of totality. My observations were not of a scientific character, and the only instrument at my command was an ordinary field-glass.

Through your kindness my attention was especially called to the observation of the shadow of total obscuration, and I watched its approach and reappearance with a good deal of care, especially the effect which it produced on the broad landscape which was spread out beneath us. The two colors of red and yellow, with the intermediate shade of orange, to which I have referred in the enclosed article, were clearly and positively shown. They fringed the edges of the shadow as it swept over the parks and plains below us. The colors did not appear to pervade the atmosphere between us and the ground, but lay flat along the surface and directly against the edge of the shadow. Of course the rapidity with which the shadow moved southward gave me only a moment in which to note and fix these colors with the eye, but I am positive that the red and yellow lines were shown. I saw no blue lines, although the shading of red may perhaps have run into purple, but General Hatch and Mrs. Aubrey H. Smith, of our party, are strongly of the opinion that the blue line was also visible.

The presentation of the colors in the manner and place I have noted certainly was not due to dampness or clouds, since the air was dry, and there were no intervening clouds and no evidence of moisture; the colors lay flat upon the surface and were visible only on the edges of the shadow as thrown upon the ground.

I am, General, very truly, yours,

CHAS. B. LAMBORN.

General ALBERT J. MYER, *Chief Signal Officer, Washington, D. C.*

P. S.—Should your office make any publication concerning the eclipse, I should be glad to receive a copy.

[Document No. 24.]

In reply to letter of inquiry, the following communication was received from Colonel Lamborn, dated October 16, 1878 (O. C. S. O. 1754, Misc. 1878):

It is impossible for me to answer the query regarding the sequence of colors. It occurred to me a day or two after the eclipse that this question would be asked, and I mentioned then my inability to decide which color, red or yellow, lay next the dark line of shadow. The movement of the shadow was so rapid, as it swept across the landscape below my point of observation, that I failed to note the sequence of the colors. But that the colors were thrown on the surface of the ground bordering the edge of the shadow as shown on the earth I am confident.

Supposing the shadow at any instant to be represented by the black band on the accompanying diagram, and that A is the rear edge of shadow and B the advance edge of shadow, then the colors lay against the shadow as at A and B, the rear and advance edge respectively; but which color, red or yellow, was next the black line of shadow I am unable to say. (Figure omitted).

[Document No. 25.]

PIKE'S PEAK SUMMIT.

Special report of Mrs. Aubrey H. Smith (see O. C. S. O. 2054, Misc. 1880, *dated July* 31, 1878).

[Extract.]

Slowly, surely, as we sat watching, the moon crept on. The light of the sun grew pale and gray. All yellow rays seemed to fade out of it, and the face of nature and of man took on a ghastly pallor. Two or three minutes before the totality of the eclipse the whole landscape before us was bathed in this cold white light. Then the gloom began to shroud the mountain tops—peak after peak was lost in shadow, and when it reached the plain it seemed to become a solid, palpable body of darkness, rising up in a great wall—not creeping, but rushing on with might and power—

> As night and day contending were.

The shadow moved at the rate of thirty miles per second. Its first appearance at the base of the mountains resembled the sudden gust of a rising sand-storm.

One curious phenomenon noticed by several of our party was that at the point of contact, as it were, of the retreating light and the advancing shadow, the white light became yellow, which deepened into orange and red, while the edge of the gloom took on a bluish hue, forming an iris fringe—a delicate washed-out rainbow. The same colors were even more distinctly visible on the retreat of the shadow after totality.

Now the gloom was upon us. The face of the sun was veiled. The heavens were dark. The stars shone out—Jupiter, Venus, Mars, Mercury, and Regulus in Leo were distinctly visible. The corona of light around the dark body of the moon cast a ring of scintillating red and yellow light, like an aurora on the far-off horizon.

[Document No. 26.]

PIKE'S PEAK SUMMIT.

Special report by Charles O. Shields, of Colorado Springs (O. C. S. O. 1324, *Misc.*, 1878).

I write you regarding the colors preceding the shadow. There was a bank of clouds extending along the northern horizon on which the colors were best shown. The first color I noticed was a very pale yellow, which gradually deepened into a dark orange. This was bordered by a pink, which deepened to a light rose and assumed different shades to a very rich dark rose. Beyond the rose the color grew darker until it became a blue-black. The colors were not arranged in bands as in the spectrum, but were so beautifully blended I could not tell where one color ended and the other began. * * * I was looking at the colors hardly one-quarter of a minute.

[Document No. 27.]

SUMMIT OF MOUNT LINCOLN.

Extract from Denver Daily Tribune, August 3, 1878, (*see O. C. S. O.* 2054, *Misc.* 1880).

There was nothing for some time noticeably more striking in the view than is frequently witnessed at this altitude, with its frequent changes from light to shadow—

nor until a few moments before the total eclipse, when the unusual darkness of the sky northwest was in striking contrast to the yellow light in the southeast. Then this darkness became more concentrated, and rapidly approaching and overspreading, seemed to draw up from the northwest horizon like a dark-blue curtain, displaying in wide bands all the colors of the rainbow, bright yellow close to the northwest horizon changing as you ascend to light yellow, pea-green, purple, and so on to the dark, almost black-blue marking the line of the total eclipse now above us, through which many stars were distinctly visible. During the time of total obscuration on Lincoln, Gray's Peak seemed to be in the line of deepest darkness, the skies gradually brightening as you looked both easterly and westerly to the light yellow now lying on both easterly and westerly horizon, all to be in an instant changed, upon the sudden appearance of the disk of the sun, to a natural display so common to the mountains.

[Document No. 28.]

PIKE'S PEAK EXPEDITION.

Report of Prof. Cleveland Abbe, Assistant O. C. S. O., filed August 12 *and October* 16, 1878. (*O. C. S. O.* 1287 *and* 1722, *Misc.* 1878.)

OFFICE CHIEF SIGNAL OFFICER,
Washington, August 12 *and October* 16, 1878.

GENERAL: In accordance with Special Order No. 97, of July 11, 1878, and your previous verbal instructions, I have the honor to report that I have returned from the expedition to observe the solar eclipse on Pike's Peak, and submit the following narrative and results of observations:

(*a*) NARRATIVE.

Transportation was received on July 13, Saturday afternoon, and I left this city on the morning of the 15th, reaching Colorado Springs on the morning of Saturday, the 20th, without any delay other than such as resulted from missing the railroad connections at Kansas City and at Pueblo.

At Colorado Springs I found that our guest, Prof. S. P. Langley, with his party, had arrived several days previous; had found no preparations made to receive him, and had telegraphed for letters accrediting him to Sergt. William Black in charge of the Signal Service stations at Colorado Springs and at the summit of Pike's Peak. The answering telegram received by Sergeant Black on July 16 was, as I understand, his first official information of, and order to prepare for, our arrival. Notwithstanding the scarcity and high prices of pack animals at this, the height of the tourists' season, Sergeant Black had been fortunate in getting about twelve such, most of them small ones; and in five separate expeditions, the first of which left Colorado Springs on the 18th, and the last about 10 o'clock a. m., Monday, July 22, he got off all the boxes, instruments, tents, and provisions belonging to Professor Langley and myself. My equatorial arrived on the evening of the 20th of July, having been delivered to the Quartermaster-General at Washington on July 1.

I left the Springs with the last train on Monday the 22d (immediately after receiving a telegram from Mr. S. T. Armstrong at Denver, division superintendent of the Western Union Telegraph Company, assuring me that all the preparations necessary to enable us to receive the daily telegraphic time signals would be made by that Company), and in company with Sergeant Black reached the Lake House Monday evening, where we spent the night and met Profs. S. P. and J. W. Langley.

On Tuesday I ascended the rest of the way to the summit, taking the walk very leisurely, as I hoped thereby to lessen the injurious effect of the rarefied air upon my system. Arriving at the summit and finding the station to be in a very bad condition, I at once ordered two of our three tents to be pitched and beds prepared for the night; in this work we were assisted by Mr. Frank Durringer, whom I had ordered employed to assist us in order not to interfere with the regular work of the men on duty at the station. The continual rains and snows were, I found, leaking through the roof of the ante-room in which our instruments had to be temporarily stored, and I therefore ordered the roof covered with cloth and painted, which work was finished by Friday, and contributed materially to the protection of our boxes. Owing to the labor of accomplishing anything on the summit, I subsequently also ordered Mr. E. D. Masters to be employed temporarily.

On Wednesday I set up the 5-inch equatorial and found it all in a perfectly good condition, except the brass driving and clamping spring for the polar axis.

Thursday, Friday, and Saturday were fully occupied in attempting to bring the equatorial into perfect adjustment; in obtaining comparisons between the chronometers and the telegraphic time signals; in observing with the dew-point apparatus; in assisting Professor Langley and his party; in erecting the third tent, and especially in vexatious alternations between wrapping and unwrapping the equatorial with every passing shower or gleam of sunshine.

The locations of tents and instruments are shown upon the map of Pike's Peak reservation given in the subsequent section.

All of the party and the workmen were suffering from headache and other symptoms due to our hard work and the rarefied air. Probably no other astronomers in Colorado experienced such intense physical and mental suffering; and by Saturday night, in view of our exhausted condition and unsatisfactory preliminary preparations, more than one looked forward with relief to the prospect of a continuance of our cloudy, unfavorable weather.

However, Sunday dawned and continued with a perfectly clear sky, and, of course, very dry air, which continued throughout Monday. Everything was therefore soon in perfect readiness, and on Sunday afternoon Professor Langley and his party assured me that they had few unpleasant symptoms left of their mountain sickness and were quite ready for the eclipse. It was otherwise with myself; day by day I had been subject to violent pains throughout my head, which, by Saturday night, had settled into a steady terrible pain in the cerebellum and upper portion of the spinal column. I concluded to lie still throughout Sunday and until Monday noon, thinking that this would be my best preparation for the eclipse of Monday afternoon. In this condition you found me Sunday evening, and I cannot doubt but that your order sending me immediately down on a stretcher to the Lake House was absolutely necessary in order to save life, inasmuch as Drs. Reed and Hart, of Colorado Springs, completely confirmed the testimony of Prof. John W. Langley, M. D. and Private Rufus Choate (formerly assistant surgeon U. S. A.), to the effect that I was in a far more critical condition than I was aware of. Of my own will I certainly would not have left the summit, since I was determined, if possible, to study the solar corona under the unique circumstances of high optical power and pure thin air. It, however, now appears that these observations would have been far less interesting than those that I was able to make with the naked eye at the Lake House.

Leaving the summit Sunday evening, July 28, about half-past six, I reached the Lake House about midnight, but should certainly have been forced to spend the night by a camp fire at timber line had it not been for my faithful bearers and the cheering influence of Private Choate, and for the kindness of Mr. E. V. McCandless, of Pittsburgh, who sent up Mr. Walter Wiley with the mule to meet us, and for the thoughtfulness of Mr. Paul Curtis, who came up with a lantern, without which it would have seemed quite dangerous to proceed.

At the Lake House Dr. Hart arrived about 1 a. m. from Colorado Springs and gave such directions as were best, ordering me not to return to the summit, but to come further down as soon as I felt strong enough. The nurses, Burton and Wilson, also sent up by your order, were quite efficient, but not needing both of them after the first day, I chose to dismiss the latter on Monday evening and retained the former until Tuesday evening.

On Monday afternoon, although unexpectedly weak and faint, I made the naked-eye observations recorded in the following chapter (*d*):

On Tuesday afternoon I borrowed a pony of Mrs. Copley, the proprietress of the Lake House, and descended by the Manitou trail to Colorado Springs, reaching there about 6 p. m. On the way down we met Mr. Masters with the mule and note, as sent up by you, allowing me to descend if able to do so. I had started down with Burton and Mr. Charles Shields, of Colorado Springs, but was soon overtaken by Profs. S. P. and J. W. Langley, who had very kindly remained a day on the summit in order to properly pack and care for our valuable instruments, for which attention our guests deserve our best thanks.

During Wednesday, July 31, I opened, rearranged, and repacked such miscellaneous boxes as first came down from the peak. Word having been sent that owing to the scarcity of pack animals nothing more would arrive from the summit before Friday night, I improved the opportunity to spend Thursday in Denver, where I met numerous astronomers, and returned Friday morning to Colorado Springs. The last boxes and instruments came down late Friday night; one piece, however, was missing, having been dropped by Mr. Marsh's men on the road-side; this was recovered and brought in Saturday noon by Mr. Wade.* On Saturday afternoon I should have started homeward had not my note-books, containing dew-point and chronometer observations, been missing—apparently still at the summit where I had left them Sunday night. Arrangements were at once made to send for them; I obtained one at 11 a. m., Monday; the other was forwarded to Washington.

Leaving Colorado Springs on Monday, at 11.50 a. m., I arrived in Washington on the morning of August 9, and returned to the ordinary duties of the *Fact Room*.

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*Mr. Wade is a very efficient, reliable packer. Both in the ascent and descent he was twice called on to complete work left unfinished by Mr. Marsh's men and should receive especial commendation therefor.

(*b*) OUTFIT.

The outfit and apparatus provided for the Pike's Peak expedition were, essentially, as follows:

1. One equatorial, 5 inches aperture and 7 feet focal length, No. 862, as made by Alvan Clark & Sons for the U. S. Naval Observatory expedition to observe the transit of Venus, and by the Observatory loaned to the Signal Office for use on this occasion. To this equatorial I had especially fitted the following, viz:

   A diaphragm with six threads.
   A low-power eye-piece.
   A frame carrying drawing-board and paper.

2. One sidereal box chronometer (Negus 1470) loaned by the Naval Observatory; this was taken from its gimbals and kept in a wicker basket surrounded with a cotton padding.
3. One bottle of a phosphorescent solution of phosphorus in olive oil, kindly prepared and furnished by Dr. W. M. Mew, in charge of the laboratory of the office of the Surgeon-General of the Army.
4. One phial each of the fluorescent powders, *Uraneme, Thallene,* and *Naphthalene,* kindly prepared and furnished by Prof. Henry Morton, president of the Stevens Institute, Hoboken, N. J.
5. Glass cells for the use of the fluorescent solutions.
6. Two of Adam Hilger's pocket spectroscopes just received from London, and specially adapted to the red end of the spectrum.
7. One Regnault's dew-point apparatus. This was received the day before leaving Washington, and having been made according to a rather old pattern, and without a proper protection for the dry bulb thermometer against radiation, I had hastily constructed a partial shelter by means of a polished brass cylinder, about three inches long by one in diameter, within which was placed the bulb of the dry bulb thermometer of the dew-point apparatus.
8. One pair of thermometers originally designed and constructed as an August psychrometer, but both of which were used by me as wet bulbs, after covering with very thin muslin or cambric.
9. Drawing and tracing paper, black card-board, crayons and pencils, white and tinted.
10. Map of Pike's Peak military reservation, constructed in 1873, under supervision of Lieut. E. H. Ruffner (see report for 1873 of Chief of Engineers).
11. The following books, viz: American Nautical Almanac for 1878; Van Asten's Ephemeris of Encke's Comet; Burnham's Lists of New Double Stars; Argelander's Uranometria; Heis' Uranometria; Eclipse circulars and directions by the Nautical Almanac Office, the Naval Observatory, the Army Signal Service, and by Otto Hess, of Fort Dodge, Iowa; Logarithmic Tables, Smithsonian Physical Tables, &c.
12. Sulphuric ether, 2 pints.
13. Dark glass shades; neutral tint spectacles; strong concave spectacles.
14. Nicol prisms.
15. Browning direct-vision prism.
16. Triangular box-wood scale.
17. Large and small dividers.
18. "T" square and ruler.
19. Three wall tents, flies, poles, blankets, &c.
20. Claw hammer.
21. Two monkey-wrenches.
22. Three screw-drivers.
23. Three wood chisels.
24. Three iron chisels.
25. Three stone chisels.
26. One hand vise.
27. One pair of pliers.
28. One set Aiken's patent handle and tools.
29. One set sail needles.
30. One bulls-eye lantern.
31. Lamp-wick, twine, sperm-oil, oil-squirt, &c.

Other articles and tools that were supposed to be available at the summit as regular station supplies were frequently sorely needed, and in general every expedition of this kind should be provided against any probable emergency.

(*c*) PROJECTED PLAN OF WORK TO BE UNDERTAKEN AT THE SUMMIT OF PIKE'S PEAK.

It was hoped that it would be practicable for me to make observations upon the following subjects:

1. Observations as frequently as possible, especially in the driest portion of the day, upon the wet and dry bulb thermometers and the dew-point apparatus.

2. Observations of relative blueness of the sky at Colorado Springs and at the summit. These were prevented by my failure to obtain a satisfactory cyanometer.

3. Observations of the increase in brightness of stars due to ascending the peak; this to be determined by examining the neighborhood of Alpha Lyræ, Alpha Cygni, Beta Cephei, Alpha Pegasi, &c., for such faint stars as might become visible.

4. Observations of Encke's comet, if visible in that portion of its orbit near the sun.

5. Observations of the stars to be detected in the darkest spots within the Milky Way.

6. Telescopic observations of the disks of the planets Jupiter, Saturn, &c.

7. Studies and sketches of some of the Nebulæ.

NOTE.—The preceding celestial observations, Nos. 3 to 7, were wholly prevented by personal illness and very unfavorable weather.

8. Observations of the aqueous bands shown by the spectroscope. These were especially to be observed during totality simultaneously at the summit and base. These observations were intrusted to Rufus Choate, M. D., Private Signal Corps, at the summit, and Prof. F. H. Loud, of Colorado College, at the base.

9. Comparison of the tint of the light of the corona with that given out by Dr. Mew's phosphorescent solution. These were expected to be almost identical.

10. Examination of the effect of the fluorescent powders, *Naphthalene* and *Thallene*, and of the fluorescent solution of *Uraneme* upon the coronal light.

11. Careful study and drawings of special portions of the corona, particularly on the following or last half of the sun, with the five-inch equatorial and as high a magnifying power as possible, in order on the one hand to discover the minute details of structure of the coronal wisps, prominences or clouds, and on the other hand to detect any phenomenon in the solar atmosphere that might throw light upon the clouds and currents of the earth's atmosphere, or that could be supposed in any way to affect the earth.

12. Careful study of the region all about the sun during totality by the naked eye and by glasses of low power, to determine the utmost limit of the coronal light and streamers, the visible stars, &c.

13. Observations of the shadow of the moon projected upon the plains surrounding Pike's Peak; also of the colors shown upon the distant clouds, if any.

14. In case the clouds or fog utterly prevented a direct view of the sun during totality, some attempt was to be made (in accordance with the verbal request of Mr. A. C. Ranyard, of London) to determine the planes of polarization of the light that penetrated through such clouds or fog.

(*d*) OBSERVATIONS OF THE SOLAR CORONA MADE DURING THE TOTAL ECLIPSE, MONDAY, JULY 29, 1878, AT THE LAKE HOUSE, PIKE'S PEAK, COLORADO.

The following drawing and description was almost wholly made out from my rough notes on the Wednesday and Thursday following the eclipse, and before I had spoken to others except Professor Langley concerning the phenomena; they therefore fairly present the impressions fresh in my memory, and this I consider important in view of the extensive interchange of views that took place between the numerous observers on Thursday evening, August 1, and subsequently.

Having been carried from the summit of Pike's Peak, altitude 14,147 feet, down to the Lake House, altitude 10,230 feet, I had by Monday noon revived sufficiently to be laid on the ground upon a gentle slope facing southwest, where I studied such phenomena as were visible during totality. Two stakes were driven down, one on each side of me, supporting between them a cross-bar or axis, to which a board was nailed carrying a sheet of paper whose plane was very nearly perpendicular to my line of sight. My head being propped up, I easily kept my gaze fixed upon the sun during the whole of totality. By slightly tipping the board about its revolvable horizontal axis I could easily bring the sun to be just visible over its upper edge while I drew in such details as I saw and that too, as it seemed at the time, with very considerable accuracy. For steadiness, ease and convenience and accuracy, the whole arrangement was highly satisfactory.

I had no optical instruments, nor even pencil and paper, except such as I could borrow. Even my spectacles were, unfortunately, not quite strong enough to entirely correct my near-sightedness, those that I habitually use when looking for faint stars or other celestial details having been left behind in the haste of the descent from the summit.* Although, therefore, I strained my eyes considerably, yet I cannot describe minute details in the structure of either the corona proper or the so-called coronal rays. My whole attention, undisturbed by any other consideration, was given to these rays, and although, owing to my feebleness, I was conscious of the exertion required in order to concentrate my thoughts on anything, yet I cannot doubt the reality of what I describe.

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* In September, 1878, I ascertained that my right eye is slightly astigmatic, but this could not have affected these observations.—C. A.

I closed my eyes and shielded them behind my drawing-board from the sunlight until perhaps five seconds after the second contact, principally because I was not at first wholly certain that totality had begun, so slight was the change of brightness in surrounding objects. Messrs. Curtis and Wiley subsequently told me that they observed the duration of totality to be 161¾ seconds. Messrs. Burton and Wilson stated that they respectively saw three and five stars visible during totality.

The following is my own record: Immediately after the second contact the moon appeared, surrounded by a narrow brilliant yellowish-white ring, less than five minutes broad, probably very nearly one-eighth of the sun's diameter, or four minutes broad. This ring was as brilliant as the full moon, of uniform tint and breadth, continuous, and without noticeable structure or rift. Within this corona I detected no reddish tinge or flames until shortly before the third contact. Outside of this ring there was no other coronal appearance except the rays and no other external boundary, and the dark blue sky immediately adjoined this ring of light, which I will call the true s olar corona or atmosphere.

The sky was perfectly free from dust, haze, or clouds—remarkably so, even for Colorado—and before totality was of immaculate dark blue, while during totality it appeared a deep blue-black. The illumination of surrounding objects due to the coronal light was so strong that the change from before to after second contact was, I thought, barely perceptible, the dark blue tint of the sky being only a few grades darker, and the diffused light from the corona being all-sufficient to read and write by, although it had nothing of the "body" that makes a bright full moon so effective.

From the moon, or corona, or sun, as you please, but as it seemed to me from far behind the sun, passed out two rays (Nos. 1 and 5 of the accompanying sketch) of the most delicate imaginable bluish tint, each tapering to a fine point, and other rays (2, 3, and 4), which seemed to be nearer me, and of all of which the following is a detailed account:

The drawing No. 9 of the accompanying collection of engravings presents some idea of this appearance. The position-angles and relative position of the vertical circle can, I believe, be relied on to within less than 5°, as my original rough sketch was carefully drawn in this respect, and, in fact, was little else than a tracing, as it were, made on a sheet of paper held before me and perpendicular to the line of sight.

No. 1 was seen on my first glance of the corona and then appeared to extend out about three solar diameters, but by the middle of the eclipse, as my eyes became accustomed to the sight, I traced its tapering end to a distance of six diameters. Its sides were straight lines; its axis passed a little below and not through the sun's center. Its light was an exceedingly faint and delicate white, apparently overspread or intermingled with the dark blue of the atmosphere, as if the ray was constituted of white gauze or very close isolated white dots, between which only the atmospheric blue existed. I saw no texture, striation or other structure, nor any variation of its light; if anything, the intensity was slightly greater towards the apex, but this may have been an optical illusion. There certainly was no great, but may have been a very slight, increase of brightness at its base in the close neighborhood of the sun; the delicate light extended continuously up to the corona, in the glare of whose irradiation it was lost. The base of No. 1 was noted as "broadening and brightening rather suddenly close to the corona," which I quickly thereafter saw and concluded to be due to the irradiation of the brilliant light from that ring. The relation of this ray to the sun or moon did not visibly vary. My previous knowledge of these rays, especially as seen by others at Sioux Falls City, Dak., in August, 1869, had led me to believe that they must be either purely subjective or else dependent on the moon and our own atmosphere; therefore I looked very closely for some change or motion or flicker, and turned my head to see if the rays moved with the eye. No changes were seen within, perhaps, thirty seconds of time. I became perfectly convinced that these rays were permanent and real and more important than I had hitherto believed. Thereupon I applied myself to more carefully study and draw whatever I could see of them on other portions of the sun's limb.

No. 2. This was seen in a general way as soon as No. 1; its bounding rays diverged not from the sun's center, but from a point beyond. The first impression was that their divergence was at an angle of about 20° or 30°, but subsequent considerations seemed to very considerably diminish this angle. When first seen, I estimated its outer limit at about one diameter from the moon's limb, but subsequently it was traced to one and a half diameters. At (2 *A*) the bounding rays were at first not noticed, but were seen at the second glance coming out with the appearance of a sudden flicker (but which may easily have been subjective, owing to the successive, rather rapid, glances given to different parts of the corona), and appearing rather more prominent than the rest of No. 2; with this exception the light was very uniformly distributed over No. 2; it did not seem to broaden or brighten at the base near the corona. The same bluish tinge pervaded No. 2 as in the case of No. 1.

No. 3. This was estimated as extending about three diameters; it was narrower and shorter than (1), and its axis was nearly a continuation of that (1) passing below the moon's center by four or five minutes of arc; it also was broader at its base, tapering to its apex like No. 1, and of the same uniform intensity and tint.

No. 4. This was not noticed until totality was half over, and subsequently became quite plain; towards the end of totality its length was one diameter, and it was certainly brighter at its apex than near the sun; gradually I became conscious of a faint light partially connecting (3) and (4), so that the final impression left on me was that these two, with the intermediate light, constituted one fish-tail-shaped mass of light similar to No. 2, but decidedly fading out in the central portions. The axes of the combined mass (3) and (4) was a continuation of the axis of (1) and passed nearly through the sun's center.

No. 5. This extended fully five diameters from the sun's limb and was in form and tint similar to No. 1: its base was broader than (1), therefore the angle at its apex was larger. Its light was, I think, decidedly fainter than that of (1); its edges were straight lines except that very near the corona they suddenly spread and brightened, which appearance I attributed, as before to irradiation from the corona, to which in this case is to be added the effect of the chromospheric light No. 6, which gradually grew brighter at the base of No. 5 until it attracted my attention.

All these rays, (1) to (5), appeared to vary somewhat both in intensity and extent, but not at all in position. And I, at the time, felt certain that their variations were subjective and connected in part with my imperfectly corrected near-sightedness, and in part with my illness and the conscious strain upon both mind and eyes. I, therefore, cannot describe these rays otherwise than as essentially permanent; whatever was once recognized seemed subsequently to remain perfectly constant. With increasing familiarity and study I saw details that at first escaped attention. Thus it became evident that the borders and axes of (2) and of (3, 4) were straight lines and continuations of the borders and axes of (5) and (1) respectively.

The impression left upon my mind with regard to these rays was that these were essentially but two tapering beams of light, far behind the sun, crossing each other nearly at right angles; the tapering being due essentially to the perspective effect of increasing distance, while the broad ends were nearer to us and possibly at their ends even nearer than the sun.

A few rapid glances during a few seconds in the midst of other occupations, or a greater thickness of dusty and hazy air, might have easily caused the impression that these rays started from the sun and radiated in four directions, or that they were atmospheric or even subjective; but the pure air, the undivided attention and study, and their quiet permanence, enable me to say that the evidence is to my mind all strongly in favor of their real existence and of their having no physical connection with either earth or moon or sun or coronal atmosphere.

The descriptions and drawing that I have since seen by Prof. Langley at the summit, and by numerous observers at Colorado Springs and elsewhere, further convince me that it must be allowed that a thickness of 4,000 feet even of the pure air that prevailed that day in Colorado exercises an appreciable influence upon the appearance of such delicate streamers as are here described. Certainly the appearance of the milky way, from the Lake House, was remarkably different from its broad expanse as seen from the summit of Pike's Peak.

It was, perhaps, an hour after the eclipse was over, and I had already returned to my bed, quite tired out, when it occurred to me that a stream of meteors, such as the November or August stream, if it happened to be in that part of its orbit lying on the further side of the sun, would present the appearance of a tapering beam of delicate light precisely such as shown by these two rays. It will, however, require some further study to decide whether any such explanation is admissible, and, if so, whether it will explain the numerous beams seen on previous occasions; such beams may be in many cases due to meteor streams new to astronomy, and some of them possibly lying so far within or without the earth's orbit as only to become observable to us during total eclipses.

No. 6. I saw no red flames until, perhaps, thirty seconds before third contact, when there appeared at the base of (5), but a little to the right, a low mound of very dark, almost black, red, which gradually rose at the center (*i. e.*, by the uncovering of its base) and appeared to form a very considerable dark mound-like projection about one-half minute high, superposed upon the base of (5), and upon the coronal ring; its real height could have been only a few seconds; its base covered 45° to 50° of the sun's limb.

No. 7. The third contact took place at or near the point (7), as indicated in the diagram, beeween the rays (4) and (5), but nearer to the base of (4).

After third contact, I was busy writing down notes and sketches, and omitted to screen the bright limb of the sun, and to attempt to continue watching the rays (1) to (5), as I am now confident that I could have done for some seconds longer.

(*e*) NOTE ADDED OCTOBER, 1880.

In a general way the ideas that the sun is fed by meteors, that the zodiacal light is an appearance due to solar light reflected from a ring or flat disk of meteoric dust, and that comets are of meteoric nature, had been familiar to astronomers for twenty years past. Numerous questions in reference to the solar corona and meteors had been treated of by eminent astronomers and physicists, whose results are given, *e. g.*, in a clear and positive style by R. A. Proctor (see his "Essays on Astronomy," 1872, and "The Sun," 2d ed., 1872), who, among other things, had himself shown that any corona seen within 5 or 6 degrees of the moon during eclipses could not reasonably be considered as due in any way to our atmosphere, or to any optical illusion on the part of the observer. This conclusion had been adopted by myself and many others, so far as it related to the so-called "inner corona," and in fact had been equally ably maintained by Harkness (Report of Eclipse of August 7, 1869, page 64), by Curtis (*idem*, page 150), &c. But with regard to the "outer corona" or the long streamers the case was quite different; these had been seen extending to great distances from the sun's surface, *e. g.*, 4°, by Otto Struve in 1842 at Lipesk, 1° in 1860 by Bruhns, 1°. 5 in August 1868 at Mantuawolok, 1°. 5 in August 1869 by General Myer; with regard to these, probably the general opinion in 1878 was expressed by Lockyer in the words "the non-solar origin of the radial structure was conclusively established"; as also, by Newcomb, page 6 of his *Instructions for observing the total eclipse of 29th July*, 1878; "DRAWINGS OF CORONA—It will be necessary to distinguish between the real object and the rays surrounding it which are the result of an optical illusion."

Now, on the other hand, Proctor and Harkness had maintained that the long streamers, the radial striæ, and indeed the whole of the outer corona are not phenomena of a gaseous atmosphere enveloping the sun, although they must be connected with, and intimately related to, the sun; since the existence of a gaseous atmosphere at a distance exceeding 10′ above the sun's surface, was supposed to have been rendered highly improbable by the arguments of J. H. Lane, Harkness, and Proctor, while the outer radiated corona was supposed to be all located higher up above the sun's surface. Proctor and also Harkness (See Report of the Eclipse of 1870, pp. 85–87) adopted the view that this radiated structure was explicable on the assumption that matter is ejected from the sun's surface with immense velocities, piercing the low thin gaseous atmosphere, and reaching to the limit of the extreme coronal streamers under the influence of a repulsive force, such as is exhibited in comets' tails. The outer corona is, therefore, according to Proctor and others, the result of, 1st, solar light reflected from meteors falling into the sun from all sides; 2d, light emitted by such of these meteors as are heated to incandescence; 3d, light emitted by and reflected from matter ejected from the sun.

Under these circumstances, I could but regard the suggestion that occurred to me on July 29 as a slight but important extension and modification of the views previously held by these and other astronomers; it amounted to saying that a large part of the phenomena of the outer corona is essentially non-solar, having to do with cold meteoric matter that is beyond the solar gaseous atmosphere, and is shining by reflected light, although it may be rushing on its way to plunge into the sun's atmosphere, where within a few hours it would be dissipated. The reader should guard against supposing that I in the least intended to suggest that the August or November or any other well-known meteor streams are identical with the beams visible on July 29; these streams were quoted merely as examples of known streams, from which, by analogy, astronomers had long been accustomed to acknowledge the probability that innumerable other streams exist throughout the solar system. In fact, I from the first considered that these beams were, in all probability, due to wholly new meteor streams, since, although they might be the perihelion portions of such streams as were already catalogued by Heis, Herschel, &c., yet equally possible was it that they consisted of meteors now for the first time approaching the sun, and that at their broad ends these streamers were already turning from the almost rectilinear portions of their orbits into curves of short radius just before being swallowed up in the sun.

I am now inclined to extend this view to very many of the radiating dark and bright lines observed during eclipses, and would explain most of them as due to brightly illuminated groups and streams of meteors and to large meteors followed by trains, all which have as yet scarcely reached the outer limit of the sun's thin atmosphere. In accordance with this view the pearly white cones seen by me August, 1869 (see Am. Jour. Sci., 1872), and also apparently by J. H. Lane (Coast Survey Report of Eclipse of 1869, pp. 168–169), the very similar mounds of light depicted by Liais, 1858, and Feilitsch, 1860, the streamers and curious streak recorded by the Manilla observers at Mantuawolok August, 1868, the brilliant tails drawn by Trouvelot, 1878, and also photographed by Harkness, would all be meteors and trails, or groups of meteors brilliantly illuminated by their proximity to the sun and moving in such eccentric orbits about him as necessarily to appear to us, in most cases, to be moving directly towards or from his center. (Might not the intensely brilliant spot seen by Carrington and Hodgson, September, 1859, be also a solar meteor with its train?)

Those meteors that enter the solar atmosphere and become incandescent will, of course, shine with a greatly increased splendor and thus constitute a portion of the inner corona; these thus show us the limit of the gaseous atmosphere of the sun, the outer regions of which atmosphere must be filled with meteoric dust due to the dissipation of meteors, but which dust will shine mostly by reflected light and with little or none of its own, therefore, the limit of the brilliant golden ring called the inner corona will be the apparent extent or contour of the thin transparent gaseous atmosphere of the sun, and its limits may vary considerably with the quantity and nature of the meteoric matter that happens to be entering into the atmosphere at or just before the time of an eclipse. The extreme limit of this gaseous atmosphere, so far as shown by the brilliancy of the incandescent particles contained therein, may be located at the outside at a distance of 5′ or 130,000 miles, and is very likely to be less than this. The mechanical conditions under which such a gaseous atmosphere must exist have been critically examined by J. H. Lane (Am. Jour. Sci., July, 1870, 2d series, vol. 50, page 57); and an approximate estimate of its density at this extreme outside limit may be arrived at by inquiring what density would be necessary in order to render meteors incandescent; the reply to which may be given by the following considerations:

Meteors glow or burn and dissipate as shooting stars when they strike our atmosphere with a relative velocity from 20 to 40 miles per second, and this occurs at an altitude of about 100 miles above the earth's surface, where the density of the atmosphere may be computed to be about 0.000,000,003 or 3×10^{-9} of that which prevails at the surface under a pressure of 30 inches and a temperature of 50° Fahrenheit. Now, these same meteors, or, in fact, any that fall from interplanetary space toward the sun will, when they have approached to within 130,000 miles of the sun's surface, have a velocity of at least 320 miles per second, or from 8 to 16 times the velocity, or 64 to 256 times the *vis viva* with which they enter the outer limit of the earth's atmosphere; therefore we are allowed to assume the density of the outer limit of the supposed solar atmosphere to be but the $\frac{1}{100}$ of that of the earth, or 3×10^{-11}; this gives us for the base of the solar atmosphere a density and pressure quite within plausible bounds.

In accordance with this view the constitution of the sun and corona would be about as follows:

(1.) The sun surrounded by its only visible surface—the photosphere; apparently a glowing mass of condensing vapors whose temperature is maintained by the slow shrinkage of its mass, whose light is not polarized and whose spectrum is continuous.

(2.) To a height of a few seconds and subject to temporary extensions called protuberances, extending in the extreme case of Professor Young to 7′ 49″—the chromosphere; a thin layer of heavy glowing red gases, whose light of itself gives us a spectrum of bright lines, but which latter, by absorption of the light from the photosphere, are themselves reversed into the dark lines of the ordinary solar spectrum.

(3.) To a height of 5′, but subject to large oscillations—the transparent atmosphere; a layer of hot, but not glowing transparent gas, through which medium the radiation from the sun is conveyed to the outside world; it is necessarily slightly cooler at its exterior limit than at its base, and is therefore in a state of convective equilibrium; its average temperature is that given by investigations into solar radiation, such as by Herschel, Pouillet, Crova, Ericsson, and may be assumed at 1500° C. or 2000° C. This atmosphere may be divided into two regions, an inner region extending to about 5′ from the sun's surface or to where the density is 3×10^{-11}, and an outer region whose limit, if there be any, is probably fixed by unknown conditions. The meteoric matter that is perpetually falling into or towards the sun is in this outer region visible only by the reflected solar light, and gives rise to an indefinite cloud, scarcely perceptible to the eye, extending a few minutes above the 5′ limit, and permeated by faint radial streaks due to meteors grouped in streams, moving in planes, passing through the sun's center. The meteoric matter that reaches the inner region becomes immediately incandescent, and gives rise to brilliant streaks, and streams, and trails, usually directed towards the sun, but not necessarily to its center, since the brightest trains may continue visible for several hours and show the curved paths that the bodies pursue near the sun.

The impact of this meteoric matter contributes sensibly to the maintenance of the temperature of the transparent atmosphere, and thereby indirectly retards the cooling of the sun's surface or photosphere; the slight variations in solar temperatures revealed by thermometric observations on the earth during the past century (See Köppen, Zeit. Met., 1876) may be due to periodical variations in this meteoric bombardment.

(4.) Beyond the outer atmosphere, or between 10′ and 5° from the sun's surface, we have to do only with meteoric and cometic matter approaching or encircling the sun, and shining by reflected light, thus giving rise to the zodiacal light, to the long streamers of the outer corona, the shorter streamers, and the comets or comet-shaped bodies observed nearer the sun.

(*f*) GEOGRAPHICAL LOCATION.

The accompanying copy of the official plat, by E. S. Nettleton, Civil Engineer, and Lieut. E. H. Ruffner, Engineer Corps, U. S. A., of the military reservation on Pike's Peak, will abundantly illustrate our position on the summit.

The position of J. T. Gardner's monument on the summit is given by his triangulation for Hayden's U. S. geological and geographical survey as follows: latitude 38° 50′ 27″.3; longitude 105° 2′ 25″.6; altitude 14,147 feet.

Additional special observations by myself for latitude and longitude were not considered necessary.

(*g*) TRANSPARENCY OF THE EARTH'S ATMOSPHERE.

My plan of work contemplated such a series of observations on faint stars and other celestial objects as would contribute something to our knowledge of the great gain to astronomy to be achieved by elevating telescopes above atmospheric obstacles to distinct vision. These obstacles are, dust—or smoke—haze, aqueous vapor—haze (either as molecular or as drops of water or spiculæ and minute crystals of ice) and minute streams of mingling warm and cool or moist and dry air.

The polarimeter and cyanometer give us some idea of the relative amounts of minute particles in different portions of the sky, and I exceedingly regretted not being able to observe with these instruments.

The spectroscope enables us to discriminate between aqueous vapor and the partiticles of dust, but the proper apparatus was not at hand.

The solar thermometer and especially the thermo-electric pile give us the means of determining the total heat absorbed by the atmosphere and dissipated by the haze or dust, but I hoped without resorting to such delicate apparatus to obtain by direct telescopic examination of faint stars and nebulæ such testimony as could be directly applied to the question of the proper location of large astronomical telescopes.

This is the first occasion on which an equatorial of 5 inches aperture and high optical perfection has ever been established at a point over 14,000 feet in elevation.

The preceding narrative will have explained in general why no special observations were undertaken during the four nights, Wednesday to Saturday inclusive, on which the equatorial was mounted and available.

So far as I saw the sky during these nights it was cloudy until late at night and again very early in the morning, with frequent squalls and snow-falls, so that Sunday was our first clear night.

On that evening as I lay face upwards upon a stretcher I had a most excellent naked-eye view of the zenithal portions of the sky, and my general impressions, for I could not take notes at the time, are as follows:

My attention was directed most of the time to the brilliancy, and especially to the great extension, of the milky way. After 9 p. m., being in the forest, I could, of course, see but little; but between 7 and 9 p. m. I had near the zenith that portion of the milky way which is in the constellations of Cygnus, Lyra, and Aquila and Cassiopeia, or between the parallels of 20° and 60° north and the right ascension of 270° and 360°. Within this region the dark spaces of the milky way seemed to entirely disappear, being replaced by a multitude of fine stars and by hazy light. The outer limits of the milky way were extended to the east and west beyond the limits given by Heis in his Uranometria, so that I should estimate its visible breadth at one-fourth or one-third greater than as given by him. On the other hand, the greater contrasts of light and dark seemed to be removed; the brightness of the light portions was not so much intensified by the clearness of vision as was that of the faint parts, and the whole via lactea assumed a continuity and a body that I never saw it have at lower altitudes. At the Lake House, at midnight, I again looked up and was struck with the fact that both the lateral extension and the filling in of the dark spaces had disappeared, and the milky way had resumed its ordinary appearance at lower altitudes, only it shone very brightly. It seemed either that a haze had formed in the upper air or else we had come down into a layer of fine dust or mist.

I should estimate that at the summit the stars that became visible to the naked eye were fully one magnitude fainter than those seen at sea-level; that is to say, the seventh magnitude of Heis's chart had become fairly visible. I should have enjoyed sharper vision had I been provided with the proper pair of concave glasses.

(*h*) SPECTROSCOPIC OBSERVATIONS.

Notwithstanding the dryness of the atmosphere in Colorado it was considered that possibly our excellent hand spectroscopes, made by Hilger, for observing aqueous lines might be turned to some useful account by attempting to answer the question proposed by you, "Where, between the earth and the sun, does aqueous vapor cease to exist?" for at this limit, wherever it is, our study of terrestrial meteorology must begin. The following considerations guided me in an attempt to frame the necessary instructions for this class of observations:

First. The heat of the solar atmosphere must prevent the existence of aqueous vapor in any form up to a very considerable distance from the sun's surface.

Second. At and beyond this limit the extreme tenuity of the vapors and gases of interplanetary space requires that an enormous thickness must intervene in order to produce visible absorption bands.

Third. If any aqueous absorption bands are visible during totality in the diffused light of our atmosphere they must be due either to absorption in the solar atmosphere near the sun or to that in the earth's atmosphere as illumined by the coronal light, since the light from the body of the sun cannot reach the observer's eye during totality.

Fourth. The lines due to absorption in the solar atmosphere must be faint, owing to the minute quantity of vapor present anywhere within the orbit of Mercury; the lines due to absorption in the earth's atmosphere during totality must be faint owing to the faintness of the coronal light, and also to the small amount of atmospheric vapor above the observer on a dry day in Colorado.

Fifth. The success of the observations will depend upon the relative intensity of these two series of faint bands originating respectively in the solar and terrestrial atmospheres; at the summit of Pike's Peak the intensity of the aqueous bands may perhaps be in equal proportions due to the solar absorption and the terrestrial absorption, but at the base of the mountain the latter will predominate.

Sixth. The examination of a belt of sky passing vertically through the sun will show the law and amount of absorption due to our atmosphere; the subtraction of this influence from the results of observations on a horizontal belt of sky through the sun's center will show the presence of any absorption beyond the earth's atmosphere, if any such takes place.

Seventh. The atmospheric absorption deduced from the observations at a low station may be reduced to the upper station and applied as a check or as a more accurate determination.

Hoping that in some such way we may with powerful instruments, at some future time, separate the absorptions due to the atmospheric, the interplanetary and the solar aqueous vapors, I endeavored to carry out your desire that at least some plan of observations should be put into practice on this occasion.

One of the Hilger's pocket spectroscopes was intrusted to Prof. F. H. Loud, at Colorado Springs, and another to Private Rufus Choate, at Pike's Peak summit. But a few hours were, however, available for any preliminary practice. They were directed to familiarize themselves with certain aqueous lines between B and D and with the varying brightness of these lines on each day and at various parts of the sky. During totality they were to sweep from the sun up and down, and right and left, and if any lines were visible to note the different rates at which their intensity varied.

Although it seemed a hopeless undertaking, yet these observers faithfully attempted to carry out the programme.

Prof. Loud reports as follows (O. C. S. O. 3695 V. R., August 21, 1878):

"Before the eclipse began I arranged the spectroscope in respect of aperture and focus so as to make the Fraunhofer lines as distinct as possible. After second contact I turned the spectroscope thus adjusted upon the corona, but the slit was so narrow that the light admitted was not sufficient to affect my eye, save in the very slightest degree. I thought I caught a vestige of color, but did not stop to notice what or where it was, in my hurry to get the slit adjusted for a little more light."

Here followed some interruptions from others, after which "I turned the screw for the slit, I imagine the wrong way, for when I again looked into it I saw nothing at all." Here followed some more interruptions, and the totality ended.

Private Rufus Choate, Signal Corps, reports as follows:

"The instrument was small, and difficult, during the eclipse, to properly adjust. Two-thirds of the time of the eclipse was lost in restoring adjustment.

"At eight-tenths of eclipse the C line was distinctly visible; D invisible; E visible, and F visible. No intermediate lines were visible.

"Just before totality, in the face of the sun, only F was visible.

"At totality the lines faded and none were prominently visible. A faint trace of D during totality was visible. D was not visible or was not observed at eight-tenths [Of course it must have been overlooked.—C. A.], but now in the totality it became faintly visible.

"Immediately after totality, that is to say, at the beginning of the solar illumination, D, E, F, and G came out distinctly visible, while C remained invisible.

"As the obscuration was removed C, D, E, F and G came out more and more distinctly visible until the brightness of the sun obscured all."

(*i*) CHRONOMETER COMPARISONS AND CONTACT OBSERVATIONS.

The telegraphic time signals from the observatories at Allegheny City and at Washington were received each day as regularly as the condition of the telegraph lines admitted, but were rarely so distinct or so free from interruptions by intermediate offices as was to be desired.

The sidereal chronometer "Negus 1470" had been chosen by me for observations of the stars, &c., in preference to a mean time chronometer, and the Naval Observatory certificate that accompanied it stated that on July 5 its correction was +2^h 53^m 8.98^s on Washington sidereal time, and its daily rate +2.73 seconds, or gaining; therefore its corrections on subsequent days should be as follows:

Correction on Washington sidereal time.

	h. m. s.
July 15	+2 52 41.68
24	52 17.11
25	52 14.38
26	52 11.65
27	52 8.92
28	52 6.19
29	+2 52 3.46

But as this rate obtains only for a temperature of 70° or 80° it cannot be expected to apply exactly to the time when the chronometer was traveling, and to the week spent on the Peak, where its temperature must have averaged about 50°.

The comparisons with the time signals telegraphed daily from Professor Langley's observatory at Allegheny City, 4*h.* 10*m.* 0*s.* Columbus time, or 4*h.* 12*m.* 0*s.* Allegheny mean time, or 4*h.* 23*m.* 50*s.* Washington mean time, are as follows:

Date.	Signals received by 1470 Negus.	Signals at Washington mean time.	Reduction to sidereal time.	Sidereal time of Washington mean noon.	Signal sent at Washington sidereal time.	Chronometer corrections on Washington sidereal time.
	h. m. s.	*h. m. s.*	*m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
July 24*	9 41 4	4 23 50.2	+0 43.34	8 9 8.80	12 33 42.34	+2 52 38.3
26†						
27	9 52 5.73	4 23 50.2	+0 43.34	8 20 58.47	12 45 32.01	+2 52 34.7
28	9 57 54.6	4 23 50.2	+0 43.34	8 24 55.03	12 49 28.57	+2 52 34.0
29‡	52.5	4 23 50.2	+0 43.34	8 28 51.28	12 53 24.82	27.7

*On the 24th the signal was considered uncertain as to the minutes.

†Signals were unintelligible on the 26th.

‡On the 29th the minutes were not recorded, whence this determination of chronometer corrections becomes somewhat uncertain.

The comparisons with Washington Observatory time signals were as follows:

Date.	Signals received by 1470 Negus.	Signals sent at Washington mean time.	Reduction to sidereal time.	Sidereal time of Washington mean noon.	Signal sent at Washington sidereal time.	Chronometer correction on Washington sidereal time.
	h. m. s.	*h. m. s.*	*m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
July 26	Unintelligible.					
27	Not received.					
27	8 28 52	3 0 0.00	+0 29.57	8 20 58.47	11 21 28.04	+2 52 36.0
28	Not received.					
29	Not received.					

Neglecting any small uncertainties in the longitudes of Allegheny City, or in the original signals at Allegheny and Washington, the resulting corrections on Washington sidereal time are, therefore, as follows:

Date.	Chronometer time.	Chronometer correction.	Signals from—
	h. m.	*h. m. s.*	
July 24	9 41	+2 52 38.3	Allegheny.
July 27	8 28	36.0	Washington.
July 27	9 52	34.7	Allegheny.
July 28	9 57	34.1	Allegheny.
July 29	10 22	27.7	Allegheny.

Whence the chronometer correction on July 29 at $10^h\ 51^m$ p. m., chronometer time, may be assumed, as given by the Allegheny signal at $10^h\ 2^m$, as being $+\ 2^h\ 52^m\ 27^s.7$ on Washington sidereal time.

This result is directly applicable to the only observation of contact that was recorded by the Negus chronometer, *i. e.*, "First contact, observed by S. P. Langley with equatorial, recorded by Choate as $10^h\ 51^m\ 30^s$ by Negus 1470, and estimated to be five seconds too late," which observation corrected as above gives—

First contact observed at $13^h\ 43^m\ 57^s.7$ Washington sidereal time.

8 28 51.58 sidereal time of Washington mean noon.

5 15 6.1 sidereal interval.
0 0 51.62 reduction to mean time,

or first contact observed at 5 14 14.5 Washington mean time, and estimated to be five seconds late.

(*k*) OBSERVATIONS OF DEW-POINT.

In view of the importance of testing Regnault's formula for the reduction of hygrometric observations made at high stations with the August psychrometer, or wet and dry bulb thermometers, I had for a long time desired to secure a full series of comparative observations at great altitudes and in very dry climates, and am therefore much disappointed at having only the following short series to present.

The Regnault dew-point apparatus having been received at the last moment before leaving Washington, no preliminary observations or comparison of its thermometers could be made. The original arrangement of its thermometers was quite inconvenient and objectionable.

At Pike's Peak the dry bulb was placed alongside of the dew-point and the two wet bulb thermometers, and all were in the same thermometer shelter with the station instruments; the dry bulb was further sheltered by a thin vertical brass cylinder.

Two thermometers, dry bulb and dew-point, were apparently by Casella, having scales engraved on the glass stems. The wet bulbs were wet by hand before taking each observation; they were: Wet bulb 274 *A*, made by Green, scale on brass back; wet bulb 274 *B*, made by Green, scale on brass back, of the same size and pattern as furnished to all Signal Service stations. The two wet bulbs were of the same size and covered with pieces of the same very thin muslin. Observations were only desired during the driest part of each day, and had to be taken at irregular intervals whenever other duties permitted. The only days on which I could attend to these observations at all were Thursday, Friday, and Saturday.

The dew-point apparatus was put in place on Wednesday, July 24, in the thermometer shelter, two feet below the station thermometer and four feet above ground.

The record of the observations is given in the first six columns of the following table; in the succeeding table I have given the dew-point, vapor tension, and relative humidity as computed from the wet and dry bulb readings by Regnault's full formula for a barometric pressure of 18 inches, and as given by Guyot's tables for a pressure of 29.7 inches. The errors in the relative humidity, dew-point, &c., introduced by using these latter tables for our high stations are very large, and especially so at low temperatures or in very dry weather.

Date.	Dry bulbs.	Wet bulbs.		Observed dew-point.	Barometric pressure.	Notes.
		274 A.	274 B.			
	°	°	°	°	*Inch.*	
July 25, noon	44.4	39.6	39.8	37.7	18.0	
12.30 p. m	48.4	41.3	41.5	37.5		
1.25 p. m	44.0	41.4	41.0	34.7		Heavy hail-storm prevailing.
3.20 p. m	37.5	35.5	35.6	33.0		Cold north wind, rain and sleet.
5.10 p. m	37.0	35.1	35.3	34.0		Cold, dry, west wind, clearing.
26, 8.00 a. m	36.0	33.9	33.7	31.5		Clear in early morning; now followed by light fog above the peak but not at the ground.
Noon	40.7	38.3	38.3	31.5	18.1	Heavy hail and fog down to the ground.
2.30 p. m	39.3	36.2	36.1	32.0		Clear spots in fog.
5.30 p. m	38.4	34.6	34.6	27.2		No wind, no fog, no cloud; moisture of breath very troublesome.
27, 9.30 a. m	34.7	32.9	32.7	29.5	18.1	Dry, cold, west wind.
4.00 p. m	36.0	31.–	31.–	24.0		Dry west wind; no fog; clouds high, but thick.
6.30 p. m	36.0	31.4	31.2	24.5		Light, cool, west wind; one-half clear blue sky.

Date.	The readings of the wet and dry bulbs give—						Observed dew-points.
	For barometer 18.0 inches.			For barometer 29.7 inches.			
	Tension.	Dew-point.	Relative humidity.	Tension.	Dew-point.	Relative humidity.	
	Inches.	°*Fahr.*	*Pr. cent.*	*Inches.*	°*Fahr.*	*Pr. cent.*	°*Fahr.*
July 25, noon	0.2075	35.4	71.0	0.183	32.3	62.6	37.7
12.30 p. m.	0.2057	35.2	75.5	0.170	30.5	49.8	37.5
1.25 p. m.	0.2370	38.9	82.2	0.222	37.4	66.9	34.7
3.20 p. m.	0.1920	33.5	85.8	0.183	32.3	80.8	33.0
5.10 p. m.	0.1913	33.4	86.8	0.182	32.2	85.0	34.0
July 26, 8.00 a. m.	0.1770	31.4	83.5	0.163	29.4	79.3	31.5
noon	0.2128	36.1	83.7	0.201	34.7	81.5	31.5
2.30 p. m.	0.1882	33.05	78.2	0.172	30.8	71.5	32.0
5.30 p. m.	0.1705	30.5	75.8	0.151	27.6	64.9	27.2
July 27, 9.30 a. m.	0.1718	30.7	85.4	0.162	29.3	80.6	29.5
4.00 p. m.	0.1382	25.6	65.2	0.116	21.6	55.0	24.0
6.30 p. m.	0.1425	26.3	67.2	0.122	22.8	57.6	24.5

These comparisons show that the errors introduced in these cases by neglecting the low pressure of 18 inches are as high as 0.036 inches in tension, 7° in dew-point, and 27 per cent. in relative humidity. The dew-points computed from the readings of the wet and dry bulbs by Regnault's full formula for a pressure of 18 inches are generally nearer to the observed dew-point than when the correction for pressure is neglected.

Very respectfully yours,

CLEVELAND ABBE,
Assistant O. C. S. O.

CHAPTER III.

COLLECTION OF MISCELLANEOUS OBSERVATIONS AND REPORTS.

A.—INTRODUCTION.

The data relating to the phenomena observed during the eclipse, as received from all miscellaneous sources, is copied in full in the following pages. This material is drawn from seven different classes of documents filed in the office of the Chief Signal Officer, under the special titles of observers' journals, special reports, &c., &c., as shown in detail in the following summary, which gives also the total number of documents examined:

Class.	Observers.	Documents.	Total number examined.	Documents herewith published in full.	Documents containing nothing very important.
A	Enlisted men of the Signal Corps	Abstract journals for July, 1878, Forms X & Y of sunset observers.	116	30	86
B	do	Special eclipse reports	40	40	0
C	Voluntary observers of the Signal Service.	Form H, for July, 1878	97	12	85
D	do	Special eclipse reports	48	20	28
E	Army post surgeons	Met. registers for July, 1878	31	2	29
F	do	Special reports	4	0	4
G	Special eclipse observers	Miscellaneous manuscript reports	2	2	0
			338	106	232

The following is a detailed list of all these reports. Since many observers have merely reported the existence of an eclipse without communicating anything of importance to meteorology or astronomy, and others have reported merely the fact that clouds obscured the view, I have therefore designated these by a † and * respectively, and have not considered it necessary to publish their remarks in full.

SOURCES OF THE MATERIAL RELATING TO THE SOLAR ECLIPSE OF JULY 29, 1878.

A.—*Monthly Journals for July from enlisted men of the Signal Corps and Forms X and Y, from Sunset observers.*

State or Territory.	Locality.	Observer.
Alabama	Mobile	†L. M. Day, sergeant, Signal Corps, U. S. A.
Arizona	Burks	*W. Manderfeld, private, Signal Corps, U.S.A.
	Camp Apache	* J. J. Falvey, private, Signal Corps, U. S. A.
	Camp Grant	W. W. Agey, corporal, Signal Corps, U. S. A.
	Camp Verde	I. R. Birt, private, Signal Corps, U. S. A.
	Florence	* W. E. Gould, corporal, Signal Corps, U. S. A.
	Phœnix	* J. W. Harrison, private, Signal Corps, U. S. A.
	Prescott	*J. S. Hunter, telegraph operator.
	Tucson	*G. V. Phillips, private, Signal Corps, U. S. A.
	Yuma	Wm. Story, corporal, Signal Corps, U. S. A.
British Columbia	New Westminter	A. Peele, sunset observer.
California	Campo	M. L. Hunn, sergeant, Signal Corps, U. S. A.
	Los Angeles	F. M. Frantz, sergeant, Signal Corps, U. S. A.
	Red Bluff	R. R. Rodgers, sergeant, Signal Corps, U. S. A.
	Sacramento	J. T. Cochran, private, Signal Corps, U. S. A.
	San Diego	*M. M. Sickles, sergeant, Signal Corps, U.S. A.
	Visalia	*E. Lloyd, sergeant, Signal Corps, U. S. A.
	Yreka	*C. H. Pyle, sunset observer.
Colorado	Denver	J. A. Barwick, sergeant, Signal Corps, U. S. A.
	Kit Carson	O. Brenham, sunset observer.
	Pike's Peak	Wm. Black, sergeant, Signal Corps, U. S. A.§
Connecticut	New Haven	†W. A. Glassford, sergeant, Signal Corps, U. S. A.
	New London	A. Reed, sergeant, Signal Corps, U. S. A.
Dakota	Bismarck	D. T. Flannery, private, Signal Corps, U. S. A.
	Lead City	†D. M. Kennedy, sergeant, Signal Corps, U. S. A.
District of Columbia	Washington	†J. B. Newlin, sergeant, Signal Corps, U. S. A.
Florida	Key West	*M. J. Shanefelter, sergeant, Signal Corps, U. S. A.
	Punta Rassa	* A. W. Browne, sergeant, Signal Corps, U. S. A.
Georgia	Augusta	*H. R. Stockman, sergeant, Signal Corps, U. S. A.
	Savannah	W. S. Popple, sergeant, Signal Corps, U. S. A.
	Tybee Island	*H. R. Hathaway, sergeant, Signal Corps, U. S. A.
Idaho	Boise City	*B. E. Light, sergeant, Signal Corps, U. S. A.
Indiana	Indianapolis	C. F. R. Wappenhaus, sergeant, Signal Corps, U. S. A.
	Longansport	†C. B. Whiting, corporal, Signal Corps, U. S. A.
Indian Territory	Fort Gibson	*O. S. M. Cone, sergeant, Signal Corps, U. S. A.
	Fort Sill	*J. McCann, private, Signal Corps, U. S. A.
Iowa	Davenport	†R. R. Martin, sergeant, Signal Corps, U. S. A.
	Dubuque	†J. H. Smith, sergeant, Signal Corps, U. S. A.
	Keokuk	* E. F. Brady, sergeant, Signal Corps, U. S. A.
Kansas	Dodge City	W. H. Clendenon, sergeant, Signal Corps, U. S. A.
	Leavenworth	J. R. Williams, sergeant, Signal Corps, U. S. A.
	Waterville	* Mrs. C. B. Phillips, sunset observer.
Kentucky	Louisville	L. E. Sebree, sergeant, Signal Corps, U.S. A.
Louisiana	New Orleans	* W. U. Simons, sergeant, Signal Corps, U. S. A.
	Shreveport	†J. B. Campbell, sergeant, Signal Corps, U. S. A.
Maine	Bangor	*L. N. Jesunoffsky, corporal, Signal Corps, U. S. A.
	Eastport	*T. A. Taylor, sergeant, Signal Corps, U. S. A.
	Portland	†W. T. Boyd, sergeant, Signal Corps, U. S. A.
Maryland	Baltimore	†E. W. McGann, sergeant, Signal Corps, U. S. A.
Massachusetts	Boston	†O. Parker, sergeant, Signal Corps, U. S. A.
Michigan	Detroit	T. V. Van Heusen, sergeant, Signal Corps, U. S. A.
	Grand Haven	†S. C. Emory, sergeant, Signal Corps, U. S. A.
	Port Huron	†J. E. Mayhew, sergeant, Signal Corps, U. S. A.

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§ See the reports of the Signal Service Pike's Peak expedition.

A.—*Monthly Journals for July from enlisted men of the Signal Corps, &c.*—Continued.

State or Territory.	Locality.	Observer.
Minnesota	Breckinridge	B. C. Anderson, sergeant, Signal Corps, U. S. A.
	Saint Paul	* R. G. Lewis, sergeant, Signal Corps, U. S. A.
Missouri	Saint Louis	* Wm. Finn, sergeant, Signal Corps, U. S. A.
Montana	Virginia City	E. McGovern, sergeant, Signal Corps, U. S. A.
Nebraska	North Platte	H. U. Jones, sergeant, Signal Corps, U. S. A.
Nevada	Winnemucca	J. Healy, corporal, Signal Corps, U. S. A.
New Jersey	Atlantic City	† D. Moore, sergeant, Signal Corps, U. S. A.
	Barnegat	† F. Greene, sergeant, Signal Corps, U. S. A.
	Sandy Hook	† P. J. Huneke, sergeant, Signal Corps, U. S. A.
New Mexico	Santa Fé	* M. Frost, sergeant, Signal Corps, U. S. A.
	Silver City	Wm. T. Blythe, sergeant, Signal Corps, U. S. A.
New York	Albany	† L. W. Beall, sergeant, Signal Corps, U. S. A.
	Buffalo	† B. M. Purssell, sergeant, Signal Corps, U. S. A.
North Carolina	Cape Hatteras	† D. Brooks, corporal, Signal Corps, U. S. A.
	Cape Lookout	† P. Belville, private, Signal Corps, U. S. A.
	Kittyhawk	† W. Davis, corporal, Signal Corps, U. S. A.
	Fort Macon	† J. H. Thompson, private, Signal Corps, U. S. A.
	Portsmouth	† Wm. Daly, private, Signal Corps, U. S. A.
	Smithville	† R. Seyboth, sergeant, Signal Corps, U. S. A.
	Wilmington	† D. C. Ralston, sergeant, Signal Corps, U. S. A.
Ohio	Cincinnati	† N. Gorom, sergeant, Signal Corps, U. S. A.
	Columbus	† D. D. Stansell, sergeant, Signal Corps, U. S. A.
Oregon	Eugene City	* O. K. Peters, sunset observer.
	Portland	R. R. Herman, corporal, Signal Corps, U. S. A.
	Roseburg	* J. Dascomb, sergeant, Signal Corps, U. S. A.
	Umatilla	J. B. Wells, private, Signal Corps, U. S. A.
Pennsylvania	Philadelphia	† C. A. Smith, sergeant Signal Corps, U. S. A.
	Pittsburgh	† George W. Hay, sergeant Signal Corps, U. S. A.
South Carolina	Charleston	* M. McGarrahan, sergeant Signal Corps, U. S. A.
Tennessee	Knoxville	† J. F. Payne, sergeant Signal Corps, U. S. A.
	Memphis	† William McElroy, sergeant Signal Corps, U. S. A.
	Nashville	† George Prender, private Signal Corps, U. S. A.
Texas	Boerne	† E. Lane, manager of telegraph office.
	Brackettsville	* R. J. Somers, corporal Signal Corps. U. S. A.
	Brownsville	* H. C. Winstand, corporal Signal Corps, U. S. A.
	Castroville	* T. Jones, private Signal Corps, U. S. A.
	Coleman City	* J. A. Perkins, private Signal Corps, U. S. A.
	Corsicana	J. W. Smith, sergeant Signal Corps, U. S. A.
	Denison	H. Frey, sergeant Signal Corps, U. S. A.
	Eagle Pass	* J. G. Prince, private Signal Corps, U. S. A.
	Fort Griffin	* J. C. Rickli, corporal Signal Corps, U. S. A.
	Fort McKavett	* H. Marsh, private Signal Corps, U. S. A.
	Fredricksburg	* C. F. Tansill, private Signal Corps, U. S. A.
	Galveston	* E. O'C. MacInerney, sergeant Signal Corps, U. S. A.
	Graham	F. Shock, manager of telegraph office.
	Indianola	* J. Kenealy, private Signal Corps, U. S. A.
	Jacksboro or Fort Richardson	* P. M. Wilson, corporal Signal Corps, U. S. A.
	Laredo	* J. McGlone, sergeant Signal Corps, U. S. A.
	Mason	* J. A. Gleason, private Signal Corps, U. S. A.
	Pilot Point	E. F. Reeves, private Signal Corps, U. S. A.
	Stockton	† C. A. Ray, private Signal Corps, U. S. A.
	Uvalde	* William Norrington, private Signal Corps, U. S. A.
Utah	Salt Lake City	* William McGillivray, sergeant Signal Corps, U. S. A.
Vermont	Burlington	† C. Cramer, sergeant Signal Corps, U. S. A.
Virginia	Cape Henry	† R. J. Bell, sergeant Signal Corps, U. S. A.
	Lynchburg	* H. F. McFarland, sergeant Signal Corps, U. S. A.
	Norfolk	† George Onslow, sergeant Signal Corps, U. S. A.
Washington Territory	Olympia	* E. F. Kubel, sergeant Signal Corps, U. S. A.
West Virginia	Morgantown	† L. Dunne, sergeant Signal Corps, U. S. A.
Wisconsin	La Crosse	† G. R. Hancock, sergeant Signal Corps, U. S. A.
	Milwaukee	S. W. Rhode, sergeant Signal Corps, U. S. A.
Wyoming Territory	Cheyenne	* J. H. Smith, sergeant Signal Corps, U. S. A.
	Hat Creek	* J. H. Bowman, sunset observer.

B.—*Special Reports by enlisted men of the Signal Corps and their assistants.*

State or Territory.	Locality.	Observers.	Nos. in the official letter file, 1878.
Colorado	Pike's Peak	(See Reports of the Signal Service Pike's Peak Eclipse Expedition.)	
	Denver	J. A. Barwick, sergeant Signal Corps.	4290 and 5058 Obs.
	Kit Carson	O. Branham, sunset observer	4249 Obs.
District of Columbia	Washington	†J. B. Newlin, sergeant Signal Corps.	4155 Obs.
Florida	Key West	M. J. Shanefelter, sergeant Signal Corps.	4378 Obs.
Indian Territory	Fort Sill	John McCann, private Signal Corps.	4389; 5278; 5697 Obs.
Montana	Virginia City	E. MacGovern, sergeant Signal Corps.	4181 and 4470 Obs.
		A. B. Knight	1284 Misc.
		J. C. Smith, M. D	1280 Misc.
New Jersey	Atlantic City	†D. Moore, sergeant Signal Corps, U. S. A.	4202 Obs.
	Barnegat	†F. Greene, sergeant Signal Corps, U. S. A.	4176 Obs.
North Carolina	Cape Hatteras	†D. Brooks, corporal Signal Corps, U. S. A.	4465 Obs.
	Kittyhawk	† William Davis, corporal Signal Corps, U. S. A.	4553 Obs.
	Smithville	†R. Seyboth, sergeant Signal Corps, U. S. A.	4279 Obs.
Texas	Corsicana	J. W. Smith, sergeant Signal Corps, U. S. A.	4357 Obs.
	Decatur	W. E. Gardner, manager telegraph office.	4455 Obs.
	Galveston	E. O'C. MacInerney, sergeant Signal Corps, U. S. A.	4323 Obs.
	Graham	Floyd Shock, manager telegraph office.	4489 and 5582 Obs.
	Henrietta	J. J. Mullen, manager telegraph office.	4577 Obs.
	Jacksboro'	P. M. Wilson, corporal Signal Corps, U. S. A.	4314 Obs.
	Pilot Point	E. F. Reeves, private Signal Corps, U. S. A.	4291 Obs.
Virginia	Norfolk	†George Onslow, sergeant Signal Corps, U. S. A.	4235 Obs.
	Cape Henry	†R. J. Bell, sergeant Signal Corps, U. S. A.	4157 Obs.
West Indies	Havana	Charles Hasselbrink, observer	4451 and 5598 Obs.

C.—*Notes on the monthly meteorological reports or the Forms II for July, 1878, of the voluntary observers of the Signal Service.*

State.	Locality.	Observer.
Arkansas	Judsonia	†J. H. Wymer.
California	Oakland	J. B. Trembly, M. D.
	Salinas	E. K. Abbott, M. D.
	San Gorgonio	J. J. Ring.
Colorado	Summit	*C. E. Robbins.
Dakota	Morriston	*J. Morris.
Florida	Biscayne	*E. T. Sturtevant.
	Daytonia	*S. M. Chamberlin.
	Milton	*J. Carlovitz.
	Near Okehumkee	*L. H. Lines, M. D.
Georgia	Near Forsyth	†T. G. Scott.
Illinois	Mount Sterling	*W. W. Bower, M. D.
	Riley	*J. W. James.
	Sandwich	*N. E. Ballou.
	Sterling	†L. W. Gillespie.
Indiana	St. Mary's Home	†R. Mueller, M. D.
	St. Meinrad's Abbey	†Benedictine Fathers.
	Vevay	C. G. Boerner.
Iowa	Afton	*M. V. Ashby.
	Boonesboro'	J. R. Lincoln.
	Cresco	†G. Marshall.
	Near Fort Madison	†Miss L. A. McCready.
	Independence	†A. Reynold's.
	Muscatine	*T. P. Walton.

C.—*Notes on the monthly meteorological reports or the Forms H for July,* 1878, *of the voluntary observers of the Signal Service*—Continued.

State.	Locality.	Observer.
Kansas	Empire City	*A. Woodworth, M. D.
	Holton	*J. Watters.
	Independence	*J. M. Altoffer.
Maine	Mount Desert	*J. D. Parker.
Maryland	The Cedars, Montgomery Co.	†A. Farquhar.
Massachusetts	Fall River	†W. Rotch.
	......do	†C. V. S. Remington.
	Mendon	†J. G. Metcalf, M. D.
	New Bedford	†Miss S. E. Rodman.
	North Billerica	†Rev. E. Nason.
	Rowe	†Jacob Davis.
	Springfield	†R. W. Foster.
	Waltham	†C. F. Blood.
Michigan	Adrian	†J. Breedon.
	Grand Rapids	*L. H. Streng.
	Northport	*Rev. G. N. Smith.
	Woodmere Cemetery	†F. W. Higgins.
Mississippi	Fayette	*Rev. G. C. Armstrong.
Missouri	Corning	*H. Martin.
	Kansas City	*H. P. Child.
	Oregon	*W. Kaucher.
	Springfield	*A. M. Lapham.
Nebraska	Clear Creek	A. F. Bryant.
	Emerson	W. Dunn.
	Near Howard	C. Blodgett.
	Plattsmouth	*A. L. Child, M. D.
New Hampshire	Auburn	F. T. Hills.
	Contoocookville	†E. D. Couch.
	Dunbarton	†A. Colby.
	Mill Village	†Rev. W. Hurlin.
New Jersey	Freehold	†C. F. Richardson.
	Linden	†A. B. Noll.
	South Orange	†W. J. Chandler.
	Trenton	†E. R. Cook.
	Vineland	†J. Ingram.
New York	Ardenia—Phillipstown	†T. B. Arden.
	Bethpage Junction	†J. C. Merrit, jr.
	Flushing	†E. A. Quarterman.
	Kensico	†C. J. McIlvaine.
	Palermo	†E. B. Bartlett.
	Penn Yan	†G. R. Young.
	Schroon Lake	†B. B. Cutter.
	Starkey	†H. L. Jennison.
	Wappinger Falls	†J. Harcourt.
	Waterburg	†D. Trowbridge.
	White Plains	†O. R. Willis.
North Carolina	Asheville	†W. Gleitsmann, M. D.
	Lenoir	†Dr. and Mrs. R. L. Beall.
	Murphy	†W. Beal.
	Weldon	†F. A. Clark.
Ohio	Bellefontaine	†W. Barringer.
	Lewisburg	†H. D. Gowey.
	Ruggles	†P. Bowman.
	Westerville	†J. Haywood.
Oregon	Eola	*T. Pearce.
Pennsylvania	Philadelphia	†J. A. Kirkpatrick.
	......do	†J. Haworth.
South Carolina	Aiken	†W. H. Gedding, M. D.
Tennessee	Austin	†P. B. Calhoun.
	Clarksville	†J. W. Caldwell, M. D.
Texas	Belmont Farm	T. M. Scott.
	New Ulm	†L. Runge.
Utah	Coalville	*T. Bullock.
Vermont	Lunenburgh	†H. A. Cutting.
	West Charlotte	*Miss M. E. Wing.
Virginia	Broad Oak, near Keswick	†E. C. Mead.
	Near Lynchburg	†C. I. Meriwether.
	Mount Solon	†Dr. J. T. and Miss E. I. Clarke.
West Virginia	Helvetia	†C. L. Stucky, M. D.
Wisconsin	Bloomfield	†W. H. Whiting.
	Manitowoc	†C. and J. Lups.
	Neillsville	*J. B. Jones.

D.—*Special reports from voluntary observers of the Signal Service.*

State.	Locality.	Observers.	Nos. in the official letter file, 1878.
California	Healdsburgh	*M. Howard	3484 V. R.
	Princeton	D. Bentley	3627 V. R.
	Santa Cruz	G. W. and M. R. Hoadley	3431 V. R.
Colorado	Colorado Springs	Prof. F. H. Loud	3695 and 3696 V. R.
	South Pueblo	E. S. Nettleton	3288 and 3556 V. R.
	Summit Station	C. E. Robins	3408 V. R.
Illinois	Anna	*J. D. Newbegin	3563 V. R.
	Mount Sterling	*W. W. Bower, M. D	3226 V. R.
Indiana	Arlington	†J. M. Clark	3511 V. R.
	Fort Wayne	†R. T. Robertson	3583 V. R.
	Vevay	C. G. Boerner	3549 V. R.
Iowa	Boonesboro	J. R. Lincoln	3411 V. R.
	Tabor	*J. F. Sanborn	3428 V. R.
Kansas	Baxter Springs	*Wm. Hyland	3252 V. R.
	Empire City	A. Woodworth, M. D	3387 V. R.
	Stanley	*R. P. Edgington	3545 V. R.
Kentucky	Danville	†L. Eddy	3581 V. R.
Louisiana	Lake Charles	W. Meyer	1253 misc.
	Point Pleasant	*E. Turner	3232 V. R.
Maine	Cornish	*S. West	3573 V. R.
	Mechanics' Falls	†W. Watters	3290 V. R.
	West Waterville	†B. F. Wilbur	3293 V. R.
Michigan	Northport	†Rev. J. N. Smith	3249 V. R.
Missouri	Corning	*H. Martin	3287 V. R.
	Frankford	Mrs. M. G. Vermillion	3388 V. R.
Montana	Virginia City	§I. C. Smith, M. D	1737 misc.
Nebraska	Clear Creek	A. F. Bryant	4809 V. R.
New Hampshire	Lake Village	†J. P. Hutchinson	3440 V. R.
New York	North Argyle	†G. M. Hunt	3250 V. R.
North Carolina	Weldon	†H. S. S. Cooper for F. A. Clark.	3223 V. R.
Pennsylvania	Catawissa	†W. G. Yetter	3224 V. R.
	Hulmeville	†L. P. Townsend	3529 V. R.
Tennessee	Near Greenville	†Prof. W. A. Kite	1224 misc.
	McMinnville	†Blanche Lewis	3251 V. R.
	Tusculum	†Julia A. Doak	3253 V. R.
Texas	Austin	D. W. C. Baker	3527 V. R.
	Clarksville	*Rev. J. Anderson	3352 V. R.
	Melissas	T. M. Scott	3443 V. R.
	Terrell	F. P. Cline	3237 V. R.
Utah	Coalville	T. Bullock	3437; 4373 V. R.
Vermont	Strafford	†H. F. J. Scribner	3543 V. R.
	West Charlotte	*Minerva E. Wing	3587 V. R.
Virginia	Dover Mines	†C. A. Harrington	3519 V. R.
	Johnson Town	†C. R. Moore	3579 V. R.
West Indies	Navassa	W. H. W—J. for the superintendent.	3445 V. R.
Wisconsin	Geneva Lake	*W. H. Whiting	3572 V. R.

§ And the accompanying letter of Prof. E. C. Pickering, of Cambridge, Mass.

E.—*Army Post Surgeons' meteorological registers for July.*

State or Territory.	Locality.	Observer.
Arizona	Camp Apache	*Walter Reed, assistant surgeon, U. S. A.
	Camp Mohave	*L. H. Clark, acting assistant surgeon, U. S. A.
California	Alcatraz Island	*James Rorke, surgeon, U. S. A.
	Angel Island	*D. B. Hoffman, acting assistant surgeon, U. S. A.
	Fort Yuma	*R. L. Rosson, assistant surgeon, U. S. A.
Dakota	Fort A. Lincoln	*W. D. Wolverton, surgeon, U. S. A.
	Fort Randall	*L. W. Crompton, assistant surgeon, U. S. A.
	Fort Rice	*B. D. Taylor, assistant surgeon, U. S. A.
	Fort Sully	*W. H. King, assistant surgeon, U. S. A.
	Fort Totten	*W. B. Davis, assistant surgeon, U. S. A.
	Lower Brulé Post	*A. G. Bergen, acting assistant surgeon, U. S. A.
Florida	Saint Augustine	*W. H. Gardner, assistant surgeon, U. S. A.
Georgia	Atlanta—McPherson Barracks.	†W. H. Forwood, surgeon, U. S. A.
Idaho	Fort Lapwai	*F. S. Sterling, acting assistant surgeon, U. S. A.
Indian Terr.	Fort Sill	*J. W. Williams, surgeon, U. S. A.
Kansas	Fort Leavenworth	B. E. Fryer, surgeon, U. S. A.
Louisiana	Baton Rouge Barracks	*L. F. Reynaud, acting assistant surgeon, U. S. A.

E.—*Army Post Surgeons' meteorological register for July*—Continued.

State or Territory.	Locality.	Observer.
Minnesota	Fort Snelling	*C. C. Byrne, surgeon, U. S. A.
Montana	Camp Baker	*J. B. Newman.
	Fort Keogh	*A. C. Girard, assistant surgeon, U. S. A.
Nebraska	Camp Sheridan	*W. H. Corbusier, assistant surgeon, U. S. A.
	Fort Hartsuff	*S. S. Boyer, acting assistant surgeon, U. S. A.
New Mexico	Fort Wingate	*J. V. Laudervale, assistant surgeon, U. S. A.
New York	Plattsburgh Barracks	†D. S. Kellogg, acting assistant surgeon, U. S. A.
Oregon	Fort Stevens	*F. B. Eaton, acting assistant surgeon, U. S. A.
Texas	Fort Concho	*J. V. DeHanne, assistant surgeon, U. S. A.
	Fort Davis	†E. Woodruff, assistant surgeon, U. S. A.
Utah	Camp Douglas	*B. A. Clements, surgeon, U. S. A.
Washington Terr	Fort Canby	*T. B. Eaton, acting assistant surgeon, U. S. A.
	Fort Walla Walla	*G. M. Sternberg, surgeon, U. S. A.
Wyoming Terr	Fort Saunders	*J. W. Brewer, assistant surgeon, U. S. A.

F.—*Army Post Surgeons' special reports.*

State or Territory.	Locality.	Observer.	No. of letter file.
Dakota	Fort Rice	*B. D. Taylor, assistant surgeon, U. S. A.	
	Fort Totten	†S. B. Davis, assistant surgeon, U. S. A.	3380 V. R. 1878.
Louisiana	Baton Rouge	*L. F. Reynaud, acting assistant surgeon, U. S. A.	3468 V. R. 1878.
Nebraska	Camp Sheridan	*W. H. Corbusier, assistant surgeon, U. S. A.	3386 V. R. 1878.

G.—*Miscellaneous sources.*

Territory.	Locality.	Observer.	No. of letter file.
Colorado	Denver	Prof. C. A. Young	1956 misc., 1880.
Wyoming	Camp No. 4, Little Sandy	A. D. Wilson and W. H. Holmes.	1951 misc., 1880.

SUMMARY.

The preceding list includes 321 reports and represents 296 different observing stations, whose geographical distribution is shown in the following table, in the second column of which is given the number of stations within the belt of totality, the whole number of which was 29.

Geographical distribution of stations.

State.	No. of observing stations.	No. within totality.	State.	No. of observing stations.	No. within totality.
Alabama	1	0	Idaho	2	0
Arizona	10	0	Illinois	6	0
Arkansas	1	0	Indiana	7	0
British Columbia	1	0	Indian Territory	2	1
California	16	0	Iowa	11	0
Colorado	13	13	Kansas	9	0
Connecticut	2	0	Kentucky	2	0
Dakota	10	0	Louisiana	5	1
District of Columbia	1	0	Maine	7	0
Florida	7	0	Maryland	2	0
Georgia	5	0	Massachusetts	9?	0

Geographical distribution of stations—Continued.

State.	No. of observing stations.	No. within totality.	State.	No. of observing stations.	No. within totality.
Michigan	8	0	Oregon	6	0
Minnesota	3	0	Pennsylvania	6	0
Mississippi	1	0	South Carolina	2	0
Missouri	6	0	Tennessee	8	0
Montana	4	2	Texas	31	10
Nebraska	7	0	Utah	3	0
Nevada	1	0	Vermont	4	0
New Hampshire	5	0	Virginia	8	0
New Jersey	8	0	Washington	3	0
New Mexico	4	0	West Indies	2	1
New York	15	0	West Virginia	2	0
North Carolina	14	0	Wisconsin	6	0
Ohio	6	0	Wyoming	4	1
Totals				296	29

B.—COPIES OF REPORTS, &C.

In order to properly present all the material at hand for future study the following copy of the data is published; in a few instances the observers' reports have been rearranged and condensed so as to present the whole systematically and clearly, but in general the exact language of the report has been literally copied.

The reports are here presented as arranged for convenience of reference in alphabetical order by States and stations.

(29.)

[Arizona Territory: Camp Grant.—July Journal, W. W. Agey, corporal, Signal Corps, U. S, A.]

Northeast winds and clear weather with very high temperature in the afternoon.

Moon entered sun's disk at 2h 20m p. m., on the sun's north limb. passing off the sun's left hand upper limb, as observed, at 4h 25m p. m. About ⅝ of the sun's disk was eclipsed.

The following observations of the temperature were made:

	°
At 2.24 p. m	100
3.0 p. m	97
3.15 p. m	96
4.30 p. m	102
4.45 p. m	103
5.30 p. m	99

(30.)

[Arizona Territory: Camp Verde.—July Journal, I. A. Birt, private, Signal Corps, U. S. A.]

Partial eclipse of the sun observed at 2h 45m p. m. When the eclipse was first noticed the thermometer stood at 106°, but in the space of fifteen minutes it had fallen to 102°.

(31.)

[Arizona Territory: Yuma.—July Journal, Wm. Story, corporal, Signal Corps, U. S. A.]

Partial eclipse. This has been the hottest day of the season.

The maximum thermometer reaching 118° about 1h 20m p. m.

(32.)

[British Columbia: New Westminster.—Form X, August 3, 1878, R. Peele, sunset observer, Signal Service.]

Eclipse commenced at 12h 27m p. m.
Greatest obscuration 1h 47m p. m.
Eclipse ended 2h 52m p. m.
Stars seen from 1.38 p. m. to 2.00 p. m.

Thermometer readings.

	°
12.00 noon	68.8
12.30 p. m.	68.8
1.00 p. m.	67.8
1.30 p. m.	66.0
1.37 p. m.	65.0
1.45 p. m.	64.0
1.50 p. m.	63.8
1.55 p. m.	63.5
2.00 p. m.	64.0
2.52 p. m.	68.0

(33.)

[California: Campo.—July Journal, M. L. Hunt, sergeant, Signal Corps, U. S. A.]

First contact, 1^{h} 25^{m} p. m.
Maximum obscuration ⅔ at 2^{h} 25^{m} p. m.
Last contact, 3^{h} 55^{m} p. m.
Clear and very warm—the warmest of the season.

(34.)

[California: Los Angeles.—July Journal, F. M. Frantz, sergeant, Signal Corps, U. S. A.]

First contact, 1^{h} 19^{m} p. m., on the west side.
Greatest obscuration, about ⅔ at 2^{h} 32^{m} p. m.
Last contact, 3^{h} 44^{m} on the northeast limb.

The weather was clear, the atmosphere having a grayish somber appearance. A perceptible lowering of the temperature was noticed.

(35.)

[California: Oakland, Alameda County.—Voluntary Form H for July, J. B. Trembley, M. D.]

At 11 a. m. a haze lined the foothills and distant water.
At 1 p. m. first looked at the eclipse.
At 2 p. m. two-thirds of the sun's disk was covered.

A dim, pale yellowish hue of light rested upon everything; in rooms where blinds and curtains were used, and closed, it was quite dark. Chickens crowed and sought their roosts. A gloomy aspect prevailed. The balance of the day was pleasant.

(36.)

[California: Princeton, Colusa County.—David Bentley, Vol. Obs. Sig. Ser. (O. C. S. O. 3627 V. R.).]

Eclipse began 12^{h} 45^{m}, ended 3^{h} 13^{m} p. m.

Temperature record.

	°
12.00 m.	102
1.00 p. m	102
2.00 p. m	98
2.30 p. m	94
3.00 p. m	98
4.00 p. m	101
5.00 p. m	99

Weather clear; wind calm.

(37.)

[California: Red Bluff.—July Journal, R. R. Rodgers, sergeant, Signal Corps, U. S. A.]

The temperature was affected during the eclipse quite perceptibly, as the following will show:

Time.	Temperatures.	Notes.
	°	
12. 40 p. m.	101	Just before the commencement of the eclipse.
1. 55 p. m.	102	
1. 34 p. m.	100	
2. 00 p. m.	98	Minimum temperature.
2. 25 p. m	98	Do.
3. 00 p. m.	104	Maximum temperature.

Weather clear and warm; light fresh north and west winds.

(38.)

[California: Sacramento.—July Journal, J. T. Cochran, private, Signal Corps, U. S. A.]

Solar eclipse began a few minutes after one o'clock. Noticed the temperature during the eclipse as follows:

Time.	Temperatures.	
	°	
1.00 p. m.	91.5	Just before the beginning of the eclipse.
1.37 p. m.	91.0	
2.00 p. m.	90.0	Marked increase in the relative humidity.
3.00 p. m.	88.5	Just before the end of the eclipse.
4.39 p. m.	96.0	Temperature began to rise as soon as the sun shone with its full force.
5.30 p. m.		No change in temperature until now, when it began to decline.

The winds blew for the greater part of the day from N. and NW., which, in this country, are the hot winds, drying and scorching everything that is green.

(39.)

[California: Salinas, Monterey County.—E. K. Abbott, M. D.]

About three-fourths of surface of sun covered. Influenced temperature about 9° during its continuance.

The Voluntary Meteorological Record for the 29th gives the following observations:

Time.	Temperatures.	Wind.	Clouds.
	°		
7 a. m	54.2	S. 1	Fog 10
2 p. m	58.0	W. 3	0
1 p. m.	53.0	NW. 1	0

(40.)

[California: San Gorgonio, San Bernardino County.—John J. Ring.]

At time of greatest obscuration a segment of the sun's lower limb was visible equal to about one-fourth of the disk.

Eclipse commenced about 1.45 p. m. and ended about 3.30 p. m.

There was a perceptible diminution of light, and the thermometer read as follows:

Time.	Temp. of air.
1.30 p. m.	95°
2.00 p. m.	93°
2.15 p. m.	90°
2.30 p. m.	87°
3.00 p. m.	90°

The regular thermometer record for this day gave also the following:

7.00 a. m.	71°
9.00 p. m.	67°

(41.)

[California: Santa Cruz.—G. W. and M. R. Hoadley. (O. C. S. O. 3431 V. R.)]

Eclipse began ——— (lost, owing to erroneous advertisement).
Maximum at 2^h, 00^m, to 2^h, 10^m.
Ended at 3^h, 20^m, 5^s.
(Series of 28 drawings were made, but not necessary to reproduce them.)

Thermometer record.

Time.	Dry.	Wet.
	°	°
1.00 p. m.	75	70
2.00 p. m.	70	68
2.15 p. m.	69	65
2.30 p. m.	67	65
2.45 p. m.	65	63
3.10 p. m.	65	62

2.40 p. m. Strong, cold NE. wind. Heavy fog bank moving NW.
2.45 p. m. Fog coming very fast and thick from SW.
3.10 p. m. Wind SE.; clear.

(42.)

[Colorado: Colorado Springs.—Prof. F. H. Loud, Vol. Obs. Sig. Ser. (O. C. S. O. 3696 V. R.)]

[The following is an abstract of this minute and important report.—C. A.]

STATIONS AND OBSERVERS.

Nineteen observers co-operated with Prof. Loud at his request; their stations and work were as follows:

STATION NO. 1.—*Colorado Springs.*

Latitude 38° 50′.5; longitude 104° 49′.5; altitude 6,038 feet.

Observers, instruments, &c.:

a. Prof. J. H. Kerr; contacts and sketch; 2-inch Signal Service glass.
b. Prof. A. H. Wright; contacts; naked eye.
c. Miss Laura Kimball; contacts; naked eye.
d. Miss S. V. Bowen; contacts; naked eye.
e. A. R. Byrd; sketch; naked eye.
f. Levi Ratliff; sketch; naked eye.
g. E. B. Curtis; sketch; naked eye.
h. Alice Stewart; sketch; naked eye.
i. Kate Jones; thermometric observations.
j. F. H. Loud; contacts; naked eye, and assisted in time and thermometric observations.
k. J. B. Rutherford; visibility of stars; naked eye.

STATION NO. 2.—*Cliff House, Manitou.*

Latitude 38° 51′.8; longitude 104° 54′.7; altitude 6,300 feet.

Observers, instruments, &c.:

a. W. W. Nichols, with two assistants; contacts; sketch; naked eye; thermometric observations.

STATION NO. 3.—*Lake House, Pike's Peak.*

Latitude 38° 49′.5; longitude 105° 0′.4; altitude 10,230 feet.

Observers, instruments, &c.:

a. Walter Wiley; sketch; naked eye; thermometric series.
b. Paul Curtis; contacts; thermometric series.

STATION NO. 4.—*"Fourmile," 11 miles W. by S. from Pike's Peak.*

Latitude 38° 49′.6; longitude 105° 15′; altitude ——.

Mabel Wiley; contacts; naked eye.

STATION NO. 5.—*Three miles east of Monument, Pike's Peak.*

Latitude 39° 5′.6; longitude 104° 49′.3; altitude 7,000 feet.

Observers, instruments, &c.:

Ella P. Beecher; contacts; naked eye; thermometric series.

Station No. 6.—South of Colorado Springs.

Latitude 38° 48′; longitude 104° 49′; altitude ——.

Observers, instruments, &c.:

Mrs. A. M. Loomis; naked eye.

The latitudes and longitudes are taken from Hayden's Atlas of Colorado, and depend on his own and the United States Coast Survey measurements.

The atmospheric conditions were most favorable and the results of the observations are as follows:

I.—Absolute times of contacts.

At Colorado Springs the correction to the watch to reduce to Washington time was found by daily comparison with the signal telegraphed from the Observatory at Allegheny City, assuming that signal to be sent regularly at 4h 23m 50s p. m. Washington time.

Prof. Kerr observed the first and fourth contacts at his own house with the two-inch glass, and Prof. F. H. Loud recorded the times with the following results:

Latitude 38° 50′ 41″.4; longitude 104° 49′ 58″.4.

First contact, 4h 14m 33s.6 Washington time.*

Fourth contact, 6h 27m 29s.0.

Professor Loud observed the second and third contacts with the naked eye and smoked glass, at the Colorado College building, and Miss S. V. Bowen recorded the times with the following results:

Latitude 38° 50′ 12″.6; longitude 104° 49′ 4″.2.

Second contact, 5h 22m 47s.7 Washington time.

Third contact, 5h 25m 27s.7 Washington time.

At Manitou, Mr. W. W. Nichols observed the four contacts, using a small field-glass, and assisted in timing by one of the guests of the Cliff House. The correction to the watch is not known. The observed times were as follows:

Contacts.	Watch time. h.	m.	s.
1	2	21	50
2	8	31	0
3	3	33	45
4	4	35	32

II.—Duration of totality.

The following table gives all the results of the observation of duration:

Location.	Latitude.	Longitude.	Duration.	Observer.	Recorder.	Instrument.
	° ′ ″	° ′ ″	s.			
Colorado Springs.	38 50 12.6	104 49 4.2	160	F. H. Loud.	S. V. Bowen.	Naked eye.
	38 50 41.4	104 49 48.4	160	Prof. Kerr.	Mrs. Kerr.	?
	38 50 25	104 49 25	161	Prof. Wright.	....	?
	38 50 40	104 49 30	162	L. Kimball.	....	?
		Average	160.7			
Manitou.	38 51.8	104 54.7	165	W. W. Nichols.	Anonymous.	Small field-glass.
Lake House.	38 49.5	105 00.4	161.7	P. Curtis.	....	Naked eye.
Fourmile.	38 49.6	105 15	75	M. Wiley.	Mrs. Faulkner.	Do.
Monument.	39 5.6	104 49.3	164	E. P. Beecher.	....	Do.

III.—Observations of temperature.

No observations of a solar thermometer were made, and the following refer to the temperature of the air in the shade:

A.—At Colorado Springs, during the 29th, the following readings were recorded by Miss Kate Jones, using the U. S. Signal Service thermometer No. 344, standing as usual in its place in the thermometer shelter of the meteorological observatory of Colorado College.

The thermometer is protected on all sides by double lattice-work and is read through the window pane. For comparative purposes Professor Loud observed on the 26th, 27th, 28th, 30th, and 31st, as also given in the subsequent accompanying table:

---

* May be a minute too late.

Local time.	29th.	Local time.	26th.	27th.	28th.	30th.	31st.
	°		°	°	°	°	°
12.30 p. m	80.0	12.00 m	73	72.5	....	80	88
1.00 p. m	81.5	12.30 p. m	72.5	73	74	80	88.5
1.30 p. m	82.5	1.00 p. m	72	....	75	....	86
2.00 p. m	83.5	1.30 p. m	71	71	73.5	81.5	....
2.30 p. m	84.0	2.00 p. m	69	68	73.5	81.5	89
3.00 p. m	83.0	2.30 p. m	69.5	64.5	74	....	88
3.20 p. m	81.0	3.00 p. m	70.5	65	74	83	87.5
3.30 p. m	80.0	3.30 p. m	72	64.5	75	83	86.5
3.40 p. m	79.0	4.00 p. m	73	64.5	76	82.5	....
3.50 p. m	79.0	4.30 p. m	72	64	74	82.5	84
4.00 p. m	78.5	5.00 p. m	71	65.5	71.5	83	85
4 10 p. m	79	5.30 p. m	70.5	67.5	....	83	84
4.20 p. m	79.5	6.00 p. m	70.5	69.5	72	82.5	82.5
4.30 p. m	80	6.30 p. m	71	69	72	82	....
5.00 p. m	83						
5.30 p. m	84.5						
6 00 p. m	83.7						

The irregularity of the thermometric changes on the 26th, 27th, and 28th is due to cloudiness. The 29th and 30th were perfectly clear and comparable.

On diagram *A*, Professor Loud gives the curves showing the mean curve for the five days, 26th, 27th, 28th, 29th, 30th, and 31st, and also the separate curves for the 29th, and 30th, on which days the other atmospheric influences resembled each other.

B.—At Manitou the following readings were taken by W. W. Nichols:

Watch time.	Thermometer.
	°
2.00 p. m	88
2.30 p. m	89
3.00 p. m	81
3.30 p. m	80
5.00 p. m	85

C.—At the Lake House Messrs P. Curtis and W. Wiley, assisted by Mrs. Copley, made the following series of readings of a standard thermometer by Kendall & Co. exposed in the open air in the shade:

Time.	29th.	Time.	26th.	27th.	28th.	30th.	31st.
	°		°	°	°	°	°
1.00 p. m	67	1.00 p. m	47	56	59	73	71
2.00 p. m	73	1.30 p. m	51	42	62	79	....
2 30 p. m	74	2.00 p. m	51	45.5	63	79	72
3.00 p. m	71	2.30 p. m	57	46.5	....	78	....
3.15 p. m	67	3.00 p. m	59.5	49	60.5	80	74
3.25 p. m	66	3.30 p. m	62.5	48	68	80.5	73
3.35 p. m	63.5	4.00 p. m	57.5	52	66	....	....
3.45 p. m	64	4.30 p. m	55.5	52	57	74	73
3.55 p. m	67.5	5.00 p. m	54.5	57	56	....	....
4.00 p. m	69	5.30 p. m	54	57	....	....	....
5.00 p. m	77	6.00 p. m	53	54.5	55.5	69	62
5.30 p. m	78	....	....	....	....	....	....
6.00 p. m	67	....	....	....	....	....	....

For these observations, also, Professor Loud presents in diagram B the curves for the mean of five days, and also the individual curves for the 29th and the 30th, respectively, as these latter were cloudless days.

D.—Miss Ella P. Beecher recorded the following thermometric readings on the 29th, at her station, 3 miles east of Monument.

[Altitude probably not much less than 7,000 feet.—C. A.]

Local time.	Thermometer.
h. m.	°
2.25 p. m	85
3.05 p. m	77
3.32 p. m	73
3.35 p. m	72
3.50 p. m	74

IV.—*Visibility of stars and planets.*

At Colorado Springs, Mr. J. B. Rutherford saw Venus a long time before second contact, also Procyon, and apparently Mercury, Regulus, and Mars. His drawing also includes Encke's comet, and a star near it whose calculated positions had been previously pointed out to him upon a map. Mr. Rutherford feels sure that he saw the comet; he observed with the naked eye.

Other observers at Colorado Springs saw Castor and Pollux besides the stars previously mentioned.

At Manitou, Mr. W. W. Nichols secured an assistant who watched for stars, and who appears to have seen:

First. A cluster of from four to seven stars, perhaps Praesepe.
Second. Pollux, which was indistinct.
Third. Castor, described as brilliant.
Fourth. Venus.

V.—*Chromosphere and protuberances.*

At Colorado Springs, Prof. A. H. Wright, with the naked eye, caught a glimpse of a protuberance just at the beginning, and another just at the end, of totality, the position in each case being nearly at the point of contact of the lunar and solar limbs, [*i. e.*, the first protuberance near the point of second contact and the second protuberance near the point of third contact.—C. A.].

At Manitou, Mr. W. W. Nichols, using a small field glass, reports one prominence quite distinct and apparently a few small ones.

On a hill two miles south of Colorado Springs, Mrs. A. M. Loomis reports having seen shortly before and again after the total phase a bright crescent detached from the sun and on the same side as the visible crescent-shaped portion of his disk. [Query: Due to reflection within smoked glass?—C. A.]

VI.—*Diffraction bands.*

The diffraction bands at the edge of the shadow, as seen by those on Pike's Peak summit, were not noted by any of these observers.

VII.—*Drawings of the corona.*

Seven observers have reported their drawings, tracings of which are herewith presented. The following notes apply to each respectively:

Sketch number.	Author.	Location.	Atiltude.	Instruments.
10	W. Wiley	Lake House	10, 230	....
11	W. W. Nichols	Manitou	6, 300	P? T.
12	J. H. Kerr	Colorado Springs	....	P. T.
13	A. R. Byrd	......do	....	P.
14	Alice Stewart	......do	....	P.
15	L. Ratliff	......do	6, 050	P.
16	E. B. Curtis	......do	....	P.

N. B.—The P indicates that the sketchers used a plumb-line and otherwise followed the instructions issued by the United States Naval Observatory. The T indicates that small telescopes were used; the others had no optical aid. The tracings sent to the Chief Signal Officer are from drawings that have not been altered since they were originally made. The jagged outlines indicate that the light faded away without leaving a definite boundary. [The engravings of sketches 10–16 attempt to reproduce this fading away.—C. A.]

L. Ratliff and E. B. Curtis were located near each other, and by previous agreement the former began his sketch at the bottom, but the latter at the top, both working around the solar disk in the direction of the movement of the hands of a watch. Ratliff's outline was unfinished when the totality closed.

(43.)

[Colorado: Colorado Springs. Letter, dated August 21, from F. H. Loud, O. C. S. O., 3695 V. R., 1878.]

In a postscript Professor Loud says: "A carpenter of this place, quite an intelligent Scotchman, with whom I spoke yesterday (August 20, 1878), claims to have seen distinctly the ray perpendicular to the ecliptic which Professor Abbe described, and his foreman says that he spoke of it to him at the time of the eclipse."

(44.)

[Colorado: Denver. Abstract Journal for July, by J. A. Barwick, sergeant, Signal Corps.]

Fine day; no clouds; a few scattering cumuli over the mountains.

Temperature in the sun during the eclipse fell from 114° at 2 p. m. to 82° at 3^h 35^m p. m., rising again to 100° at 4^h 35^m.

Temperature in the shade fell from 89° at 2^h 30^m p. m. to 83° at 3^h 50^m p. m.

The corona appeared quite bright to the naked eye. The spangles running off from the corona were distinct and were extended farthest from the moon's edge in the line of the ecliptic; that is, where the moon first entered the sun and where it made its exit. On top and bottom the rays extended only a short distance. The stars seen were Mercury, Regulus, Mars, Pollux, Castor, Procyon, and Venus, seven in all. Chickens went to roost and roosters crowed at end of totality and for several minutes after. A drawing was made by Mr. Bagley, the engraver, from the roof of the Signal Office (Broadwell block), for the Chief Signal Officer (see sketch No. 5). He also made a cut of the drawing for the Denver Tribune.

(45.)

[Colorado: Denver. Special reports by J. A. Barwick, sergeant, Signal Corps, U. S. A., O. C. S. O. 4290 Obs., 1878.]

The sky was without clouds and there was no wind. The wind had been blowing steadily during the entire day from southeast.

The contact points were observed through a transit [portable astronomical transit. —C. A.], kindly furnished by A. B. Ingols, whose chronometer was also used for time.

The sketch showing the position of the point of contact was made by Mr. Ainsworth, who also called the times of contacts.

The sketch [No. 5] showing the corona and rays during totality was made on the spot by the engraver, Mr. J. M. Bagley.

The contacts were observed as follows: [See Document No. 47.]

Contacts.	Times. *h. m. s.*
First	2 20 00
Second	3 29 6
Third	3 32 5
Fourth	4 34 41

The aureola or glory surrounding the sun and moon was of a bright silvery appearance, and devoid of any color. A few red prominences, or as it appeared to be an overflowing of a red color brighter in some parts than in others, was seen through the glass at the points of first and fourth contacts, more of them appearing when the fourth contact was afterwards observed. No striæ or lines were visible in the bright coronal ring, whose shape appeared to be nearly circular, being fuller at the points where first and fourth contacts occurred; the bright aureola did not extend more than one-third of the diameter of the sun at its widest part.

There were brushes of light radiating in all directions from the edge of the bright corona or halo surrounding the moon; these brushes resembled the shadows of clouds as seen at or near sunset; but those seen during totality were much finer and closer together; they extended out from the edge of the aureola much farther on the sides of first and fourth contacts than they did on the upper and lower sides; some of them appeared to be turned aside at their extreme points, especially on the upper and lower sides of the moon.

The light during totality was, out of door, enough to have enabled one to read print very well; indoor it would have been too dark for a few seconds.

The following observations were made of thermometers in the sunshine and in the shade:

Temperature at Denver.

In the sun.		In the instrument shelter.		
Time.	Thermometer.	Time.	Dry bulb.	Wet bulb.
	°	*p. m.*	°	°
2.00 p. m	114	2.00	88	61
2.23 p. m	114	2.10	88	61
2.25 p. m	108	2.20	88	61
2.31 p. m	108	2.30	89	61
2.38 p. m	102	2.40	89	61
2.48 p. m	100	2.50	88.5	61.5
3.00 p. m	96	3.00	88	62
3.10 p. m	91	3.10	87.5	62
3.20 p. m	88	3.20	86	62
3.32 p. m	83	3.30	85	62
3.35 p. m	82	3.31	84.5	61.5
3.45 p. m	83	3.32	84.5	61.5
4.00 p. m	88	3.40	83.5	61.5
4.10 p. m	92	3.50	83	61
4.23 p. m	97	4.00	84	62
4.35 p. m	100	4.10	85.5	62.5
4.45 p. m	94	4.20	86.5	63
		4.30	88	64
		4.55	90.5	64
		5.10	92	65

[Mr. Bagley's sketch is reproduced in the accompanying collection as sketch No. 5, with the addition of the radial lines used by him in sketching, and by Mr. Ainsworth in locating the points of first and fourth contacts.—C. A.]

(46.)

[Colorado: Denver.—Special report of J. M. Bagley, dated September 20, 1878) filed with 4290, Obs.).]

"I had for use a medium-sized telescope, but could not use it to advantage. Sketch No. 5 was made with naked eye.

"Stars as near in proportion to size of circle as I could guess in free-hand sketching; but if I have shown any stars in the coronal rays it was not my intention. I remember I did not see any stars very close to the rays.

"I could not use the telescope, because it would take only a little more than the circle, when I wanted to make as much of a general view as possible."

(47.)

[Colorado: Denver.—Letter from J. A. Barwick, sergeant, Signal Corps, U. S. A., dated September 20, 1878 (O. C. S.O., 5358, Obs.).]

"Mr. Ingols' chronometer was compared at the Western Union Telegraph office, and on each day of comparison the noon signals at Washington were received at 10^h 8^m 12^s a. m.

Mr. Ingols' chronometer was 1.5 seconds fast as calculated from sun observations taken daily by transit instrument.

Our contacts were obtained by Mr. Ainsworth (Mr. Ingols' assistant, who does all chronometer and transit work). Mr. Ainsworth used his transit in observing the contacts. The transit is a "Bliss, No. 10," the ordinary size used by watchmakers in determining time. Mr. Ainsworth counted the time by the chronometer, and also looked through the transit to observe the contacts, he being used to doing both, that being the manner in which he gets meridian time here by his transit; he says there may have been an error of not more than five seconds in determining the end of totality.

The times of contacts are as follows:

	h.	*m.*	*s.*
First contact	2	20	00
Second contact	3	29	46
Third contact	3	32	5*
Fourth contact	4	34	41

---

* May be an error of five seconds too much in determining this contact.

[Assuming these to be watch times we add $1^h\ 51^m\ 48^s$, and obtain the Washington times as follows:

Washington mean time.

	h.	*m.*	*s.*
First contact	4	11	48
Second contact	5	20	54
Third contact	5	23	53
Fourth contact	6	26	29

C. A.]

The inclosed diagram [which need not be published—C. A.], will give an idea of the positions of the different points desired in your letter of inquiry. (The following distances are given by Sergeant Barwick:)

1. From government monument (*i. e.*, the monument near Denver and Rio Grande Railroad, and whose position was determined by the U. S. Coast Survey—C. A.) to the city corner section is 240 feet south.
2. From city corner section to Nineteenth street is 87 feet SW.
3. From Nineteenth street to Larimer street is 1,399 feet SE.
4. From Larimer street to U. S. signal station (*i. e.*, end of building nearest Sixteenth street where eclipse was observed) is 1307.55 feet SW.
5. From U. S. signal office to Fifteenth street, 550 feet SW.
6. From Fifteenth street (Larimer? C. A.) to corner of Mr. A. B. Ingols' building is 125 feet SE.
7. From position of transit instrument to corner of building is 5.9 feet.
8. Making 119.3 feet from Larimer street to transit instrument.
9. Width of building [depth from street?—C. A.] is 75 feet.

[From a plat of Denver have been measured the following distances, which suffice to show the relations of the points in question:

Object.		Distance.	Bearing.	Difference of—	
				Latitude.	Longitude.
		Feet.		*Feet.*	*Feet.*
A. Government monument	A to B.	240	S.	240	0
B. City corner section	B to C.	87	SW.	61	61
C. Corner Nineteenth and Hazee streets	C to D.	1, 399	SE.	989	989
D. Corner Nineteenth and Larimer streets	D to E.	1, 307. 55	SW.	924	924
E. Signal Service Office, end of Broadwell block nearest Sixteenth street.					
F. Corner Fifteenth and Larimer	D to F.	1, 857. 55	SW.	1, 314	1, 314
G. South corner of Ingols' building	F to G.	125	SE.	88	88
H. East corner of Ingols' building	G to H.	75	NE.	53	53
I. Transit established on back wall of Ingols' building.	H to I.	5. 9	NW.	4	4

Assuming the bearings to be exactly NE., SW., &c., we have the above given differences of latitude and longitude, and the following results:

From A to E: differences of—		From A to I: differences of—	
Latitude.	Longitude.	Latitude.	Longitude.
Feet. —240 — 61 —989 —924	*Feet.* 0 + 61 —989 +924	*Feet.* — 240 — 61 — 989 —1, 314 — 88 + 53 + 4	*Feet.* 0 + 61 — 989 +1, 314 — 88 — 53 + 4
—2, 214 Or — 21″. 9	— 4 Or — 0″. 0 = — $0.^s0$	— 2, 635 Or —26″. 0	+ 249 Or + 3″.2 = + $0.^s2$

For the conversions into arc we adopt 1″ latitude = 101.2 feet, and 1″ longitude = 78.1 feet.—C. A.]

(48.)

Notes by Prof. C. A. Young, of Princeton, N. J., communicated September 5, 1878, and September 27, 1880. (1956 O. C. S. O., Misc., 1880.) Stationed at Denver, Colo.

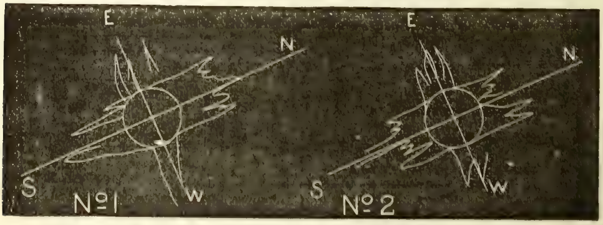
I only looked at the corona about 10 seconds near the middle of totality; then I was immediately struck by the polar streamers of the corona—directed nearly along the hour circle passing through the sun.

The little sketch No. 1, is a rough copy of the still rougher sketch in my note-book. I recollect most distinctly the extension to the right and upwards and the serrations at its edge. The equatorial streamers did not seem nearly so bright to me as the others, but my view was too hasty to be worth much.

Note, added September 27, 1880.—I do not mean to vouch for the outline of the serrations only for the fact that there were serrations. I think the pencil sketch marked 2 is nearer right than the first.

I have no doubt that to most eyes what I did not see of the corona, the long equatorial streamers, was more conspicuous than that which I did see, and I do not wish to seem in any way to contradict the observations of others. My case seems to me a very pretty instance of the manner in which an observer whose attention is caught and preoccupied by one point, will often fail to see something else quite as obvious or even more so. I still think, however, that the polar streamers must have been much more sharply defined than the equatorial, or they would not so have fixed my attention to the exclusion of the others; this view is confirmed by the experience of Professor Brackett, of my party, who saw the corona just as I did, and of Mr. Paul, who sketched it upon a ground-glass screen.

[It seems probable that Professor Young's view of the corona for 10 seconds was with telescopic aid through the finder and not with the naked eye. His location was about $2\frac{1}{4}$ miles southeast of Denver, or about latitude 39° 43′ 27″ north, longitude 1^h 51^m $40^s.4$ west of Washington. Altitude about 5,400 feet.—C. A.]



(49.)

[Colorado: Kit Carson.—Form Y, O. Branham, sunset observer.]

Eclipse, 3^h 13^m to 5^h 29^m.
Totality, 4^h 26^m 12^s to 4^h 26^m 15^s.
Jefferson City, Missouri, mean time.

(50.)

[Colorado: Kit Carson.—Special report by O. Branham, sunset observer (O. C. S. O. 4249, Obs. 1878).]

	h.	m.	s.
First contact	3	13	—
Second contact	4	26	12
Third contact	4	26	15
Duration	0	0	3
Fourth contact	5	29	—

The time used was Jefferson City, Mo. [This apparently means Jefferson City (Mo., local time, perhaps the same as the Kansas Central Railroad time, and obtained by telegraph. The watch, however, does not appear to have been very closely accurate.—C. A.]

Thermometer fell from 92° to 82°. Saw only two stars—one directly east and the other northwest.

[NOTE—The longitudes are approximately as follows:

	West of Greenwich.		West of Washington.		West of Washington.	
	°	′	°	′	h.	m.
Denver	105	0	27	57	1	52
Kit Carson	102	40	25	37	1	43
Jefferson City	92	15	15	12	1	1
Washington	77	3	0	0	0	0

Whence the following times may be deduced:

Middle of totality occurred at Denver 3h 30m 35s Denver local time.

Middle of totality occurred at Kit Carson 3h 33m 35s Denver local time.

Middle of totality occurred at Kit Carson 3h 42m 35s Kit Carson local time.

Whence middle of totality should have occurred at Kit Carson 4h 24m 35s Jefferson City local time.

Whence it would seem that the observer's watch must have been somewhat in error, unless, indeed, the railroad time used by him was not Jefferson City local time.—C. A.]

(51.)

Colorado: South Pueblo, Pueblo County.—Special report of E. S. Nettleton (O. C. S. O. 3288 and 3556 V. R).]

Sky clear; saw a few clouds hovering over Pike's Peak. Did not get Washington time signals. Local time determined by observations of the sun at 10 a. m.; watch evidently too slow.

Contacts observed through the telescope of power 20 of an ordinary engineer's transit; situated, S. 40° 0′ W., 650 feet from the Ruffner monument, whose position is latitude 38° 15′ 42″.8, longitude 104° 36′ 57″.5.*

Contacts.	Local time. h.	m.	s.
First	2	22	16
Second	3	31	11
Third	3	33	44
Fourth	4	36	52
Duration of totality	0	2	33
Duration of eclipse	†2	14	41

A thermometer by Green, exposed to the rays of the sun, lying horizontally 4 feet above the ground and 50 feet distant from any body that would reflect or radiate heat except the earth, which was dry and covered with grass, was read as follows:

Time.	Thermometer. °	Time.	Thermometer. °
Noon	95	3.35 p. m	82
12.15 p. m	98	3.36 p. m	80.5
12.30 p. m	101	3.38 p. m	79.5
12.45 p. m	101.5	3.40 p. m	79.5
1.00 p. m.	98	3.45 p. m	80
1.15 p. m	99	3.50 p. m	82
1.30 p. m	96.5	4.00 p. m	85.5
1.45 p. m	101	4.10 p. m	87.5
2.00 p. m	99	4.15 p. m	90
2.15 p. m	102	4.25 p. m	92
2.30 p. m	102	4.30 p. m	92.5
2.40 p. m	99	4.37 p. m	93.7
2.45 p. m	99	4.50 p. m	92
2.50 p. m	97	5.00 p. m	92.5
2.55 p. m	96	5.10 p. m	92
3.08 p. m	94.5	5.20 p. m	91.5
3.15 p. m	92.5	5.30 p. m	91
3.20 p. m	87	5.45 p. m	90
3.30 p. m	83	6.00 p. m	89

Did not observe any protuberances; the sunlight seemed to last a second or two after the crescent shape of the sun had disappeared. The light seemed to appear about the same at the instant of the end of totality.

Four or five stars were plainly visible to the naked eye; chickens went on the run to their roosts; horses standing in the shade of the trees fighting flies went to grazing. [Mr. Nettleton's sketch of the corona, No. 17 of the accompanying collection, appears to have been made by the naked eye.—C. A.]

(52.)

[Colorado: Summit Station, Rio Grande County.—Special report by C. E. Robins, Vol. Obs. Sig. Ser. (O. C. S. O. 3408, V. R.).]

Seventeen persons were organized into three parties, as follows:

No. 1 at the Little Annie Mill, altitude 11,260 feet.

No. 2 on the apex of South Mountain, altitude 12,500 feet.

No. 3 at the triangulation monument on Summit Peak (Belleview Mountain of Wheeler's survey.—C. A.), altitude 12,748 feet.

---

*This places Mr. Nettleton 5″.4 west, and=4″.9 south of Ruffner's monument, or in latitude 38° 15′ 37″.9 north, longitude 104° 37′ 2″.9 west.—C. A.

†So given by Mr. Nettleton, who has apparently added 5 seconds for the uncertainty of the first contact.—C. A.

No. 2 and 3 were about 4½ miles apart north and south of each other, and No. 1 was nearly between them.

As the observations by each party were conformable, I report only those of party No. 3, under my own direction.

The time is not reliable, but the watches were in agreement.

	h.	m.	s.
First contact	2	15	30
Greatest obscuration	3	25	..
Last contact	4	30	0

Meteorological notes.

Time.	Temperature of air.	Wind.	Upper clouds.	Lower clouds.	Sun's place.
2.15	62	SE. force 2	3 Cir. Cum	3 Cum	Unobscured.
2.30	62	SE. force 2	– Cir. Cum	– Cum	Light cirrus.
3.00	59	NW. force 2	2 Cum	3 Cum	Unobscured.
3.25	56	SE. force 1	4 Cum	3 Cum	Unobscured.
4.30	..				Unobscured.

Miscellaneous phenomena.

Time.
3.00 p. m. One bright star seen north of and below the sun—Venus (?).
3.25 p. m. Greatest phase. Star above noted brilliantly visible.

A thin crescent of the sun visible on its lower edge. The vast ranges of mountains in every direction were veiled in shadow.

The light around us was a greenish yellow, yet objects near and at a distance could be seen almost as plainly as before contact. Nothing was seen of chromosphere or corona or other attendants of the total phase.

The day and weather were superb. I have never at the same elevation known it so warm and still. Our outlook extended 150 miles and assures us that the same favorable conditions prevailed in Southern Colorado.

The domestic animals at the Annie Camp took no notice of the eclipse.

(53.)

[Dakota Territory: Bismarck.—July Journal, D. T. Flannery, private, Signal Corps, U. S. A.]

At 2^h 35^m p. m., through a rift in the clouds, by means of smoked glass, the eclipse was observed; excepting an occasional obscuration by passing clouds, it was visible until 3^h 45^m p. m., when it was totally obscured by clouds and so continued.

At the greatest obscuration there was a mellow light, much like that produced by vivid lightning on a cloudy night, which with a light fitful breeze gave a portentous character to the surroundings. The cirro-stratus clouds were occasionally of the proper density to enable one to see the eclipse with unusual distinctness without using smoked glass.

(54.)

[Florida, Key West:—Special report by M. J. Shanefelter, sergeant, Signal Corps, O. C. S. O., 4378, Obs.

Every preparation made to observe and photograph the eclipse. Shortly before second contact a heavy dense cumulo-stratus cloud passed over and hid the sun until some minutes after third contact. During this interval of about 20 minutes the eclipse was apparently total. [NOTE.—Totality, if it occurred at Key West, could have lasted only a few seconds.—C. A.] While the cloud was passing over shadows were observed beyond the edge of the clouds; also opaline reflections on small outlying cirrus clouds.

The following were the observers and times of contact. All watches were compared fifteen minutes before and after observations:

Party.	Location.	Observers.	Time noted by—	Recorder.
No. 1	Roof of cupola	M. J. Shanefelter	William Ledwitch	G. W. Maslin
No. 2	West window	C. W. Tift	J. M. Baldwin	P. T. Knight
No. 3	South of cupola	E. B. Rawson	R. J. Perry	M. J. Whitehurst
No. 4	South of cupola	J. M. Baldwin	W. Ledwitch	G. W. Maslin
No. 5	West window	C. W. Tift	E. B. Rawson	M. J. Shanefelter

Party.	First contact.	Fourth contact.
	h. m. s.	*h. m. s.*
No. 1	4 37 49	
No. 2	4 37 51	
No. 3	4 37 50	
No. 4		6 29 19
No. 5		6 29 19

A photograph by Pinard of the cloud obscuring the eclipse and drawing of the appearance before and after the cloud obscured the eclipse are given. [These need not be reproduced.—C. A.]

(55.)

[Indiana: Indianapolis.—July Journal, C. F. R. Wappenhaus, sergeant, Signal Corps, U. S. A.]

Shortly after 4 p. m. the sky cleared and showed the eclipse progressing. About 4.30 p. m. there was about one-half of the sun's disk covered. Was prevented from timing the beginning and ending of eclipse by occasional clouds. Temperature in the shade not affected during eclipse, but light toned down to a peculiar yellowish light.

(56.)

[Indiana: Vevay, Switzerland County.—Meteorological record for July, by Charles G. Boerner, Vol. Obs. Sig. Ser.]

Diminishing pressure with increased humidity and cloudiness; unfavorable prospect for observations of the eclipse. At 2 p. m. our observing corps took up our position on Seminary Hill with the necessary instruments and chronometers. The telescopes were in position to observe the first contact; the temperature and pressure were constantly noted at 3h 0m p. m.; threatening clouds moved from the SW. to the NW. at 3h 30m p. m. The wind backed to SW. and accompanied by copious rains drove us from our position. We had a few minutes before succeeded in bringing the instruments under shelter; the storm raged with great violence, and the SW. wind blew a strong gale. Seeing no encouragement for further observations, the party returned at 5h 30m p. m., and on the descent caught a faint glimpse of the moon's shadow through a break in the clouds. Observations of pressure and temperature were taken at the end of every minute.

(57.)

[Indiana: Vevay, Switzerland County.—Special report by Charles G. Boerner, Vol. Obs. Sig. Ser. (O. C. S. O., 3549, V. R.).]

ABSTRACT.—Fully prepared with telescopes, chronometers, and assistants, but astronomical observations prevented by cloudiness, and at 3h 35m p. m., a drenching rain. Meteorological observations were taken during July 28 and 29, at Mr. Boerner's observatory in Vevay, and every ten minutes on the afternoon of the 29th at the station occupied to observe the eclipse, which was 1.5 miles due north of and 223 feet above Mr. Boerner's residence.

Observations at Vevay. Location, as above given. Green's barometer 1687, *corrected for temperature, &c.*

JULY 28.

Time.	Barometer.	Dry.	Wet.	Force of vapor.	Relative humidity.	Clouds.			Wind.	
						Amount.	Kind.	Direction.	Direction.	Force.
	Inches.	°	°	*Inches.*	*Pr.ct.*					
5 a. m.	29. 53	69	64	0. 529	75	5	Cir. cu	NW.	N.	2
6 a. m.	29. 54	70	65	0. 550	75	9	Ci. cu	NW.	NE.	1
7 a. m.	29. 54	70, 5	65	0. 544	73	4	Ci. cu	NW.	NE.	3
8 a. m.	29. 57	72	67	0. 595	76	9	Ci. cu	NW.	NE.	1
9 a. m.	29. 56	77	68	0. 564	61	3	Ci	NW.	NE.	2

Observations at Vevay, &c.—Continued.

JULY 28—Continued.

Time.	Barometer.	Dry.	Wet.	Force of vapor.	Relative humidity.	Clouds.			Wind.	
						Amount.	Kind.	Direction.	Direction.	Force.
	Inches.	°	°	*Inches.*	*Pr. ct.*					
10 a. m	29. 57	80	72	0. 677	66	2	Ci	NW.	NE.	2
11 a. m	29. 55	82	73	0. 690	63	5	Cu	NW.	NE.	2
12 m	29. 53	84. 5	74	0. 697	59	5	Ci. cu	NW.	NE.	2
1 p. m	29. 50	85	74	0. 691	57	7	Ci. cu	0	NE.	1
2 p. m	29. 49	84	74	0. 704	60. 5	7	Ci. cu	0	NE.	1
3 p. m	29. 48	83. 5	74	0. 711	62	9	Ci. cu	0	NE.	2
4 p. m	29. 46	83	74	0. 718	64	8	Ci. cu	0	NE.	2
5 p. m	29. 45	83	73. 5	0. 683	62	6	Cu	NW.	NE.	2
6 p. m	29. 45	82	72	0. 650	59. 5	9	Cu	NW.	NE.	2
7 p. m	29. 46	80	71	0. 637	62	5	Ci. cu	NW.	NE.	3
8 p. m	29. 46	79	71	0. 651	66	5	Cu	SW.	NE.	3
9 p. m	29. 49	76	69	0. 614	68. 5	9	Ci. cu	SW.	NE.	2

JULY 29.

5 a. m	29. 41	73	70	0. 693	85	10	Nim	SW.	NE.	1
6 a. m	29. 41	73	70	0. 693	85	8	Cu. st	SW.	NE.	1
7 a. m	29. 42	75	73	0. 784	90	8	Cu. st	SW.	SE.	1
8 a. m	29. 42	78	75	0. 827	86	6	Cu. st	SW.	SE.	1
9 a. m	29. 42	81	76	0. 829	78	9	Cu. st	SW.	S.	2
10 a. m	29. 42	83	76	0. 802	71	9	Cu. st	SW.	SW.	3
11 a. m	29. 41	80	75	0. 800	78	10	Nim	SW.	SW.	3
12 m	29. 38	82	76	0. 816	75	9	Nim	SW.	SW.	1
1 p. m	29. 38	83	76	0. 802	71	6	Cu	SW.	SW.	1
2 p. m	29. 35	85	77	0. 819	68	5	Cu. st	SW.	SW.	3
3 p. m	29. 34	86	77	0. 805	65	8	Cu. st	SW.	SW.	3
4 p. m	29. 35	85	77	0. 819	68	10	Nim	SW.	SW.	4
5 p. m	29. 34	85	76	0. 775	64	10	Nim	SW.	SW.	3
6 p. m	29. 34	80	76	0. 843	82	9	Nim	SW.	NW.	3
7 p. m	29. 35	77	74	0. 799	86	9	Nim	W.	W.	2
8 p. m	29. 36	75	73	0. 784	90	9	Nim	W.	W.	2
9 p. m	29. 36	75	73	0. 784	90	9	Nim	W.	W.	2

Observations at the eclipse station. Compensated aneroid by Negretti and Zambra, not corrected nor reduced.

Time.	Aneroid barometer.	External thermometer.	Time.	Aneroid barometer.	External thermometer.
3. 00 p. m	28. 90	90	4. 40 p. m	29. 05	76
. 10 p. m	. 92	88	. 50 p. m	. 04	76
. 20 p. m	. 95	86	5. 00 p m	. 04	76
. 30 p. m	. 95	84	. 10 p. m	, 05	76. 5
. 40 p m	. 96	80	. 20 p. m	. 04	76
. 50 p. m	. 97	79	. 30 p. m	. 04	77
4. 00 p. m	. 96	77	. 40 p. m	. 05	76
. 10 p. m	28. 98	75	. 50 p. m	. 05	75
. 20 p. m	29. 00	76. 5	6. 00 p. m	29. 04	75
. 30 p. m	. 05	76. 5			

(58.)

[**Indian Territory: Fort Sill.—Special report by John M'Cann, private, Signal Corps (O. C. S. O., 4389, Obs.).**]

The weather was propitious in every respect; was assisted by Lieut. S. R. Whitall, Sixteenth United States Infantry, who made the accompanying sketch, No. 19 [in reference to which the only notes are by Private M'Cann, as follows:—C. A.].

"The sketch is from my remembrance a very creditable drawing. The white lines shot out and flickered uniformly; the inner circle of light during totality was of a purple hue, around which was a circle of pale yellow skirted with a circle of orange, from the edge of which the irregular striæ were observed. During totality there was no appreciable change in the color of the striæ, which color was white with a yellow tinge, and no red flames were observed."

There were no solar spots seen during the eclipse. During the total phase the vicinity of the observer was a purple twilight, and the horizon for the complete circle of the azimuth, with the exception of about 30° of the western section, presented the appearance of the morning aurora as it appears 20 or 30 minutes before sunrise, with the exception of being of a more brilliant orange color. The western section for a distance of about 30°, as above referred to, was of a much lighter hue. There were no new planets not already laid down in charts discovered.

The position of place of observation was a few feet SE. of the Signal Office and 250 yards south 40° east of the center of this post. The watch used was compared with time received daily for three days from Washington, during which period it lost 30 seconds. The telescopes used were the Signal Service glasses. The contacts were observed as follows:

Contacts.	Washington time.	Instrument.
	h. m. s.	
First	*4 25 58	Signal Service field-glass, with "smoked focus glass" to remove glare of sun.
Second	5 31 20	Signal Service field-glass, clean lenses and blue spectacles.
Third	5 33 48	Signal Service field-glass, clean lenses without spectacles.
Fourth	6 34 2	Signal Service field-glass, with smoked focus glass.

* May be 1 or 2 seconds late.

Duration of eclipse 2^h 8^m 4^s. Duration of totality 2^m 28^s. (The above times appear to be about 5 minutes too early.—C. A.)

(59.)

[Indian Territory: Fort Sill.—Special report by John M'Cann, private, Signal Corps (O. C. S. O., 5278, Obs., September 13.).]

"On the 28th of July the watch was set with the noon signal at exactly 12 o'clock, and when compared with the noon signal of the 29th was found to be 9 or 10 seconds late. I would therefore state that, in my opinion, the watch at the hour of beginning of the eclipse was 11.90 seconds later than Washington mean time.

"The sketch taken by Lieutenant Whitall (No. 19) was made with the naked eye."

(60.)

[Indian Territory: Fort Sill.—Special report by John M'Cann, private, Signal Corps (O. C. S. O., 5697, Obs., October 4, 1878.).]

The times given [in Document 58] are from the reading of the watch, which was set at exactly noon, upon receipt of the noon signal of July 28. Upon receipt of the noon signal of July 29 the watch, as stated in my communication of September 13, was observed to lose 9 or 10 seconds, which fact was also observed upon receipt of the noon signal of July 30.

The error of the watch, as computed in my communication of September 13, is the difference that, in my judgment, existed between the watch and Washington mean time at the hour of occurrence of first contact. On the 29th the watch was observed to be 10 seconds late; on the 30th, 19 seconds late. At that rate I compute the error on Washington time at first contact to be 11.9 seconds.

The watch times of contacts uncorrected for any error are:

	h. m. s.
First	4 25 58
Second	5 31 20
Third	5 33 48
Fourth	6 34 2

[NOTE.—By applying his error, 9.5 seconds, July 29, at noon, and daily rate of 9.5

seconds losing, or hourly rate of 0.4 seconds, I find the watch corrections and the corrected Washington times to be as given in the following columns:

Contacts.	Observed watch time.	Watch correction.	Correct Washington time.
	h. m. s.	*s.*	*h. m. s.*
First	4 25 58	+11.3	4 26 9.3
Second	5 31 20	11.7	5 31 31.7
Third	5 33 48	11.7	5 33 59.7
Fourth	6 34 2	+12.1	6 34 14.1

C. A.]

(61.)

[Iowa: Boonesboro, Boone County.—Meteorological record for July, by J. R. Lincoln, Vol. Obs. Sig. Ser.]

Temperature fell 6 degrees during first half of the eclipse. After the close it went up 3 degrees in a half hour.

Meteorological record.

Time.	Temperature.	Wind.	Clouds.	
			Upper.	Lower.
July 29th, 7 a. m.	68	SE. 1	Strat. 10 SE.	Cu. 6 NW.
2 p. m.	82	NW. 2	0	0
9 p. m.	70	NW. 1	0	0

(62.)

[Iowa: Boonesboro.—Special report by J. R. Lincoln, Vol. Obs. Sig. Ser. (O. C. S. O., 3411, V. R.).]

Beginning obscured by clouds.
Eclipse first seen at 3.44 p. m., Chicago time, on the southwest limb.

	h.	*m.*
Maximum phase	4	35
Ended	5	39

Temperature fell 6°.

(63.)

[Kansas: Dodge City.—July Journal, W. H. Clendenon, sergeant, Signal Corps, U. S. A.]

Eclipse obscured at times by cumulus clouds.
First contact at $2^{h}\ 49^{m}\ 30^{s}$ p. m.

	h.	*m.*	*s.*
Greatest obscuration about seven-eighths at	3	59	30
Last contact	4	59	30

(64.)

[Kansas: Empire City.—Special report by Dr. A. Woodworth, Vol. Obs. Sig. Ser. (O. C. S. O., 3387, V. R.).

Observation of contacts and progress of moon with large theodolite by Ch. L. M'Clung, C. E.; notes, &c., by Dr. Woodworth.

	h.	*m.*	*s.*
Eclipse began	3	16	0 p. m.
Maximum			
Ended	5	22	30 p. m.

Atmosphere clear, calm, hazy.
Two flashes from the sun's edge as the moon impinged on it at the first contact.
[Very careful drawing of progress of eclipse; need not be reproduced.—C. A.]

(65.)

[Kansas: Fort Leavenworth.—Meteorological record for July, by B. E. Fryer, surgeon, U. S. A.]

	h.	*m.*
Partial eclipse (first visible)	3	15 p. m.
Greatest obscuration	4	20 p. m.
Last contact	5	18 p. m.

Temperature fell from 86° at 3.30 p. m. to 77° at 5 p. m.
Regular daily thermometer record, 87° at 2 p. m. and 69° at 9 p. m.

(66.)

[Kansas: Leavenworth.—July Journal, J. R. Williams, sergeant, Signal Corps.]

The morning was cloudy, but the afternoon clear, and everything most favorable for observing the solar eclipse, which began about 3.15 p. m.

As I could not get correct time from the State University, I took no observations of the time of contact.

The sun was about nine-tenths eclipsed; affected temperature slightly, as follows:

Time.	Temperature.
h. m.	°
3 15 p. m	82
3 30 p. m	82
4 00 p. m	80
4 30 p. m	77
4 45 p. m	76
5 00 p. m	77

The wind was north, fresh.

(67.)

[Kentucky: Louisville.—July Journal, L. E. Sebree, sergeant, Signal Corps, U. S. A.]

The clouds prevented observer from noting time of first contact, and it was not until $4^h 39^m$ p. m. that the sun's disk was visible. It became obscured again at $4^h 49^m$, visible at $5^h 21^m$ and until $5^h 25^m$, and again visible $5^h 25^m$ to $5^h 26^m 30^s$ p. m. The clouds prevented another view until $5^h 47^m$ p. m., when the disk remained quite distinct until the last contact, at $5^h 52^m 45^s$ p. m., Washington time.

The thermometer fell 4° during the duration of the eclipse. Its readings were:

Time.	Thermometer.
h. m.	°
4 00 p. m	83
4 35 p. m	81
4 50 p. m	80
5 55 p. m	79

A curious phenomenon was observed during the eclipse. A bow was formed, having colors somewhat similar to those of the rainbow, by the sun's rays on the transparent clouds near the zenith, and about 10° to the westward. The arc was about 60° and with the reverse position to that of a rainbow. Had the circle been complete, the zenith would have been near the center.

(68.)

[Louisiana: Lake Charles, Calcasieu Parish.—Special report by William Meyer, Vol. Obs. Sig. Ser. (O. C. S. O., 1253, Misc. 1878).]

William Meyer, assisted by M. J. Rosleet and A. Meyer, sends a series of careful drawings, which need not be reproduced, and notes from which the following abstract is made:

Time.	Phase of eclipse.	Temperature.	Wind.
h. m. s.		*Degrees.*	
3 51 00	First contact	90	S. E.
4 20 00	Half eclipse	88	
4 40 00	Three-fourths	87	
4 50 00	Total	86	
Duration of totality, $3^m 40^s$.*			
4 56 30	Beginning of transit	89	
5 26 30	Half of transit	88	
5 43 40	End of transit	86	S. E.

Observations apparently taken with naked eye only.—C. A.]

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* Thus in manuscript, but apparently a mistake for $2^m 30^s$, or $2^m 40^s$.—C. A.

(69.)

[Michigan: Detroit.—July Journal, by T. V. Van Heusen, sergeant, Signal Corps.]

A cloudy day; frequent light rains. Between 2 p. m. and 5 p. m. the temperature fell from 63° to 59°, rising again after 5 p. m. It is supposed that this was due to the eclipse.

(70.)

[Missouri: Frankford.—Special report by Mrs. M. G. Vermillion, Vol. Obs. Sig. Ser. (O. C. S. O., 3388, V. R.).]

Eclipse commenced at $3^h\ 43^m$.

Eclipse ended at $5^h\ 32^m$.

Temperature 87° at commencement of eclipse, fell two degrees, and at the close rose to its normal height.

(71.)

[Montana Territory: Virginia City.—Extract from July Journal, by E. McGovern, sergeant, Signal Corps, U. S. A.]

July 26.—Engaged A. B. Knight as my assistant for observing the eclipse. Borrowed two telescopes and prepared to open four eclipse stations.

July 27.—Washington time noon signal not received.

July 28.—Washington time noon signal not received. Sixteen citizens offer their services in observing solar eclipse. Three left to-day for Baldy Mountain, ten miles [eight miles?—C. A.] southeast of this city.

July 29.—Clear and pleasant. Eclipse of the sun passed off in full view, and was the grandest sight possible for man to see. I secured the services of fifteen of our citizens, and, with A. B. Knight, who was principal and most valuable of all my help, a full and successful series of observations was obtained. I borrowed two telescopes and three field glasses, and, with my office telescope, opened four stations in this city and one on Baldy Mountain, eight miles southeast of Virginia City and 10,000 feet above sea-level.

Unfortunately we got Washington time only once, which was Washington noon of the 29th, and that not satisfactory. We made one photometer, four sketching frames, and one swinging support for telescope, and with these opened the following stations:

No. 1.—U. S. Signal Office, Virginia City.

Observer	E. McGovern.
Telescope	A. B. Knight.
Sketch	F. Kellegher.
Time	E. Stark.

No. 2.—Tilton and Barber Building, Virginia City.

Observer	D. W. Tilton.
Sketch	A. J. Bennet.
Time	H. Pease.

No. 3.—Masonic Temple, Virginia City.

Observer	R. B. Wassel.
Sketch	A. A. Leonard.
Photometer	I. C. Smith.
Time	F. H. Baker.

No. 4.—Court-house, Virginia City.

Observer	Dr. H. Schmallhausen. (F. W. Muffley ?)
Sketch	A. Jassen.
Temperature	W. A. Buttermore.
Time	H. S. Howell.

Times of contact were recorded very closely at all the stations, but as all the time-keepers had different watch-times no two of them were alike. The duration of totality was very accurately given, and is at the different stations as follows:

Station.	Duration. m.	Duration. s.
No. 1	3	0
No. 2	2	58
No. 3	3	0
No. 4	2	56

Four sketches of the corona and a series of photometric measurements were taken. No phenomena were seen by any of the observers, neither were any red prominences, variety of colors, or flashes of light seen during totality.

The corona was very brilliant and well-defined around its circumference, and had a moon-like color, but a paler glow, and looked to be farther off than the moon was.

The striæ [rays?—C. A.] had a dark, pale color, and extended only on the line of the ecliptic. The striæ [rays?] came on gradually, and had their greatest extent in the third minute of totality. The greater part of the striæ [rays?] could not be traced to the edge of the corona; neither could the outward limits of the striæ [rays?] be traced to a terminal point. The whole view of the outward boundary of the striæ [rays?] presented the appearance of a large opened fan with the ends of its leaves irregularly broken off, and from this ragged and abrupt disappearance of the wide ends of these pale columns of light I could with aptitude imagine that they extended along the entire line of the ecliptic. There are, however, some exceptions to the above-described character of the striæ [rays?] which you can readily see on corona sketch No. 1, [No. 3 of the accompanying collection of engravings], by F. Kellegher, a Catholic priest, which is the best and most accurate of all the coronal sketches taken here.

At the first second of totality the whole course of the horizon had the appearance of a beautiful sunset. A strong yellowish pale tint hung over everything in the line of our vision. The sky being dark and every particle of light from the sun shut off, and this color still lingering on the mountain sides and far up on the horizon, presented a very unnatural scene. At about the fifth second of totality a sudden transition from light to darkness took place, and at this moment this strange scene perished in a cloud of darkness and the concluding interval of totality exhibited only the phases of an ordinary clear moonless evening just before full night-fall. A little while before the maximum density of darkness had settled upon the earth the eastern horizon was arrayed in a brighter light than the western horizon.

The phenomena preceding complete darkness were like the coming of a very dark shadow from the western horizon and along the line of the ecliptic to the moon's dark disk, where it suddenly dropped as a pall over the earth.

I cannot, neither do any of my assistants, claim to have seen any flying shadow from west to east, or in any other direction, yet we all admit that we had an indescribable sensation of an immense dark shadow which first gathered in the western sky and then in an instant reached us and enveloped the whole sky.

There were only two small cumulus clouds visible at the time of the eclipse, one of which was in the northern and the other in the western sky, and they both reflected very dark and pretty shadows [shades?] some time before and during totality.

Venus was seen ten minutes before and twenty minutes after totality, and the majority of the stars located in the line of the ecliptic were plainly visible during total darkness. Some four or five seconds before the last ray of sunlight had disappeared, the full image of the black-looking moon came to view and made a most miraculous contrast to the sunlight still twinkling on its eastern border.

It was astonishing with what rapidity the first bursting out ray of sunlight shot through and over the whole sky; daylight appeared quicker than it disappeared; sometime before total darkness set in all the cocks in the city began to crow lustily and in a regular succession until the sunlight had wholly disappeared, when they stopped crowing and began a stampede to their hen-coops and actually went to their roosts. The night-hawks came out and flew around as still as usual, and large numbers of grasshoppers that were flying during the day fell to the ground. Add to these the nightly bark of the dog and we had not a typical [fancied?] but real night in mid-day.

The temperature record at the signal office was as follows:

In the thermometer shelter.		*In the sun.*	
	°		°
5.15 a. m	64	1.00 p. m	80
7.00 a. m	68	2.00 p. m	79
9.40 a. m	68	3.00 p. m	70
2.00 p. m	73	4.00 p. m	79

This record gives the smallest daily range during the month.

(72.)

[Montana Territory: Virginia City.—Special report by E. McGovern, sergeant, Signal Corps. See letters No. 4181 Obs. and 4470 Obs.; also 1280 Misc. and 1284 Misc.]

[These latter two are, properly speaking, enclosures in 4470, and 1284 would be enclosure No. 1.—C. A.]

[Sergeant McGovern in the first of these documents telegraphs the general results of his observations; in the last three documents he forwards the observations made at five different points, by his numerous assistants, whose services he secured as he detailed in his general account already given in the Abstract Journal for July. The following is a full abstract of these individual reports.—C. A.] No photographer could be found in the city. The time was received from Washington but once, and that not satisfactorily.

§ I.

[Abstract of report of A. B. Knight (see 1284 Misc.).]

"As your assistant * * * For the observation of the eclipse four stations were established." The locations, observers, and apparatus were as follows:

No. 1.—*Roof of U. S. Signal Office.*

Observers:

Sergeant E. W. McGovern, A. B. Knight: 30-inch Signal Service telescope steadily mounted, casting the sun's image on sheet of paper.
Rev. F. Kellegher: Sketching frame (as described below in report of A. J. Bennet).
E. Stark: Time.

STATION No. 2.—*Roof of Tilton and Barber building.*

Observers:

A. J. Bennet: Sketching frame.
D. W. Tilton: Binocular field-glass; blue glass shade.
H. A. Pease: Time.

STATION No. 3.—*Roof of Masonic Temple.*

Observers:

R. B. Wassell: 30-inch Signal Service telescope, less steadily mounted, casting the sun's image on sheet of paper.
A. A. Leonard: Sketching frame.
Dr. I. C. Smith: Photometer, constructed in strict conformity with the U. S. N. Observatory instructions.
J. H. Baker: Time.

STATION No. 4.—*Cupola of Court House.*

Observers:

Dr. H. Schmallhausen: Field-glass.
A. Jassen: Sketching frame.
W. A. Buttermore: Signal Service standard dry-bulb thermometers.
H. S. Howell: Time.

The sketch of Rev. F. Kellegher, who is an accomplished artist, is quite elaborate. [See No. 3 of the accompanying collection of engravings.]

The photometer gave satisfactory results.

There was no change during the eclipse in the barometric pressure, but the temperature of the air fell 10° from the first to the second contacts; immediately after the fourth [third?—C. A.] the thermometer rose 9°.

TIME.

Washington noon signal was received on the 29th only. At the final signal (not the *first* double stroke); time was called and noted by the four watches as follows:

Station and name.	Signal for $12^h\ 1^m\ 0^s$ of Washington mean time received at—
	h. m. s.
No. 1.—E. Stark	9 50 15 watch time.
No. 2.—H. A. Pease	10 3 15 watch time.
No. 3.—J. H. Baker	9 49 48 watch time.
No. 4.—H. S. Howell	9 51 15 watch time.

The watches were all good ones; that of No. 1 had a daily losing rate of about 10 seconds; that of No. 3 variable rate of about 2 seconds; the others are not given.

The watch times of noting contacts were as follows:

Contact.	Stations.			
	No. 1.	No. 2.	No. 3.	No. 4.
	h. m. s.	h. m. s.	h. m. s.	h. m. s.
First	1 42 55	1 55 11	1 42 30	1 46 20
Second	2 53 42	3 6 50	2 53 18	2 55 **
Third	2 56 42	3 9 48	2 56 18	2 57 56
Fourth	*4 2 32	4 13 59	4 2 12	4 1 25

* Time was called for fourth contact, but the time-keeper did not note it; he claims that it was 4 hours 2 mins. 32 secs.

** This blank is so given in the original, but has been by Mr. Knight used as a zero, and was evidently so intended.—C. A.

[NOTE BY C. A.—Allowing for the approximate rates of Nos. 1 and 3, we have the following corrections to reduce to Washington mean time:

	Stations.			
	No. 1.	No. 2.	No. 3.	No. 4.
	h. m. s.	h. m. s.	h. m. s.	h. m. s.
Corrections to reduce to Washington mean time	+ 2 10 46	+ 1 57 45	+ 0 11 12	+ 2 10 45

Whence the Washington times of contacts are as follows:

Contacts.	Stations.			
	No. 1.	No. 2.	No. 3.	No. 4.
	h. m. s.	h. m. s.	h. m. s.	h. m. s.
First	3 53 41	3 52 56	3 53 42	3 57 5
Second	5 4 28	5 4 35	5 4 30	5 5 45
Third	5 7 28	5 7 33	5 7 30	5 8 41
Fourth	6 13 18	6 11 44	6 13 24	6 12 10

§ II.

STATION No. 1.—E. Stark (4470 Obs., enclosure).

Original of the report on time.
Location at U. S. Signal office, corner of Jackson and Wallace streets.

Washington Noon Signal.

July 27, not received.
July 28, not received.
July 29, received at $9^h\ 50^m\ 15^s$, but not received satisfactorily.
July 30, not received.
July 30, 7 p. m. signal not received.

Error of watch + 10 mins. 15 secs. [This refers to local time, assuming Virginia City $2^h\ 20^m$ west of Washington.—C. A.].

[According to §I, Knight's report, the last of the sixty double beats or $12^h\ 1^m\ 0^s$ Washington time was observed whence the correction to Washington time would be $+2^h\ 10^m\ 45^s$.—C. A.]

Times of contacts were called by Mr. Knight and recorded by Mr. Stark, as follows:

	h. m. s
First	1 42 55 watch time.
Second	2 53 42 watch time.
Third	2 56 42 watch time.
Fourth*	------

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* Was not sure when time was called at last contact, but think it was at 4h. 2m. 32s.

§ III.

STATION No. 1.—A. B. Knight (4470 Obs., enclosure 1).

Gives diagrams four inches in diameter of sun's disc as projected by telescope on card, showing location of points of contact.

Note 1. No solar spots.

Note 2. First contact, $1^h\ 42^m\ 55^s$.

[Need not reproduce these diagrams.—C. A.]

§ IV.

STATION No. 1.—F. Kellegher (4470 Obs., enclosure 8).

[This is an original sketch on rough pasteboard ruled in squares of the solar corona and is reproduced in accompanying engraving No. 3, to which the following notes refer.—C. A.]

NOTES.—The upper part of corona presented an almost opaque spot at B, which gradually disappeared.

The rays as represented did not appear all at once but by degrees; obtaining their greatest extent towards the third minute. The thermometer fell 10°, *i. e.*, from 80° to 70°; when the moon had quite passed over, it rose from 70° to 79°.

	h.	*m.*	*s.*
First contact	1	42	55.
Second contact	2	53	42.
Third contact	2	56	42.
Duration of totality	0	3	0.

§ V.

STATION No. 2.—H. A. Pease (4470 Obs., enclosure 2).

Original of the report on time.

[Watch set at 9 a. m., July 26, *i. e.*, set by the clock of some jeweler.—C. A.]

July 26 to July 27, 9 a. m., watch slow 2 seconds.

July 27 to July 28, 9 a. m., watch slow 3½ seconds.

July 28 to July 29, 9 a. m., watch slow 5 seconds.

Washington noon signal.	Received at watch time.
July 27	Not received.
July 28	Not received.
July 29	Received at $10^h\ 3^m\ 15^s$, not satisfactory.
July 30	Not received.

Whence error of watch $23^m\ 15^s$ [this refers to local time assuming Virginia City $2^h\ 20^m$ west of Washington.—C. A.].

[According to § I Knight's report, the last of the sixty double beats, or $12^h\ 1^m\ 0^s$, Washington time, was observed, whence the watch corrections to reduce to Washington time would be + $1^h\ 57^m\ 45^s$.—C. A.]

Contacts were observed and called by D. W. Tilton; the recorded times were—

Contacts.	Watch time.			
	h.	*m.*	*s.*	
First	1	55	11	p. m.
Second	3	6	50	p. m.
Third	3	9	48	p. m.
Fourth	4	13	59	p. m.

§ VI.

STATION No. 2—A. J. Bennet (4470 Obs., enclosure 6).

[This is an original sketch and is enlarged and reproduced in engraving No. 2 to which the following notes refer.—C. A.]

The accompanying sketch was drawn by the aid of a sketching frame arranged with cross-wires at right angles forming squares of one inch each. At center was a small pearl button attached to wires. The sight 21 inches in rear of frame and on a line with center. The sketch is drawn in the proportion given by this apparatus, the size of moon and corona being given as nearly as possible, as it appeared with reference to sketching frame.*

NOTES.—Streaks of light at *a* and *a′*. The ring of light surrounding moon of a yellowish cast; brightest in inner portion of corona, the outer edge of corona sharply defined, except at A and A′, at which points it shaded gradually away and was broken up into streaks. No rose-colored protuberances visible. Edge of moon regular and circular.

Light sufficient to show lines on paper and cross lines in sketching frame without aid of lamp. At second contact, light disappeared very suddenly; at third contact it broke out with startling brilliancy.

§ VII.

STATION 3.—J. H. Baker (4470 Obs., enclosure 3).

Original time record.

July 29.—Washington noon signal received by watch at $9^h 49^m 48^s$, but not satisfactory. Watch error, $9^m 48^s$. [This refers to local time, assuming Virginia City to be $2^h 20^m$ west of Washington.—C. A.]

[According to § I, Knight's report, the last of the sixty double beats, or $12^h 01^m 00^s$. Washington time, was observed, whence the watch corrections to reduce to Washington time would be $+ 2^h 11^m 12^s$.—C. A.]

Contacts were observed by R. B. Wassell, and recorded by J. H. Baker, as follows:

Contacts.	Watch time.
	h. m. s.
First	1 42 30 p. m.
Second	2 53 18 p. m.
Third	2 56 18 p. m.
Fourth	4 2 12 p. m.

§ VIII.

STATION No. 3.—I. C. Smith, M. D. (O. C. S. O., 1280 misc.).

"The photometer was a pine-wood box, made similar to the one Professor Pickering used at Cape of Good Hope [thus in MSS. but see Coast Survey report, 1870, page 172.—C. A.], being 6 feet long, 9 inches wide, 18 inches deep; made dead-black on the inside with gum shellac, lamp-black and alcohol; according to instructions given in the U. S. Naval Observatory Instructions for observing eclipse of July 29.

The number of observations taken during totality was eight, and the average of these gave a distance of 4 feet and 3¼ inches from the paper to the candle.

The paper that I used and the candle I inclose herewith.

I also took an observation every 20 secs. one minute before and after totality, but was told it was not necessary to send a record of these.†

§ IX.

STATION No. 4.—H. C. Howell (4470 Obs., enclosure 4).

Original time record.

Washington noon signal received on July 29, at $9^h 51^m 15^s$, watch time, but not satisfactory.

Error of watch, $+ 11^m 15^s$. [This refers to local time, assuming Virginia City $2^h 20^m$ west of Washington.—C. A.]

[According to § I, Knight's report, the last of the sixty double beats, or $12^h 1^m 0^s$, Washington time, was observed, whence the correction to reduce watch time to Washington time would be $+ 2^h 9^m 45^s$.—C. A.]

Contacts observed by Schmallhausen and the times recorded by Howell were as follows:

Contacts.	Watch time.
	h. m. s.
First	1 46 20 p. m.
Second	2 55 ‡ p. m.
Third	2 57 2 p. m.
Fourth	4 1 25 p. m.

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* [At twenty-one inches, one inch subtends 2° 44′=164′, and the moon's radius of 16′ corresponds to 0.1 inch, whereas in Mr. Bennet's original sketch it appears as 0.2 inch. In the accompanying enlarged copy the moon has been enlarged to a size uniform with our other drawings, the corona, &c., have been (in the same proportion) enlarged, and the squares of Mr. Bennet's sketch have been omitted; this assumes that Mr. B. used the moon's diameter as his unit of measure.—C. A.]

† See his letter following this report.

[‡ The original record leaves these seconds entirely blank. Mr. Knight adopts zero seconds instead of blank.—C. A.]

§ X.

STATION No. 4.—W. H. Buttermore (4470 Obs., enclosure 7).

Original records of temperature observations.

(S. S. hygrometer, 545; dry bulb in the sun.]

Time.	Reading.	Notes.
	°	
1.30 p. m.	80	
1.40 p. m.	79.5	
1.50 p. m.	80.5	
2.00 p. m.	73	First contact visible $1^h\ 56^m$ p. m.; temperature, 79.5.
2.10 p. m.	73.5	
2.20 p. m.	75	
2.30 p. m.	77	
2.40 p. m.	73.5	
2.50 p. m.	74	
3.00 p. m.	71	
3.10 p. m.	70	Second contact visible at $3^h\ 6^m$; temperature, 70°. Duration of totality, $2^m\ 59^s$.[*]
3.20 p. m.	71	Third contact visible at $3^h\ 9^m\ 1^s$; temperature, 70°.
3.30 p. m.	72	
3.40 p. m.	73.5	
3.50 p. m.	74	
4.00 p. m.	76	
4.10 p. m.	75.5	Fourth contact at $4^h\ 10^m$; temperature, 76°.
4.15 p. m.	76	

[[*] So given in MSS., although the difference of the recorded times gives us 3 mins. 1 sec.—C. A.]

[The times recorded in these notes by W. H. Buttermore do not agree with those of any other observer's watch, nor with any corrected times; they must therefore be assumed to be times observed by W. H. B. with his own watch and with the unaided eye. They therefore constitute an additional set of independent observations, and will be so used in the general summary.—C. A.]

§ XI.

STATION No. 5.—H. N. Blake (4470, obs. enclosure 5).

Eclipse observed at "Old Baldy" ten miles SE. from Virginia City and 10,000 feet above the sea-level.

The party consisted of—

Henry N. Blake, observer [binocular?].
A. C. Hall, timekeeper.
William Martin, sketcher.
William Etchell, thermometer, made by Kendall & Co.

Observed contacts.	Watch-time.			Observed temperature.
	h.	*m.*	*s.*	°
First	1	42	35	66
Second	2	53		58
Third	2	55	50	54
Fourth	3	58	55	65
Duration of totality		2	50	
Duration of eclipse	2	16	20	

The seconds-hand of a watch could be seen during totality without any artificial light.

No stars, not upon the map, were visible.

No red prominences were seen.

The wind was blowing from SW.

§ XII.

STATION No. 5.—William Martin (4470, obs. enclosure 5).

Original sketch of corona as seen [with the naked eye] from near the summit of "Old Baldy;" altitude 10,000 feet.

[No explanatory notes accompany this sketch, which is reproduced in engraving No. 1.—C. A.]

(73.)

[Copy of letter from Dr. I. C. Smith, Virginia City, Mont. (1737 O. C. S. O. Misc., 1878).]

In reply to your letter, I have the honor to inform you that my photometer readings during the total eclipse of the sun began precisely at the first contact, but the photometer did not work until about one minute before totality, as previous to that time the light from the sun was too intense to be neutralized by the candle light of the photometer, and again at one minute after totality the same difficulty was experienced, after which time my observations were discontinued.

The following figures give the distances between the candle and the paper at the times designated:

At 60 seconds before totality the distance was 4 inches from candle to paper.
At 50 seconds before totality the distance was 5 inches from candle to paper.
At 40 seconds before totality the distance was 8 inches from candle to paper.
At 30 seconds before totality the distance was 12 inches from candle to paper.
At 20 seconds before totality the distance was 18 inches from candle to paper.
At 10 seconds before totality the distance was 30 inches from candle to paper.
At 0, or first second of totality, 51 inches from candle to paper.
3 measurements during the second minute read 51¼ inches.
3 measurements during the third minute read 51¼ inches.

The measurements taken in the first minute after totality were precisely the same as in the first minute before totality. The increase of light during the first minute after totality was in the same ratio as the decrease before.

(74.)

The candle and paper used by Dr. I. C. Smith in his photometric observations at Virginia City were referred to Prof. E. C. Pickering, director of Harvard College Observatory, for comparison with the apparatus used by him during the eclipse of 1870, and the following letter was received from him dated Cambridge, October 31, 1878.

[Extract from letter No. 1280, Misc., O. C. S. O. 1878, C. A.]

On inquiry I find that the candle used by Mr. Ross in observing the eclipse of 1870 does not appear to have been preserved. I have accordingly obtained a sperm candle resembling it as nearly as possible, with which I have photometrically compared the candle used by Dr. Smith.

Three minutes after lighting Dr. Smith's candle its light was found to be 0.91 and 0.96, that of the sperm candle being taken as unity. Five minutes later the ratio was 1.29 and 1.27; and after the candle had been burning twenty minutes, 1.43 and 1.40. A comparison with a standard gas-burner showed that the change was mainly in Dr. Smith's candle, the flame of which had in fact nearly doubled in length, as its wick was not uniformly consumed.

The results obtained in photometric observations with an ordinary candle of this kind can evidently be only approximate.

This seems in fact to be the view taken by the observer at the time of the eclipse, judging from the general character of his report and especially as he confines himself to the remark with regard to the observations after the total phase, that they agreed with those taken before it. It is also to be noted that in observations undertaken for a like purpose, in which care is taken to secure complete independence of the separate estimates, differences between them of several inches are to be expected under the most favorable circumstances. On the whole it does not seem that in any discussion of Dr. Smith's observations it can be advantageous to employ corrections for differences between the apparatus used on this occasion and in 1870.

Assuming the candles used in 1870 and in 1878 to give equal amounts of light, it appears that the light of the corona in 1870 equaled that of a candle at the distance of 18 inches, and that the corresponding distance in 1878 was 51¼ inches. Since the light received from the candle is inversely as the square of its distance the conclusion thus reached is that during the total phase the light in 1870 was about eight times as great as in 1878.

Part of this difference may of course be ascribed to the usual causes likely to affect the accuracy of photometric observations in which a candle is taken as the standard. Such are: the irregular consumption of the wick, the overhanging of the snuff, and the increased melting of the candle, due to a rise in the temperature of the surrounding air, which is very likely to occur when the flame is inclosed in a box. It does not seem likely, however, that the whole difference can thus be explained.

(75.)

[Nebraska: Clear Creek, Saunders County.—Meteorological record for July, by A. F. Bryant, volunteer observer, Signal Service.]

First contact, 2h 53m 30s, 20° below North Pole [vertex?] of sun's limb.
Last contact, 4h 58m 45s, near South Pole [vertex?] of sun.

Sun about nine-tenths covered; observed through a smoked glass.

At the center of the eclipse it looked as if I could see down alongside of the moon toward the earth, as if it was a long big pine log projecting out of the sun.

The watch was regulated according to sunset of July 29, by Jayne's Almanac.

(76.)

[The preceding notes having attracted my attention a request was sent to Mr. Bryant for further information and the following reply was received.—C. A.]

[Extract from letter No. 4809, Vol. Obs. O. C. S. O., 1878. A. F. Bryant, observer, Clear Creek Saunders County, Nebraska, dated November 3, 1878, in reply to letter of September 13.]

I thought what I saw during the center of eclipse was a natural sight, having read that the moon was a long body hanging down towards the earth; one of my children, a girl of seventeen, saw the same appearance. It appeared to emanate directly from the sun, no space between; its size was the diameter of the sun and faded off on each side a little farther, perhaps one digit, and did not look altogether like rays of light, as when the sun shining through the clouds is said to draw water, but had dark and light spots on it. It was of length 2½ or 3 diameters of the sun and faded off gently into the surrounding light, and was oval or slightly oval across the surface. It looked a little like No. 6 on your paper as to rays and size, and like No. 3 as to spots, but not so many, and of larger size; and like No. 12 as to the upper surface, but with an oval top. [These numbers refer to some sketches sent him as guides.] We looked through smoked glass. I saw the phenomenon during 30 or 40 minutes, looking at it several times.

Have tried to draw a sketch [No. 18 of the accompanying collection] on the paper you sent me; this is from memory, having taken no sketch at the time. The spots on the drawing are not located with exactitude nearer than to show the general appearance. The dark spots shaded off gently into the light ones. It looked like what I have seen in mountainous countries when the sun got into a position to shine down alongside of a snowy peak, some places being bright and some dark, or like a pine log, on account of dark and light spots on it, as seen at a distance.

[Mr. Bryant's sketch is No. 18 of the accompanying collection of engravings.]

(77.)

[Nebraska: Emerson, Otoe County.—Meteorological record for July, by Wm. Dunn, Vol. Obs., Sig. Ser.]

An excellent day for seeing the eclipse.

	°
At beginning of eclipse thermometer read	82
At greatest obscuration thermometer read	75
At close of eclipse thermometer read	84

The regular observations as given in the meteorological record were:

7 a. m. thermometer read	71
2 p. m. thermometer read	82
9 p. m. thermometer read	68

(78.)

[Nebraska: Near Howard, Nemaha County.—Meteorological record for July, by Charles Blodgett, Vol. Obs., Sig. Ser.]

Partial eclipse; no observations except the following:

	°
Temperature of air at beginning of eclipse	84
Temperature of air at lowest during eclipse	74. 2
Temperature of air subsequently rose to	78

No wind at all during the eclipse.

The regular observations were, 7 a. m., 67°.5; 2 p. m., 86°; 9 p. m., 70°.

(79.)

[Nebraska: North Platte.—July Journal, by H. A. Jones, sergeant, Signal Corps.]

Clear, with very little wind.
Thermometer fell during eclipse 5°.
Relative humidity increased 15 per cent.
Barometer not perceptibly affected.

(80.)

[Nevada: Winnemucca.—July Journal, by John Healy, corporal, Signal Corps.]

Solar eclipse observed through smoked glass.
First contact about $1^h\ 15^m$ p. m.
Greatest obscuration about $2^h\ 25^m$ p. m.
Amount two-thirds.
Last contact about $3^h\ 35^m$ p. m.

The air had been hazy and the dull light caused by the eclipse made the atmosphere appear more so during the phenomenon.

Thermometer readings as follows:

	°
Just before the eclipse	91
Greatest obscuration	85
After the end of the eclipse	88 5

(81.)

[New Hampshire: Auburn, Rockingham County.—Meteorological record for July, by Frank T. Hills, Vol. Obs., Sig. Ser.]

[This report (O. C. S. O. 3381 V. R.), consisting of a diagram and table, is filed with the July Form H. Times of observation, as given by a first-class chronometer, which was 0.5^s fast on Cambridge Observatory time signals, or $23^m\ 56^s.8$ fast on Washington time.—C. A.]

First observation (after first contact) at $5^h\ 0^m\ 10^s$, Cambridge time, or $4^h\ 36^m\ 13^s.2$ Washington time. Sun's altitude, 22° 42′ 21″.

Second observation (near maximum obscuration) at $5^h\ 30^m\ 10^s$, Cambridge, or $5^h\ 6^m\ 13^s.2$ Washington time.

Meteorological observations.

Time.	Barometer.	Temperature.	Humidity.	Dew-point.	Wind.		Clouds.				
					Direction.	Force.	Amount.	Lower.	Upper.	Direction, lower.	Direction, upper.
5.00 p. m.	29.89	81	55	63.5	W.	2	8	Cu.	Ci. cu.	S.	W.
.10 p. m.	.88	79.5	60	64.4	W.	2	9	Cu.	Ci. st.	S.	WSW.
.25 p. m.	.88	78	82	72	ENE.	3	10	Ci.	St.	S.	SW.
.40 p. m.	.89	76	73	66.5	E.	2	10	Cu.	Ci. st.	SSE.	SW.
5.55 p. m.	.88	74	72	64.5	ESE.	2,3	10	Cu.	Ci. st.	SSE.	SW.
6.10 p. m.	.89	73	76	65	SE. by S.	2	10	Cu.	Ci. st.	SE.	SSW.
.25 p. m.	.88	72.5	74	63.5	SE. by S.	2	10	Cu.	Ci. st.	SE.	SSW.
.40 p. m.	.89	69.5	88	66	ESE.	3	10	Cu.	Ci. st.	SE.	SSW.

[The longitude of Cambridge Observatory is $0^h\ 23^m\ 41^s.11$, but the meridian whose standard time is distributed by telegraph daily throughout New England is that of Boston, $0^h\ 23^m\ 56^s.8$ east of Washington, and it is assumed that this was the time signal by which the observer regulated his watch.—C. A.]

(82.)

[New Mexico: Silver City.—July Journal, by Wm. T. Blythe, sergeant, Signal Corps.]

§ I.

Eclipse began approximate at $3^h\ 10^m$ p. m. Santa Fé time. The first of the eclipse could not be seen, the sky being covered with cumulus clouds. About one digit of lower limb, or a segment whose arc would include an angle of 30 degrees, was unobscured.

End of eclipse at $4^h\ 44^m\ 20^s$ p. m.

Took five-minute readings of barometer and thermometer. The former instrument was not affected, but the latter went down 3°.2

§ II.

The following report was furnished to Sergeant W. T. Blythe by C. W. Irish, of the surveying party of W. R. Morley, engineer of the Atchison, Topeka, and Santa Fé, Railroad, Silver City, N. Mex., 31° 17′ W.=$2^h\ 5^m\ 8^s$ W., 32° 47′ N., altitude, 5,725 (?) feet.

Observers: C. W. Irish and Clarence Pullen.

First contact obscured by clouds.

Last contact $4^h\ 42^m\ 04^s$ p. m. Santa Fé time by telegraph. These were observed with a watch whose original readings were—last contact at $5^h\ 50^m\ 29^s.5$.

The watch correction appears to have been computed from the following:

At $5^h\ 27^m\ 41^s$ the sun's upper limb had the—

	° ′ ″
Altitude	34 05 00
Index error to be applied	00 28 30
	33 36 30

By the same watch at $5^h\ 29^m\ 13^s$ the sun's lower limb had the—

	° ′ ″
Altitude	33 45 00
Index error	00 28 30
	33 16 30

The following limb of the sun as seen in the transit instrument had an azimuth of 87° 38′ 30″ from the north by the west at the time of last contact.

[NOTE.—For observations at Santa Fé see Ann. Rep. Chief of Engineers, 1879, page 2247.]

(83.)

[Oregon: Portland.—Abstract Journal for July, by R. R. Herman, corporal, Signal Corps.]

The eclipse began at $12^h\ 35^m$ p. m. and ended at 3^h p. m. Clear weather prevailed during the eclipse. Towards the time of greatest obscuration the thermometer had fallen 2°. The sun's light was now decidedly dimmed and had a resemblance to twilight. At the time of greatest obscuration a small portion of the sun's surface, the southern rim, shone about the shape of a new moon.

(84.)

[Oregon: Umatilla.—Journal for July, by J. B. Wells, private, Signal Corps.]

Atmosphere hazy; eclipse of the sun; thermometer falling 3°.

(85.)

[Texas: Austin.—Special report, by D. W. C. Baker, Vol. Obs., Sig. Ser. (O. C. S. O. 3527 V. R.)]

Observations made at Austin, using a marine binocular with protected lenses. Washington time was obtained by telegraph from the Signal Service stations at Galveston and San Antonio. Occasionally interrupted by clouds:

	Austin time.	Washington time.
	h. m. s.	h. m. s.
First contact	3 26 45	4 33 45
Greatest obscuration eleven and a half digits	4 34 —	5 41 —
Last contact	5 35 —	6 42 —

The thermometer fell from 90° to 88°. Wind south, force 2, clouds cir. cum. 3. [Four sketches illustrating progress of eclipse; need not be reproduced.—C. A.]

(86.)

[Texas: Belmont Farm, near Melissa, Collin County.—Meteorological record for July, by T. M. Scott, Vol. Obs., Sig. Ser.]

	h. m. s.
First contact	3 11 — p. m.
Total obscuration	4 15 20 p. m.
Reappeared	4 16 20 p. m.
Last contact	5 16 — p. m.
Duration of totality	0 1 0

Sky to the west was very favorable for observation. During period of totality three stars appeared, one in NW., one in SW., and one in SW. at higher elevation. Not a breath of air stirring during the whole eclipse. The birds ceased to sing, fowls hovered around their roosting-places, and an air of stillness prevailed.

(87)

[Texas: Belmont Farm, near Melissa.—Special report by T. M. Scott, Vol. Obs., Sig. Ser. (O. C. S. O., 3443, V. R.).]

Western sky clear except a few fleecy scattering clouds. Perfectly calm; had no Washington time, and gives local time instead.

	h. m. s.
First contact	3 11 — p. m.
Second contact	4 15 20 p. m.
Third contact	4 16 20 p. m.
Fourth contact	5 16 — p. m.
Duration of totality	60

During totality three stars appeared; one 10° elevation in the N. W.; one 15° elevation in the S. W.; one 45° elevation in S. W.

[NOTE.—Gives a sketch of corona, which is reproduced with the reference numbers and text as No. 26 of the accompanying collection of engravings.—C. A.]

(88)

[Texas: Corsicana.—Abstract Journal for July, by J. W. Smith, sergeant, Signal Corps.]

Eclipse of the sun only partially visible on account of intervening clouds and haze. The first contact obscured by clouds; second and third noted with some degree of accuracy, and fourth doubtful, as follows:

	Local time.	Washington time.	
	h. m. s.	h. m. s.	
First contact		....	Stratus clouds.
First observation	3 — —	4 19 —	Stratus clouds.
Second contact	4 20 48	5 39 48	
Third contact	4 23 19	5 42 19	
Fourth contact	5 21 52	6 40 52	Time doubtful.

Duration of totality, 2 mins. 31 secs.

Aureola and corona not well defined. Dense, yellowish, hazy sky and sunset. Large solar halo at 3 p. m., not well defined.

(89.)

[Texas: Corsicana.—Special report by J. W. Smith, sergeant, Signal Corps (O. C. S. O., 4357, Obs.).]

The assistants and work were as follows:

Sergeant J. W. Smith	Signal Service telescope, power, 30; contacts and time.
A. S. Nowren, C. E	Astronomical telescope, power 110; contacts and time.
H. K. Farren, C. E. Prof. M. Cumming	Sketches I to IV

Time signals were received at Washington noon, on the 28th, 29th, and 30th. Heavy rain from the north commenced at $12^h\ 35^m$, and ended at $1^h\ 20^m$ p. m. First contact was therefore lost. Eight digits were eclipsed before a distinct view could be obtained. Second and third contacts well observed. Fourth contact not satisfactorily observed.

	Local time.	Washington time.
	h. m. s.	h. m. s.
Second contact	4 20 48	5 39 48
Third contact	4 23 19	5 42 19
Fourth contact	5 21 52	6 40 52
Duration of totality	2 31	

At the very moment of beginning of totality, a sheet of flickering, whitish light flashed from the western limb of the sun, appeared as if driven onward by the moon, continued a few seconds and disappeared. During the whole of totality reddish flames were observed issuing from the sun's northern limb, apparently about one-twelfth the diameter of the sun in width and one-sixth in height. About thirty seconds before the ending of totality the same phenomena were observed on the sun's western limb, in the wake of the moon, covering an arc of about 60°, and having a rolling motion like water running rapidly over a broken surface. [It is not definitely stated whether the preceding phenomena were seen through the telescope or with the naked eye nor by whom they were observed.—C. A.]

The aureola or glory and corona were both visible but not well defined, the latter not sufficiently so to permit of a satisfactory sketch. The instruments used were the Signal Service telescope and a small astronomical telescope of a power of 110, purchased by Mr. A. S. Nowren for the occasion.

Professor Cumming sketched the corona figures I to II; also a peculiar crescent of light seen just before and immediately succeeding totality; figures III and IV.

[NOTE.—These four sketches are combined in one figure, No. 27, of the accompanying collection of engravings.—C. A.]

(90.)

[Texas: Decatur, Wise County.—Special report by W. E. Garver, manager telegraph office (O. C. S. O., 4455 Obs.).]

W. E. Garver observed external contacts with Signal Service field-glass and shade-glass, but internal contacts with naked eye; at a point 50 yards S. W. of the court-house, Geo. P. Thompson recorded the times. [The watch was apparently one second too slow, for which correction has been made.—C. A.]

Washington noon signal received July 30, when watch was 2 seconds slow.

Contacts.	Washington mean time.
	h. m. s.
First	4 30 57 p. m.
Second	5 36 20 p. m.
Third	5 39 49 p. m.
Fourth	6 37 51 p. m.

[Hence duration of totality was 0^h 3^m 29^s; but this seems likely to be an error for 2^m 29^s.—C. A.]

No photographer at this station; was unable to get any one to make a drawing of the corona.

(91.)

[Texas: Denison.—Abstract of Journal for July, by H. Frey, sergeant, Signal Corps.]

Commenced clearing at 1^h 30^m p. m., although the sky was three-fourths covered with clouds nearly all the afternoon.

From 3 p. m. to the commencement of the eclipse, a close watch was kept by all the men on duty at this office in order to note the first contact and also the last, with the following results:

First contact, 3^h 13^m 30^s, as seen through smoked glass.

Last contact, 5^h 18^m 10^s, as seen through smoked glass.

Greatest obscuration, 4^h 41^m 50^s, at which time the sky had the appearance of twilight, and the star Venus shone brightly. During the afternoon the clouds overhead were tinged with prismatic colors.

(92.)

[Texas: Galveston.—Special report by E. O'C. MacInerney, sergeant, Signal Corps (O. C. S. O., 4323 Obs.).]

Reports that the only scientific observations made at Galveston were by H. C. Ripley, United States assistant engineer; M. W. Shaw, esq.; Capt. C. E. L. B. Davis, Engineer Corps, U. S. A.; D. Shaw, and S. Jones. According to these observations the times of contacts were:

	h. m. s.
First contact	3 30 45 p. m.
Last contact	5 34 32 p. m.

Time was determined by a transit instrument, and the sun was observed through a good equatorial.

(93.)

[Texas: Graham.—Abstract of Journal for July, by F. Shock, manager telegraph office.]

The eclipse was attentively observed here. Judge E. T. Hilliard used theodolite telescope, while A. B. Grant sketched the corona (Fig. No. 24 of the accompanying collection of engravings).

	h. m. s.
First contact	4 31 43 p. m.
Second contact	5 37 50 p. m.
Third contact	5 39 50 p. m.
Fourth contact	6 38 30 p. m.

Set my watch on the 28th to agree with the noon signal by telegraph from Washington.

The noon signals of the 29th and 30th were received as follows:

On the 29th at 12h 0m 23s by my watch.

On the 30th at 12h 0m 56s by my watch.

There may have been an error of 5 seconds in noting the time of first contact and of 10 seconds in noting that of fourth contact, but the duration of totality was correctly recorded.

July 30.—I have seen others in the town and vicinity who observed the duration of totality, each affixing it at two minutes.

[The above observed times seem to require a correction. See below.—C. A.]

(94.)

[Texas: Graham, Young County.—Special report by Floyd Shock, manager telegraph office (O. C. S. O., 4489 Obs.).]

Assistants.	Work arranged.
F. Shock	Recorded time by Waltham watch.
E. T. Hilliard, C. E.	Observed with theodolite telescope set upon a tripod.
A. B. Grant	Sketched corona with naked eye and observed with smoked glass.
Hallis Spiller	Searched for stars.

Location of station is:

143.52 miles west of Denison by telegraph wire.

41.28 miles east of Fort Griffin by telegraph wire.

27.36 miles west of Old Fort Richardson by telegraph wire.

The Twin Mountains of Young County are 200 yards northeast from the point of observation. Graham is 8 miles north of east from the mouth of the Clear Fork of the Brazos River.

Washington time received July 28, 29, and 30. The watch was on these dates, respectively, 0 seconds, 23 seconds, and 56 seconds too fast.

Contacts occurred as follows:

	Watch time.	Washington time, as corrected by C. A., for the watch error.
	h. m. s.	h. m. s.
First	4 31 43	4 31 14
Second	5 37 50	5 37 20
Third	5 39 50	5 39 20
Fourth	6 38 30	6 37 59

There may have been an error of 5 seconds in noting the time of first contact and one of 10 seconds in that of fourth contact, but the duration of totality as well as the ending of the same were correctly recorded.

Mr. A. B. Grant sketched the corona, which sketch I inclose; though it is rough in appearance it is entirely accurate [sketch is reproduced in No. 24 of the accompanying collection of engravings].

(95.)

[Texas: Graham.—Special report by Floyd Shock, manager telegraph office(O. C. S. O., 5582 Obs.).]

In reply to your communication of August 26 I have to state: The name of the gentleman who timed the duration of totality of eclipse is F. L. Caldwell; his place of observation in the town of Graham; no instruments except an ordinary watch. The other gentleman who assured me that totality lasted two minutes was a traveling salesman, name unknown; he was 8 miles northwest of Graham at the time of second contact.

(96.)

[Texas: Henrietta.—Special report of J. J. Mullen, manager telegraph office (O. C. S. O.,4577 Obs.]

Sky clear of clouds nearly the whole time, and no wind. The assistants previously trained were sick, and Mr. Mullen's own work was done alone. Independent sketches of the corona were made by Dr. M. Harrold, and Mrs. J. D. Harston and J. J. Mullen [see Nos. 22, 21, 20 of the accompanying collections of engravings].

§ I.

J. J. Mullen's observations: believes time to be accurate, especially in regard to duration of totality [evidently had set his watch by Washington noon time signal.—C. A.].

Had no telescope [one had been sent, but did not arrive in time].

Contacts.	Washington time.
	h. m. s.
First	4 25 36 p. m.
Second	5 34 52 p. m.
Third	5 37 29 p. m.
Fourth	6 36 28 p. m.

His time was much occupied during totality getting exact time, but adds the following notes:

The first contact was between lines 210 and 240 [on the accompanying sketch No. 20 by Mullen]. The second contact was between 30 and 60, when the last seen of the sun was a red hook or arc of about one-tenth of a circle; this appeared about an inch wide for an instant, when suddenly the eclipse was complete. The first reappearance of light was a red flame about three inches long darting out from the dark object on the line marked 270, and having the slope drawn on the diagram. "The blue-gray halo surrounding the moon was about as sketched. I have made no corrections on it." I noticed two red spots through the face of the moon after totality; the first on line 210 and about 1½ inches from the western edge. The other red spot appeared through the moon near line 30, about 1 inch from western edge and 3 inches below the top point of shadow [by shadow is apparently meant the dark disk of the moon.—C. A.].

The eclipse disappeared [fourth contact] between lines 30 and 60.

The appearance of the rays reminded me more of northern lights in the Arctic region than anything else. The sky was clear of clouds during the whole of the eclipse.

§ II.

[Dr. M. Harrold's sketch of corona.]

[This is reproduced in figure (No. 22); on one corner of the original sketch is the following note:]

On—9 mins. 10 secs. after 4.

Went off—11 mins. 40 secs. after 4.

[This is presumed to be an observation independent of that previously given by Mullen, and gives 2^{m} 30^{s} for the duration of totality.—C. A.]

§ III.

[Mrs. Harston's sketch is reproduced in figure No. 21. No notes accompanied it.]

(97.)

[Texas: Jacksborough.—Special report by P. M. Wilson, corporal, Signal Corps (O. C. S. O., 4314 Obs.).]

Washington noon signal received on 28th; at that moment set the watch to exactly 10.36 a. m.

Washington noon signal received on 29th at $10^h\ 35^m\ 57^s$ by the watch, again set the watch to 10.36 a. m. [Assume correction in Washington time to be $+1^h\ 24^m\ 1^s$.—C. A.]

Contacts.	Observed times.	Washington time.
	h. m. s.	*h. m. s.*
First	3 13 1	4 37 2
Second	------	------
Third	4 13 2¼	5 37 3.2
Fourth	5 17 29	6 41 30

Large cumulus clouds hanging over the face during the entire time. Eclipse only seen through rifts in the clouds. Above times not very exact, except the third contact.

A beautiful silvery corona could be seen around the edge and a few lines were seen to shoot out steadily to the NW., beaming steadily, not waving at all.

The planets Mercury and Mars were seen, and some stars were visible in the northwest.

[No further explanation accompanies Wilson's drawing, which is reproduced in Fig. No. 23.—C. A.]

(98.)

[Texas: Pilot Point.—Special report by E. F. Reeves, private, Signal Corps (O. C. S. O., 4291 Obs.).]

Signal Service station is 20 miles from the county court-house. Observed with S. S. field-glass; aperture, 2 inches; power, (28?). Washington noon signal received by observer's watch as follows:

Date.	Watch time.
27th	No signal.
28th	No signal.
29th	$10^h\ 40^m$ a. m.
30th	$10^h\ 45^m$ a. m.

[Probably on the 29th observer's watch correction on Washington time was $1^h\ 20^m$.—C. A.]

Observed the contacts as follows. The time was recorded by J. C. Newberry:

Contact.	Watch time.	Washington time.
	h. m. s.	*h. m. s.*
First	3 12 2	4 33 2
Second	4 17 48	5 37 48
Third	4 19 30	5 39 30
Fourth	5 18 18	6 38 18

[Duration of totality was therefore 1 min. 42 secs.—C. A.]

[A sketch of the corona is given in Private Reeves's report without further remark; it is reproduced in Fig. No. 25 of the accompanying collection of engravings.—C. A.]

(99.)

[Texas: Pilot Point.—Abstract of Journal for July, by E. F. Reeves, private, Signal Corps.]

Took full observations of solar eclipse; it was perfect throughout this place, being about centrally located.

	h.	m.	s.
First contact	3	12	2
Second contact	4	17	48
Third contact	4	19	30
Fourth contact	5	18	18

The corona was a light pale color. Cloudy at 9 a. m., and inappreciable rainfall, followed by clearing weather.

(100.)

[Texas: Terrell.—Special report by F. P. Cline (O. C. S. O., 3237 V. R.).]

Used Texas Pacific Railroad time, as given by Marshall regulator.
3.30 p. m. Clouds obscure the sun.
3.45 p. m. The moon has just entered the sun.
4.28.10 p. m. Totality begins.
4.30.24 p. m. First reappearance of the sun.

Duration of totality, $1^m 53^s$ [so given by F. P. Cline MSS., although these observations make it $2^m 14^s$.—C. A.].

Could see nothing of the corona, as the clouds were too heavy.

Thermometer fell from 100° at 2 p. m. to 83° just after totality.

One star visible 4½ solar radii northeast of the sun [need not reproduce the diagram.—C. A.].

(101.)

[Utah: Coalville, Summit County.—Special report by T. Bullock, Vol. Obs., Sig. Ser. (O. C. S. O., 3437 V. R.).]

1.42 p. m. Observed small nip on north limb of the sun.
2.17 p. m. Thermometer, 83°.
2.25 p. m. North half obscured.
2.35 p. m. Rays appear toward NE. and NW.
2.47 p. m. The atmosphere looks like sunset.
2.50 p. m. The sun looks like the moon when about two days old.
2.54 p. m. Four long rays of flame in opposite directions; very many small rays like a corona round it.
2.57 p. m. The sunlight on the west side. East side dark, very near total.
3.01½ p. m. The sun brighter in the northwest; the dark side on the south and east.
3.22½ p. m. The north half clear.
3.57 p. m. The eclipse finished.

[This station is 100 miles or more southwest of the limit of totality. Cannot this observation of the four coronal streamers and very many small rays be said to agree with the observations on Pike's Peak of the corona and rays visible for 260 seconds after third contact? Compare the reports from (No. 76) Clear Creek, Saunders County, Nebraska—C. A.]

(102.)

[Utah: Coalville.—Special report by Thos. Bullock (O. C. S. O., 4373, September 22, V. R.).]

In answer to yours, I inclose a faint sketch [No. 4 of the accompanying collection of engravings—C. A.] of the rays of the sun corona as seen by myself and others when nearest total eclipse on July 29.

As it requires a master's hand to imitate the beauty of a full-blown rose or a golden-banded lily, so it is utterly impossible for me to explain or describe the flickering, flaming streamers, as seen in the sketch herewith inclosed, or the gorgeous deep golden border of rays around the sun, continually changing or moving. All who were near me exclaimed "Oh, how beautiful; what a glorious sight!"

(103.)

[Washington Territory: Fort Walla Walla.—Meteorological record for July, by G. M. Sternberg, surgeon, U. S. A.]

Eclipse began at 12.50 p. m.
Eclipse ended at 3.20 p. m.

During the time the thermometer fell from 90° to 84°; eclipse nearly total, only the lower portion of the sun being visible at $2^h\ 10^m$.

Temperature.

	°
7 a. m.	72
2 p. m.	86
9 p. m.	78
Max.	92
Min.	64

(Clear, and light westerly wind.)

(104.)

[West Indies, Cuba: No. 2 Aguacate street, Havana.—Special report by Charles Hasselbrink, obs. Sig. Ser. (O. C. S. O., 4451 Obs.).]

Had an opera glass as his only optical aid. The following is a complete copy of this interesting report. [According to Mr. Hind's computation the sun would be about 15° high, and totality would last $1^m\ 53^s$ at Havana—C. A.]

§ I.

Original note written out at 7 p. m., July 29th:

	h.	*m.*	*s.*	
First contact	4	37	47	local time.
Second contact	5	35	57	
Third contact	5	37	51	
Fourth contact	6	30	15	

Duration of totality $1^m\ 54^s$.

CORONA.—Extension from sun from one and a half to two solar diameters.

COLOR.—Silver white (interior halo of regular circular form, very bright).

STRIÆ AND LINES.—Parting from edge of black disk of moon (most of them in straight, some in curved concentric lines).

SHAPE AS A WHOLE.—The accompanying sketch (No. 28) gives the general appearance, but the rays parting from the interior bright halo must be thought to be exceedingly light, not forming a dense mass, but a delicate translucent film, silver-white; unpolished silver.

RED PROMINENCES.—Nothing, absolutely nothing, seen or noted of this phenomenon; but the reappearance of true sunlight was preceded by a brilliant glowing spot (without radiation) of beautiful intensity, reminding one of that particular spark (French, *éclair;* German, *blick*) noted at the termination of gold and silver assays (by cupellation) at the bottom of cupel on the metallic button.

DARKNESS.—During totality the obscuration was very incomplete; it did not exceed a clear twilight, allowing to read distinctly seconds on watch without turning face to the light of the corona.

STARS, &C.—I had not any time to devote to stars, &c., and only noted a shooting star at about 7 inches from the sun, as measured on a rule held at 18 inches from the eye.* The approximate direction or bearing was as marked on the diagram.

§ II.

Additional remarks, written August 1.

The eclipse presented itself under the most favorable conditions for observation. The western sky clear, without a cloud; relative humidity, 66 per cent.

The director of the observatory of San Fernando, who had come from Cadiz with two Spanish naval officers, and other scientific commissions established at the port of Mariel (about 25 miles westward) and vicinity, all are reported to have been completely successful in their observations. These commissions are still absent; will return within a few days.

OBSERVED TIMES.—Two excellent watches (á seconde morte) gave the following times [as before given].

RED PROMINENCES.—Not trusting my own eyes (66 years old), I had with me my son and two of my sons-in-law, all three young men with excellent sight. Neither of them has seen anything of these appendices around the moon.

---

* This corresponds to an angular distance of 21°.2.—C. A.

STARS VISIBLE DURING TOTALITY.—Very few have been seen, owing to the incomplete darkness. For my part, I only caught a glimpse of two stars near the horizon, noting at the same time a shooting star. All my attention was directed to the corona, which I sketched during totality; and, simultaneously, to the search for the red protuberances or prominences, which I did not see. Might not that brilliant glowing spot preceding the reappearance of true sunlight (mentioned above in my original note) have been a fractional part of said prominences?

[Mr. Hasselbrink's sketch is carefully reproduced in Fig. 28 of the accompanying collection of engravings.—C. A.]

(105.)

[Cuba: Havana, No. 2 Aguacate street.—Special report by Chas. Hasselbrink, obs. Sig. Ser. (O. C. S. O., 5598 Obs.).]

In reply to yours of the 11th September, I have to state: First, my sketch of the corona represents it as seen by direct vision, only aided by an excellent opera-glass by Voigtlander & Son, of Vienna; second, the times of contact were observed in the same manner with superior time-pieces.

(106.)

[West Indies: Navassa Island.—Special report by ——, W. H. W. F. for the superintendent (O. C. S. O. 3445 V. R.).]

Total eclipse about 6 p. m.
Sun two-thirds covered at sunset.
Sky comparatively clear.

[NOTE.—The totality must have lasted about 1½ minutes, and the sun's altitude have been about 8° at Navassa at 6 p. m.—C. A.]

(107.)

[Wisconsin: Milwaukee.—Abstract Journal for July, by S. W. Rhode, sergeant, Signal Corps.]

Partial eclipse fully observed to-day at the astronomical observatory of the female college in this city. Good observations were made, as not a cloud obscured the sun.

The following times were computed [communicated?] by Professor Farrar, in charge of the observatory.

The chronometer was corrected by Washington time [noon-day signal].

	h.	m.	s.	
First contact at	3	39	35.5	
Last contact at	5	37	11.5	actual local time.
Making total duration of eclipse	1	57	36	or nearly two seconds less than the time predicted for this locality.

The mountains on the moon were plainly discernible during its passage across the sun's disk. No spots on the sun were visible.

NOTE.—In a letter of November 19, 1880 (O. C. S. O. 2436, Misc. 1880), Prof. C. S. Farrar states: "I corrected our chronometer for the occasion by telegraphic report from the observatory at Chicago. The observation was made by Professor Luther, of Racine College, Professor Markham, of this city, and myself. The dome having been successfully darkened, the whole phenomenon was projected on a screen; the diameter chosen for the disk was three feet, and the disk was remarkably well defined. We three were within one second of agreement as to the moment of first contact. We have not determined the exact position of our observatory, but intend to do so soon."

(108.)

[Wyoming Territory: Camp No. 4.—Geological and Geographical Survey (O. C. S. O. 1951, Misc. 1880).]

Observations were made at Camp No. 4, Little Sandy, in western part of Wyoming Territory, by observers of the United States Geological and Geographical Survey of the Territories; communicated by Dr. F. V. Hayden, director of the survey, and Dr. Elliott Coues, secretary in charge, September, 1880.

Observer.	Instruments.	Observed durations of totality.
		m. s.
A. D. Wilson	Telescope, large theodolite	2 27.5
James Eccles	Smoked glass only	2 26
W. H. Holmes	Telescope of small theodolite and smoked glass	2 27

The telescope of the large theodolite, focal length of about 24 inches; aperture, 1.5 inches; power, 90; field 1°.

The telescope of the small theodolite, focal length of about 20 inches; aperture, 1.2 inches; power, 50?; field 1°.5.

The location of the station Camp No. 4 is approximately—

Latitude north	42° 8′ 25″
Longitude west	109° 9′ 52″
Altitude	7,300 feet

Mr. W. H. Holmes also made a small sketch in water-colors, which is reproduced as sketch No. 6, of the accompanying collection of engravings, and in reference to which he has given the following note:

The sketch presents the appearance of the corona as seen through the small theodolite (field, 1°.5; power, 50?); smoked glass was placed in front of the object glass when observing contacts, but not when observing the corona. The sun was surrounded by minute pencils of light that played rapidly to the left and right, disappearing and reappearing; these pencils of light were very minute and quite brilliantly colored with all the colors of the spectrum. The groups of rays, as at B and C, were not constant in length and conspicuousness, but were so in position; these rays were parallel or very slightly inclined.

At A, B, and C the sketch represents the rays and colors very nearly as seen; the rest of the sketch is approximate, but gives the correct effect. The length of the rays at B was about three-fourths the solar diameter. No red protuberances or mounds, and no sudden shades of light were noticed.

CHAPTER IV.

GENERAL RESULTS.

A.—Condition of the weather.
B.—Observations of contacts.
C.—Observations of duration of totality.
D.—Geographical positions of stations.
E.—Temperature changes during the eclipse.
F.—Observations of shadow bands and fringes.
G.—Observations and sketches of the corona.
H.—Brightness of the corona.

INTRODUCTORY.

It is not designed in the present work to do much more than to merely present a collation of the observations upon such of the phenomena and features of the eclipse as have excited especial interest. After the completion of the manuscript of this chapter, I, on November 11, 1880, for the first time, had opportunity to examine fully the great work of A. C. Ranyard, published a few months before as vol. xli of the Memoirs of the Royal Astronomical Society of London, under the modest title of *Observations made during Solar Eclipses*, and in which the learned author has brought together and analyzed all the observations of any value that had been made before 1878. The reader may therefore now refer at once to Ranyard's volume instead of having to search laboriously for such earlier observations and explanations as he may need for study and comparison with the results of the observations of the eclipse of 1878, as detailed in the preceding and present chapters.

A.

CONDITION OF THE WEATHER.

A general account is given in Chapter I of the studies made preparatory to the eclipse, in order to determine approximately what locality, if any, might be expected to offer fair prospects of good observing weather, and the percentages of favorable chances are given in detail in Document I, Chapter I.

It will be interesting to compare, in a general way, the agreement of these predictions with the weather actually experienced on July 29.

The accompanying map, showing the path of the eclipse and the locations of the seventy stations whose reports are published in Chapters II and III, also shows the wind and weather reports made simultaneously throughout the country at 4.35 p. m., Washington time, July 29; and which, therefore, very fairly represent the weather prevailing during the eclipse, since totality occurred at 4^h 50^m, Washington time, in British Columbia, and ended about 6 p. m., Washington time, in the West Indies.

In order to reduce to percentages and compare the predictions with the actual weather, the following table was compiled, which relates, however, strictly to the path of totality:

Weather within the path of totality.

State or Territory.	Number of stations within totality.	Number of months examined.	Predicted percentage of favorable chances.	Actual percentage of area favorable to observation.
Washington Territory	1	8	81	100
Montana	4	19	80	80
Wyoming	4	29	81	75
Colorado	16	55	67	100
Indian Territory	2	10	87	50
Texas	7	24	87	50
Average	....	....	80	76

The second, third, and fourth columns give the average data from the table in Chapter I, Document I, for stations within the path of totality; the fifth column gives the estimated average area of the favorable weather actually experienced within that State on July 29.

The small percentage expected for Colorado is due to the fact that in that State in July and August the afternoon hours are those in which cumulus clouds and light rains occur. The unexpectedly favorable weather that was actually experienced seems to have been due to the advance southward of an extensive area of cool dry air, which, however, had not extended so far as to prevail throughout Texas, in the greater part of which State the weather was unfavorable.

The general average of the figures in the last two columns of the preceding table shows that taking the whole path of totality in one comprehensive view we should have expected 80 per cent. of its area to have been favorable for the observations of the sun, whereas the percentage actually experienced was 76. Texas and Indian Territory fell below, while Colorado surpassed all anticipations, a change that was eminently favorable to astronomical progress.

B.

OBSERVATIONS OF CONTACTS.

As far as possible, the observed times of contacts, given in Chapter III, have been corrected for errors of watches, and the resulting Washington times are given in the following table.

Those observers have been omitted from this table for whose observations we have no means of reducing the observed watch time to Washington mean time, but these latter observations are utilized in section C in compiling the table of observed durations.

Washington times of observed contacts.

Report No.	Station.	Observer.	Instrument.	First.			Second.			Third.			Fourth.			Remarks.
				h.	*m.*	*s.*	*h.*	*m.*	*s.*	*h.*	*m.*	*s.*	*h.*	*m.*	*s.*	
28i	Pike's Peak Summit	S. P. Langley	5-inch equatorial	5	14	14.5										Estimated to be 5 seconds too late.
42	Colorado Springs	J. H. Kerr	2-inch glass	4	14	33.6							6	27	29.0	First contact may be 1 minute too late.
42	do	F. H. Loud	Naked eye				5	22	47.7	5	25	27.7				
47	Denver	Mr. Ainsworth	Transit telescope	4	11	48	5	20	54	5	23	53	6	26	29	Third contact may be 5 seconds too late.
50	Kit Carson	O. Branham	Naked eye	4	13	48 ?	5	27	0	5	27	3	6	29	48	Correction of watch very uncertain.
51	South Pueblo	E. S. Nettleton	Small telescope	4	12	32	5	21	27	5	24	0	6	27	8	
60	Fort Sill	John M'Cann	2-inch S. S. glass	4	26	9.3	5	31	31.7	5	33	59.7	6	34	14.1	
72$_1$	Virginia City	A. B. Knight	2-inch S. S. glass	3	53	41	5	4	28	5	7	28	6	13	18	
72$_2$	do	D. W. Tilton	Field glass	3	52	56	5	4	35	5	7	33	6	11	44	
72$_3$	do	R. B. Wassel	2-inch S. S. glass	3	53	42	5	4	30	5	7	30	6	13	24	
72$_4$	do	H. Schmallhausen	Field glass	3	57	5	5	5	45	5	8	41	6	12	10	
85	Austin	D. W. C. Baker	Field glass	4	33	45							6	42	—	
88	Corsicana	I. W. Smith	S. S. telescope				5	39	48	5	42	19	6	40	52	First contact lost in clouds; fourth contact unsatisfactory.
90	Decatur	E. E. Garver	S. S. glass and naked eye.	4	30	57	5	36	20	5	39	49	6	37	51	Apparently an error of 1 minute in second or third contact.
93	Graham	E. T. Hilliard	Small telescope	4	31	14	5	37	20	5	39	20	6	37	59	First contact doubtful, 5 seconds, and fourth contact 10 seconds.
96	Henrietta	J. J. Mullen	Naked eye	4	25	36	5	34	52	5	37	29	6	36	28	
97	Jacksboro	P. M. Wilson		4	37	2				5	37	3.2	6	41	30	Eclipse observed through rifts in clouds. First and fourth contact not exact.
98	Pilot Point	E. F. Reeves	2-inch S. S. telescope	4	33	2	5	37	48	5	39	30	6	38	18	Observed at the Observatory of the Female College.
107	Milwaukee	C. S. Farrar			(*)									(*)		

(* See the approximate location given in Chapter IV, § D.)

C.

OBSERVATIONS OF DURATION OF TOTALITY.

The following table compiled from Chapter III gives all the individual observations of duration of totality that have been reported. To a certain extent some of these may contribute to the exact location of the limits of the path of totality, and by so much contribute to increase the accuracy of astronomical tables, but as a general rule these figures are liable to all the uncertainties that attend observations made by persons inexperienced in the use of astronomical instruments:

Duration of totality.

Report No.	Station.	Observer.	Duration. s.	Instrument.
18	Pike's Peak Summit	S. P. Langley	178?	5-inch equatorial.
20	do	do	158	do.
42	Colorado Springs	F. H. Loud	160	Naked eye.
42	do	J. H. Kerr	160	2-inch telescope.
42	do	A. H. Wright	161	Naked eye.
42	do	L. Kimball	162	Naked eye.
42	Manitou	W. W. Nichols	165	Field glass.
42	Lake House	P. Curtis	161.7	Naked eye.
42	Four Mile	M. Wiley	75	Naked eye.
42	Monument	E. P. Beecher	164	Naked eye.
47	Denver	Mr. Ainsworth	179	Small telescope; may be 5 sec. too much.
49	Kit Carson	O. Branham	3	Naked eye.
51	South Pueblo	E. S. Nettleton	153	Small telescope.
60	Fort Sill	John M'Cann	148	2-inch telescope.
68	Lake Charles	W. Meyer	220 160	Naked eye.
72	Virginia City (1)	A. B. Knight	180	2-inch telescope.
72	Virginia City (2)	D. W. Tilton	178	Field glass.
72	Virginia City (3)	R. B. Wassel	180	2-inch telescope.
72	Virginia City (4)	H. Schmallhausen	176	Field glass.
72	Virginia City (4)	W. H. Buttermore	181 179	Naked eye.
72	Virginia City, Old Baldy (5)	H. N. Blake	170	Field glass.
87	Belmont Farm	T. M. Scott	160	Naked eye.
88	Corsicana	I. W. Smith	151	2 inch S. S. telescope.
90	Decatur	W. E. Garver	209 149	S. S. glass and naked eye.
93	Graham	E. T. Hilliard	120	Small telescope.
95	do	F. L. Caldwell	120	Naked eye.
95	8 miles northwest of Graham	Unknown	120	Naked eye.
96	Henrietta	J. J. Mullen	157	Naked eye.
96	do	M. Harrold	150	Naked eye.
98	Pilot Point	E. F. Reeves	102	2-inch S. S. telescope.
100	Terrell	F. P. Cline	134 113	Naked eye?
104	Havana	Chas. Hasselbrink	114	Field glass.
106	Navassa	W. H. W. J	*	Unknown.
108	Camp No. 4	A. D. Wilson	147.5	1.5-inch telescope.
108	do	James Eccles	146	Naked eye.
108	do	W. H. Holmes	147	1.2-inch telescope.

* At sunset the sun was two-thirds covered; totality occurred about 6 p. m. local time or 5^h 52 Washington time.

D.

GEOGRAPHICAL POSITIONS.

It will be found convenient for reference to have the latitudes and longitudes of all the stations occupied by the observers collected together as in the following table, where the stations are arranged by States, with the references to the original documents published in Chapters II and III.

For the majority of these stations the locations are but approximate and the authorities are given in the last column, so that any systematic corrections can be hereafter applied. When the location is from a map or chart on which is given the position of some neighboring astronomical station, the location of the latter is also given, since it is presumed that upon it depends the adopted charting of the surrounding region.

Among the authorities most frequently quoted in this table are the following, viz:

COAST SURVEY. Annual reports of the Superintendent of the United States Coast Survey.

LIGHT-HOUSE LIST. List of light-houses, &c., corrected to January 1, 1879. Washington, 1879.

WHEELER'S SURVEY. United States Geographical Surveys west of 100th meridian; Lieut. G. M. Wheeler, Corps of Engineers, in charge. Annual reports in the Annual Report of the Chief of Engineers, 1869–1879.

RUFFNER'S SURVEY. Explorations and surveys in the Department of the Missouri; Lieut. E. H. Ruffner, Corps of Engineers, in charge. Annual reports in the Annual Report of the Chief of Engineers.

GREGORY'S SURVEY. Explorations and surveys Military Division of the Missouri; Capt. James F. Gregory, Corps of Engineers, in charge. Annual reports in the Annual Report of the Chief of Engineers.

ENGINEER'S MAP, 1879. Map of Territory west of the Mississippi; compiled in the office of the Chief of Engineers. Washington, 1879.

HAYDEN'S SURVEYS. United States Geological and Geographical Survey of the Territories, under the Interior Department, 1868–1879; F. V. Hayden in charge. Also the Atlas of Colorado, 1878, included in the publications of that office.

Of course the positions read off from maps refer to the centers of the circles that are given thereon as the locations of towns. In general we have no data that will enable us to refer to the exact locations of the observers who may have been 5 or 10 miles distant from such centers.

The altitudes are frequently given from miscellaneous sources, but generally depend on those adopted by Gardner or Wheeler or by the Signal Service.

Geographical positions of stations.

State and locality.	Latitude.		Longitude west from Greenwich.		Altitude, feet.	Authority.
ARIZONA.	°	′	°	′		
Camp Grant	32	36.9	110	56.4	4,833	Latitude by sextant, Wheeler's survey, 1873. Longitude, map Engineers, 1879.
Camp Verde	34	34.3	111	53	3,160	Latitude by sextant, Wheeler's survey, 1871. Longitude, approximate, 1871.
Yuma	32	42.2	114	36.9	....	Engineers' map, 1879.
BRITISH COLUMBIA.						
New Westminster	49	13.6	122	53.3	....	Engineers' map, 1879.
Fort Langley	49	11.2	122	33.7	....	Do.
CALIFORNIA.						
Campo	32	36.2	116	24.1	....	Engineers' map, 1879.
Los Angeles	34	3.6	118	12.8	....	Rendezvous camp, Wheeler's survey, 1875.
Oakland	37	48.3	122	15.3	24	Communicated by the observer, Dr. J. B. Trembley, probably from Coast Survey maps.
Princeton	39	25.3	122	2.1	140	Engineers' map, 1879.
Red Bluff	40	10.6	122	12.0	....	Do.
Sacramento	38	35.2	121	30.0	....	Do.
Salinas	36	39.6	121	37.6	49	Do.
San Gorgonio	33	56.6	116	58.7	4,000	Do.
Santa Cruz	36	56.9	122	1.6	....	Light-house at entrance to Harbor. (See Coast Survey Rep., 1868, p, 234.)
COLORADO.						
Colorado Springs (1)	38	50.5	104	49.5	6,038	Communicated by Prof. F. H. Loud, depend on the astronomical station occupied by G. W. Dean, of the Coast Survey, 1873.
Colorado Springs (2), Manitou.	38	51.8	104	54.7	6,300	
Colorado Springs (3), Lake House.	38	49.5	105	0.4	10,230	
Colorado Springs (4), Four mile.	38	49.6	105	15	....	
Colorado Springs (5), Monument,	39	5.6	104	49	7,000?	
Colorado Springs (6)	38	48	104	49	....	
Pike's Peak Summit	38	50.5	105	2.4	14,147	Hayden's surveys, 1873.
Denver (Ainsworth)	39	46.0	104	59.6	5,300	Communicated by the observers and depend on Dean's Coast Survey station, 1873.
(C. A. Young)	39	43.4	104	58.1	5,400	

Geographical positions of stations—Continued.

State and locality.	Latitude.		Longitude west from Greenwich.		Altitude, feet.	Authority.
COLORADO—Continued.	°	′	°	′		
Kit Carson	38	45.2	102	46.7	4,300	Engineers' map, 1879.
South Pueblo	38	15.7	104	37.0	4,732	Wheeler's surveys, 1873.
Summit District:						
1) Little Annie	37	26	106	36	11,260	Hayden's triangulations and observers' references.
2) South mountain	37	27	106	36	12,500	
3) Summit	37	27	100	36	12,748	Hayden's survey. Wilson's triangulation communicated by the observer in 1877, 1878.
4) Belleview	37	27	106	35.8	12,673	Wheeler's surveys, chart 61 D.
DAKOTA.						
Bismarck	46	58.2	100	46.9	....	Lake Survey, Safford's pier, 1873.
Fort Abraham Lincoln	46	46.2	100	50.9	2,211	Ludlow's surveys, 1874.
FLORIDA.						
Key West	24	33.0	81	48.1	....	Harbor light-house, southern edge of town, U. S. Coast Survey.
INDIANA.						
Indianapolis	39	45.1	86	8.5	....	Engineers' map, 1879.
Vevay	38	46	84	59.3	525	Communicated by the observer, C. J. Boerner.
....	38	44.6	85	4.6	....	Engineers' map, 1879.
INDIAN TERRITORY.						
Fort Sill	34	39.5	98	22.7	....	Engineers' map, 1879.
IOWA.						
Boonesboro	42	4.7	93	53.4	....	Engineers' map, 1879.
KANSAS.						
Dodge City	37	45.8	99	59.0	....	Engineers' map, 1879.
Empire City	37	6.1	84	37.1	....	Nicholson Post-route map of Kansas, 1879, allowing 77° 0′ for longitude of "Capitol."
Leavenworth	39	19.0	94	56.8	813	Signal Office and Engineers' map, 1879.
Fort Leavenworth	....		94	54.8	....	Ruffner's observatory of 1871. (See Report Chief Engineers, 1872, p. 1118.
Fort Leavenworth	39	21.7	94	56.8	....	Engineers' map, 1879.
KENTUCKY.						
Louisville	38	14.7	85	44.4	530	Engineers' map, 1879.
LOUISIANA.						
Lake Charles	30	12.2	93	6.4	....	Engineers' map, 1879.
MICHIGAN.						
Detroit	42	21.2	83	3.0	....	Latitude from Engineers' map, 1879; longitude of new Lake Survey observatory. Report Chief Engineers, 1871, p. 1014, &c.; 1872, p. 1052, &c.
MISSOURI.						
Frankford	39	11.6	91	2.4	....	Engineers' map, 1879.
MONTANA.						
Bozeman	45	40.9	111	2.6	4,839	Wheeler's survey, astronomical station, 1873. (See W. G. S. Reports, vol. ii, p. 488.
Fort Ellis	45	40.2	110	58.5	4,747	Wheeler's survey, Flag staff, 1877.
Fort Ellis	45	40.1	110	59.8	4,878	Geodetic connection with Bozeman, 1873. W. G. S. Reports, vol. ii, 491.
Old Baldy	45	13	111	50		
Virginia City	45	19.3	111	56.5	....	Hayden's survey; Gannett's report. (Ann. Rep. Hayden's survey for 1872.)

Geographical positions of stations—Continued.

State and locality.	Latitude.	Longitude west from Greenwich.	Altitude, feet.	Authority.
NEBRASKA.	° ′	° ′		
Clear Creek	41 13	96 24	1,200	Communicated by the observer.
Emerson	40 40	96 10	1,300	Do.
Howard	40 28	96 0	....	Do.
North Platte	41 8.3	100 46.8	2,838	Engineers' map, 1870. Altitude by the Signal Office.
NEVADA.				
Winnemucca	40 58.3	117 43.9	4,355	Wheeler's survey, astronomical monument, 1873.
NEW HAMPSHIRE.				
Auburn	42 59	71 28	332	Communicated by the observer.
NEW MEXICO.				
Fort Bayard	32 47.7	108 9.1	6,097	Wheeler's survey, astron. monument. Report Chief Engineers, 1879, p. 2,059.
Silver City	32 43	108 15	....	
OREGON.				
Portland	45 31.0	122 41.0	97	Engineers' map, 1879.
The Dalles	45 36.3	121 12.3	180	Wheeler's survey, astron. station, 1878.
The Dalles	45 35.3	121 15.6	....	Engineers' map, 1879.
Umatilla	45 54.0	119 16.3	....	Engineers' map, 1879.
TEXAS.				
Austin	30 16.4	97 44.1	....	Engineers' map, 1879.
Belmont Farm	33 8	96 31	722	Communicated by the observer.
Melissa	33 17.6	96 36.3	....	Engineers' map, 1879.
Corsicana	32 6.3	96 26.3	....	Do.
Decatur	33 12.2	97 35.1	....	Do.
Denison	33 48.5	96 31.8	....	Do.
Galveston	29 18.3	94 57.2	....	Do.
Graham	33 16.4	98 39.3	....	Do.
Henrietta	33 44.9	98 10.0	....	Do.
Jacksboro	33 12.1	98 9.8	....	Do.
Fort Richardson	....	98 9.7	....	Lake Survey, Report Chief Engineers, 1877, p. 1132, &c.
Pilot Point	33 36.8	97 0.0	....	Engineers' map, 1879.
Terrel	32 47.8	96 16.4	....	Do.
UTAH.				
Coalville	40 54.5	111 26.0	....	Center of town; communicated by Wheeler's survey.
Coalville	40 53.5	111 25	5,630	Observer's station from data communicated by him.
WASHINGTON TERRITORY.				
New Fort Walla Walla	46 5	118 20	....	Engineers' map, 1879.
New Fort Walla Walla	46 3.9	118 20.8	1,034	Wheeler's survey, astron. station, 1878.
Old Fort Walla Walla	46 4.7	118 54.9	....	Engineers' map, 1879.
WEST INDIES.				
Havana	23 9.4	82 21.5	....	Lieut. F. M. Greene, U. S. N., Morro Light-house.
Navassa	18 25	75 0	....	Colton's Atlas
WISCONSIN.				
Milwaukee	43 2.4	87 54.1	....	Engineers' map, 1879.
WYOMING TERRITORY.				
Camp No. 4	42 8.4	109 9.9	7,300	Hayden's surveys, 1878. Approximate location communicated by A. D. Wilson.

While the locations given in the preceding table may be accurate enough for most purposes, yet it may at some time become desirable to know something of the authority upon which the longitudes and latitudes rest, and therefore the following additional information has been compiled from which, indeed, corrections proper to be applied to the preceding figures may in some cases be deduced, as the latter were only provisionally adopted in compiling the map of stations and weather.

The elaborate maps published independently by the War Department, "Geographical surveys west of the 100th meridian," Lieut. Geo. M. Wheeler, Engineer Corps, in charge; and by the Interior Department, "Geological and Geographical Survey of the Territories," Dr. F. V. Hayden, geologist, in charge, have afforded the means of locating points west of the Mississippi with accuracy sufficient for most purposes, but the references to original results of geodetic and astronomical work as given in the following pages, will afford a basis of judgment as to the perfect accuracy of the results.

The system of telegraphic longitudes which has since 1846 been extended throughout the United States by the joint labors of the Coast Survey, Naval Observatory, and Army Engineers, is now satisfactorily connected with Greenwich and Europe. The longitude of Washington from Greenwich generally adopted during the years 1872 to 1877, was $5^h\ 8^m\ 12^s.12 = 77^\circ\ 3'\ 1''.80$; see "Astronomical and Meteorological Observations, U. S. Naval Observatory, 1871, Introduction, page xvi, dated October 6, 1871, by Rear-Admiral B. F. Sands, Superintendent." See also "American Nautical Almanac and Astronomical Ephemeris" for the years 1875–1880. This value seems to have been received by the Navy Department as a preliminary result of the work of the Coast Survey, and as this value has been generally quoted in the reports of the surveys of Wheeler, Hayden, &c., it has been uniformly retained in this present chapter, although the more recent investigations of the Coast Survey have suggested slight corrections, and have given as final $5^h\ 8^m\ 12^s.09$, which is now also adopted by the Naval Observatory and the Nautical Almanac Office. The authority for this latter value will be found in Coast Survey Report for 1872, appendix No. 13, "Preliminary Report on the determination of Transatlantic Longitudes, by J. E. Hilgard, Assistant, Washington, 1875," an early copy of which paper was read in August, 1873, and appears at page 144, XXIInd meeting, Portland, 1873, of the Proceedings of the American Association for the Advancement of Science. This preliminary report was followed by a "Final report on the determination of 1872, with a review of previous determinations, by J. E. Hilgard," published as appendix 18, Coast Survey Report, 1874, pp. 163–242, Washington, 1877, in which the following results are given on pages 181 and 182, as subject to but very slight uncertainty or probable further change, and as entirely corroborating the figures just quoted from the preliminary report.

	West of Greenwich.
Cambridge, Harvard College Observatory dome, west of Greenwich	$4^h\ 44^m\ 30^s.98$
Washington Observatory dome, west of Cambridge, 0 23 41.11	5 8 12.09

The details of the astronomical work and results of the surveys of the Engineer Corps, and especially those under Lieut. Geo. M. Wheeler, will be found principally in the following places:

1. Annual reports of the Chief of Engineers, U. S. A., 1868 to date, 8vo.
2. Geographical surveys, &c., with atlas, Lieut. Geo. M. Wheeler in charge, vol. II., 4to., 1877.
3. Report on the determination of the astronomical co-ordinates of the primary stations in 1872 and 1873, Washington, 1874.

The results of the geodetic work of the surveys of the Interior Department, especially those of the geological surveys under Dr. Hayden, will be found in the annual report of the U. S. geologist, and of the "Geologist in charge of Surveys of the Territories," in the "Atlas of Colorado," and in the "Bulletin of the Geological Surveys under the Interior Department."

Special longitude results are also published in the annual reports of the Superintendents of the Coast Survey and of the Naval Observatory.

These longitudes in many cases demand a revision and correction for "personal equation," the correction for which has sometimes been neglected even when it was believed to amount to $0^s.2 = 3''.0$, as the elimination of this source of error by means of the interchange of observers has apparently not always been practicable in the field operations of the longitude campaigns.

COLORADO.

Colorado Springs.—A point in this city was occupied in 1873 by G. W. Dean, Assistant U. S. Coast Survey, and its position determined as follows:

Colorado Springs, Dean's Pier, 1873:

	° ′ ″
Latitude	38 50 0.3
Longitude	104 49 7.6
Altitude	5,990 feet.

This determination of longitude depends upon that assumed for Omaha, Neb., but the details of the work have not yet been published, so far as I know (see Coast Survey reports 1873, page 44, and 1874, page 64). The above latitude and longitude have been adopted as a "primary standard" in the surveys under Dr. F. V. Hayden (see Gardner's report on geodesy, 1873, and Wilson's report on geodesy, &c., 1877, in Hayden's bulletins of surveys, &c.). The positions of the eight points occupied by Prof. F. H. Loud and his assistants have been by him carefully referred to Hayden's primary standard with results as before given.

Another point in Colorado Springs, occupied also in 1873 by Dr. F. H. Kampf, astronomer to Lieut. Geo. M. Wheeler's surveys west of the 100th meridian, was by him determined as follows (see pages 69 and 79 of Kampf and Clark's reports on primary astronomical determinations in 1874):

Colorado Springs, Kampf's Pier, 1873:

	° ′ ″
Latitude	38 49 41.67
Longitude	104 49 15.10
Altitude	6,009.7 feet.

The several steps in this latter determination of longitude appear to be as follows:

		West of Greenwich.
	h. m. s.	h. m. s.
Washington Naval Observatory, west of Greenwich		5 8 12.12
Salt Lake City, Mormon Observatory, west of Washington (see below under UTAH)	2 19 22.74	7 27 34.86
Colorado Springs, Kampf's Pier, east of Salt Lake City (see Kampf's report, pp. 69 and 79)	0 28 17.852	6 59 17.008

The location of Kampf's Pier was about 650 feet distant from the freight depot of the Denver and Rio Grande Railroad and is marked by a permanent monument.

DENVER.—A point in this city was occupied in 1873 by G. W. Dean, of the U. S. Coast Survey, who determined his position to be as follows:

Dean's Pier, at Denver:	° ′ ″
Latitude	39 45 21.8
Longitude	104 59 33.5
Altitude	5,240 feet.

He also determined by geodetic connection the following:

Cupola of the Denver High School:	° ′ ″
Latitude	39 45 0.7
Longitude	104 59 33.5

The details of this work have not yet been published, so far as I know. Approximate locations are given on page 64 of the Coast Survey report for 1874. The preceding figures are given as adopted by Gardner in the geodetic work of the surveys under Dr. Hayden.

A point in Denver was occupied in 1872 by Professor T. H. Safford, in connection with Lieutenant Ruffner's surveys and explorations in the department of the Missouri. (See report of Chief of Engineers, 1873, page 1240.) He determined the location of his observing pier as follows:

Safford's pier, near the Denver and Rio Grande Railroad depot:	° ′ ″
Latitude	39 45 21.68
Longitude	104 59 35.05

By geodetic connection he also determined the following:

Flag-staff U. S. Branch Mint:	° ′ ″
Latitude	39 45 1.8
Longitude	104 59 41.55

The eclipse observer, Mr. Ainsworth, seems to have been located about 21″.9 south and 0″.0 east of Safford's pier, whence

Mr. Ainsworth's location, July 29:	° ′ ″
Latitude	39 44 59.8
Longitude	104 59 35.0

The details of the steps in the above longitude for Safford's pier may be gathered from the reports of the Chief of Engineers, as follows:

		West of Greenwich.
	h. m. s.	h. m. s.
Washington Naval Observatory dome, west of Greenwich (Washington Naval Observatory, observations 1871)		5 8 12.12
New Lake Survey Observatory at Detroit, east transit pier, west of Washington Naval Observatory dome (report Chief of Engineers, 1871, p. 1017; 1872, p. 1053)	0 24 0.12	5 32 12.24
Ruffner's Observatory at Fort Leavenworth, west of Lake Survey Observatory at Detroit (report Chief of Engineers, 1872, p. 1118)	0 47 27.11	6 19 39.35
Safford's Pier at Denver, west of observatory at Fort Leavenworth, by direct and indirect determinations (report Chief of Engineers, 1873, p. 1241)	0 40 18.99	6 59 58.34

FOUR-MILE.—The position of the observer at this station was, according to Professor Loud's report, eleven miles west by north from Pike's Peak, and the corresponding latitude and longitude would be 38° 49′.6 north, 105° 15′ west, as already given. This, however, also corresponds nearly with "Riggs' Ranche," as laid down on Hayden's Atlas of Colorado, and whose position as read off therefrom is 38° 48′.8 north, 105° 14′.6 west.

MONUMENT.—If the observer was stationed at Monument City, then the position of this place as read off from Hayden's Atlas would be required; this is:

Monument City:

	° ′
Latitude	39 5.5
Longitude	104 51.81
Altitude	6,356 feet.

The altitude here given is that ascribed by Gardner to the track at the railroad station.

The eclipse observer is said to have been three miles east of Monument, or in longitude 104° 48′.4.

One of Gardner's geodetic monuments or triangulation stations is laid down on Hayden's Atlas as about four miles southeast of Monument City, and may have been introduced by Professor Loud under the title Monument.

PIKE'S PEAK SUMMIT.—The primary triangulation monument, a pile of stones erected by Gardner in 1873, on the summit of Pike's Peak, was by him determined geodetically as follows:

Pike's Peak Summit, Gardner's monument:

	° ′ ″
Latitude	38 50 27.3
Longitude	105 2 25.6
Altitude	14,147 feet.

This rests on triangulation to Denver and Colorado Springs, and therefore, I presume, on the astronomical positions of these stations as determined by the Coast Survey and adopted by Hayden's survey.

The northwest corner of the Signal Service station was by him determined to be 169 feet north 53¾° west of this monument, or

Pike's Peak Summit, Signal Service station:

	° ′ ″
Latitude	38 50 28.1
Longitude	105 2 26.9

The equatorial telescopes of Professors Abbe and Langley were stationed about 50 feet north of this northwest corner, or as follows:

Pike's Peak Summit, eclipse equatorial:

	° ′ ″
Latitude	38 50 28.5
Longitude	105 2 27.0

Pike's Peak Summit was also occupied by Lieutenant Bergland, of Wheeler's survey, as a triangulation station in 1874, and the resulting position is given as:

Pike's Peak Summit, geodetic station:

	° ′ ″
Latitude	38 50 23.25
Longitude	105 2 24.66

It appears probable that the point to which this determination refers is identical with the monument called Gardner's monument in the preceding part of this report.

SOUTH PUEBLO.—Stations in either South or North Pueblo have been occupied by Ruffner's, Wheeler's, and Hayden's explorations respectively; these towns are separated by the Arkansas River. The location given in Hayden's Bulletin, vol. iii, p. 714, is:

Hayden's survey, geodetic station:

	°	′	″
Latitude	38	16	36
Longitude	104	33	38
Altitude	4,713 feet.		

It is believed that this station was in North Pueblo.

The locations determined by the surveys of the Army Engineer corps are as follows:

				West of Greenwich.		
	h.	m.	s.	h.	m.	s.
Lake Survey Observatory, Detroit, west of Washington	0	24	0.12	5	32	12.24
Ruffner's Observatory, Fort Leavenworth, west of Detroit	0	47	27.11	6	19	39.35
Safford's Pier, at Denver, west of Ruffner's, Fort Leavenworth (September and October, 1872. See Report Chief Engineer, 1873, p. 1241)	0	40	18.99	6	59	58.34
Ruffner's Pier, at South Pueblo, east of Safford's, at Denver (September, 1872. See Report Chief Engineer, 1873, p. 1249)	0	1	31.23	6	58	27.11
Indirect determinations via Denver and direct from Fort Leavenworth, southeast corner of Denver and Rio Grande Railroad depot				6	58	27.16

The latitude of the post occupied by Ruffner in 1872 was determined by Lieut. G. M. Wheeler in 1874 after rebuilding it (see Report of Chief of Engineers, 1875, p. 928), as follows:

Latitude of Ruffner's post, South Pueblo .... 38° 15′ 42″.84

Lieutenant Wheeler also at the same time made a new determination of the longitude by means of a geodetic connection with the primary astronomical stations at Labran, Colorado Springs, and Trinidad, Colo., which in turn depend on the longitude adopted for Salt Lake City. The various steps in the work are apparently as follows:

				West of Greenwich.		
	h.	m.	s.	h.	m.	s.
Salt Lake City Observatory, in Mormon Temple Square, west of Washington, as determined by the United States Coast Survey (see Coast Survey Report, 1874, p. 64, and Wheeler's Reports, vol. ii, pp. 4–55)	2	19	22.740	7	27	34.860
Labran Station, east of Salt Lake City (Wheeler's Reports, vol. ii, p. 279)	0	27	9.675	7	0	25.185
Colorado Springs Station, east of Salt Lake City (Wheeler's Astronomical Co-ordinates, 1872–'73, p. 69.)	0	28	17.852	6	59	17.008
Trinidad Station, east of Salt Lake City (Wheeler's Reports, vol. ii, p. 303)	0	29	34.765	6	58	0.095
South Pueblo, Ruffner's Pier, by geodetic connection with the preceding (Report Chief of Engineers, 1875, p. 928) three stations				6	58	27.83

The location of the station occupied by the eclipse observer, Mr. E. S. Nettleton, was by him reported to be 4″.9 south and 5″.4=0s.36 west of Ruffner's monument, or

E. S. Nettleton, eclipse station, South Pueblo:

	°	′	″
Latitude	38	15	37.9
Longitude	104	37	2.9

Mr. Nettleton also states that the barometer used in his regular meteorological observations is elevated as follows (O. C. S. O. 5139 V. R. 1877):

	Feet.
Barometer above ground	3
Ground above railroad track at South Pueblo, depot of Denver and Rio Grande Railroad	74
The track according to Gannett is above sea-level	4,676
Barometer above sea-level	4,753

The barometer is also stated to be 460 feet, bearing south 40½° west from Ruffner's monument of 1874; therefore, probably the elevation of 4,753 is nearly that belonging also to his eclipse station.

SUMMIT PEAK.—The observer, C. E. Robins, wrote, in 1877, as follows (O. C. S. O. 5391 V. R. 1877): "The station for meteorological observations, or Little Annie Mine, is 20 miles SSW. in a direct line from Del Norte, latitude 37° 28′ 18″, longitude 106° 30′, as determined in the official survey for the patent of the Little Annie Mine; the altitude is 11,000 feet." Hayden's Atlas of Colorado, Washington, 1877, places Summit district, which apparently coincides with Little Annie Mine, in latitude 37° 26′, longitude 106° 36′, altitude 11,300 feet—which I therefore conclude to be the meteorological station.

The eclipse was observed from three stations in this neighborhood, *i. e.:*

(1) "Little Annie Mill, altitude 11,260," "located midway between Stations No. 2 and 3." This would place No. 1 in latitude 37° 26′, longitude 106° 36′.

(2) "On the apex of South Mountain, altitude 12,500," "about four and a half miles south of No. 3." This would place No. 2 in latitude 37° 27′, longitude 106° 36′.

(3) "At the triangulation monument on Summit Peak, altitude 12,748 feet." This Summit Peak is evidently that secondary triangulation station near Summit district, and whose position as given on Hayden's Atlas of Colorado is latitude 37° 27′.4, longitude 106° 36′.2, altitude 12,748 feet; it is not the Summit Peak of Hayden's primary triangulation which is so called in Hayden's Bulletin, vol. iii, 1877, p. 713, and where the location according to Gardner's and Wilson's triangulation is given as follows:

Hayden's survey, geodetic station, Summit Peak:

	°	′	″
Latitude	37	21	7.3
Longitude	106	41	35.4
Altitude	13,323 feet.		

It is likely that Robins' Summit Peak is identical with the Belleview Mountain of Wheeler's survey, whose position is given by him as follows (see Wheeler's Reports, atlas sheet 61 D):

Wheeler's survey, geodetic station, Belleview Mountain:

	°	′
Latitude	37	27
Longitude	106	35.8
Altitude	12,673 feet.	

Assuming this identity we have the positions of Nos. 1 and 2 as given above. The altitude given by Wheeler's survey for general level of Summit Mines is 11,089 feet.

DAKOTA.

BISMARCK.—The locations were determined by Professor Safford and Lieutenant Barlow for the Lake Survey in 1873 (see Report Chief Engineers, 1874, pp. 608–620); the resulting location is:

Safford's observing pier, Bismarck:

	°		″
Latitude	46	58	14.6
Longitude	100	46	52.7

The several steps in this longitude were as follows:

				West of Greenwich.		
	h.	*m.*	*s.*	*h.*	*m.*	*s.*
Washington, Naval Observatory dome, west of Greenwich				5	8	12.12
Detroit, Lake Survey Observatory, west of Washington	0	24	0.12	5	32	12.24
Duluth, north base monument, west of Detroit	0	36	5.95	6	8	18.19
Duluth, Lake Survey Observatory, west of north base	0	0	6.10	6	8	24.29
Bismarck, Safford's Pier, west of Duluth	0	34	43.22	6	43	7.51

FORT ABRAHAM LINCOLN.—This fort was apparently located by reference to Bismarck, and was the base of the Black Hills expedition of Captain Ludlow in July and August, 1874; its position as given by him is as follows (see Report Chief of Engineers 1875, pp. 1209–1230):

Fort Abraham Lincoln:

	°	′
Latitude	46	46.10
Longitude	100	50.57
Altitude	2,211 feet.	

This post, according to Captain Ludlow's map, is 3.5 miles = 6′.3 west of that fort, and 3.2 miles = 3′.2 south of Bismarck, which latter is also on the opposite side of the Missouri. Therefore, by reference to the Lake Survey determination of the position of Bismarck, we have the following:

Fort Abraham Lincoln:	° ′
Latitude	46 54.8
Longitude	100 40.6

FLORIDA.

KEY WEST.—A revision of the adopted positions of light houses, &c., at Key West is published in Coast Survey Report 1875, p. 139, according to which we have the following figures:

Key West astronomical station:	° ′ ″
Longitude	81 48 24.66

Key West Tifft's observatory:	° ′ ″
Longitude	81 48 30.73

Key West light on southern edge of the town:	° ′ ″
Longitude	81 48 4.26
Latitude	24 32 58.09

MICHIGAN.

DETROIT.—The old observatory of the Lake Survey was dismantled March, 1870, and the new one occupied in March, 1871. The longitude adopted for the old observatory as quoted in Report Chief of Engineers 1870, p. 600, was: old observatory west transit pier west of Greenwich 5^h 32^m 11^s.57.

The relation of the new to the old observatory is given by the following (see Report Chief of Engineers 1871, p. 1015):

New observatory east transit pier, 143.7 feet = 0^s.127 west, 146.6 feet = 1″.45 north of old observatory, west transit pier.

The longitude of the new observatory was independently determined in October, 1871, with the following results as adopted by the Lake Survey (see Report Chief of Engineers 1871, p. 1017, and 1872, p. 1053, where slight corrections are given but which have not been adopted):

New observatory, east transit pier, west of dome of Naval Observatory, Washington, 0^h 24^m 0^s.12.

This latter gives an independent value of the longitude of the old observatory, namely (see Report Chief of Engineers 1871, p. 1017):

Old observatory, west transit pier, 0^h 23^m 59^s.99 west of Washington.

The result of the observations in 1871 is also given in Washington Naval Observatory Observations for 1872, Appendix II, on longitude of Detroit, Carlin and Austin, where Professor Eastman gives Detroit west of Washington 0^h 24^m 0^s.16.

MISSOURI.

FORT LEAVENWORTH.—This post was occupied by Lieut. E. H. Ruffner, in September, 1871. The pier of his observatory was 945 feet west of the Steamboat Landing, and 160 feet above the Missouri River. His results are as follows:

	h. m. s.
Fort Leavenworth observatory, west of Detroit observatory (see Report Chief of Engineers, 1872, p. 1118)	0 47 27.11
Detroit new Lake Survey observatory west of Washington, dome of Naval Observatory (see Report Chief of Engineers 1871, p. 1017, and 1872, p. 1053	0 24 0.12
Washington west of Greenwich	5 8 12.12
Leavenworth west of Greenwich	6 19 39.35 94° 54′ 50″.25

The latitude does not seem to have been determined.

From the Engineers' map 1879, before alluded to, we have:

	° ′	° ′
Fort Leavenworth	latitude 39 21.7;	longitude 94 56.8
Leavenworth	latitude 39 19.0;	longitude 94 56.8

MONTANA.

VIRGINIA CITY.—The only determination of geographical position that has as yet come to hand will be found at page 796 &c., of the Sixth Annual Report (for 1872) of Hayden's Surveys, where Mr. H. Gannett gives the following:

Virginia City, Mont., United States Army Signal office:	°	′	″
Latitude	45	19	1.5
Longitude	111	56	30

This longitude depends upon that assumed by him for Salt Lake City, and on the chronometer rates.

OLD BALDY.—The Signal Office barometric record was used as a base in determining the altitude of Old Baldy, which Mr. Gannett gives as 9,711 feet, but the height assumed for the base station is not given. (See Hayden's Report, 1872.)

The location of this peak is not known, further than that it is "8 miles," or, according to others, "10 miles" southeast of Virginia City, which would place it in latitude 45° 13′, and longitude 111° 50′.

NEVADA.

WINNEMUCCA.—A point in this city was occupied by Lieutenant Wheeler's survey in 1873 (see Wheeler's Reports, Vol. II., pp. 157–182), where the location is given as follows:

Winnemucca, astronomical monument, northeast part of the town:	°	′	″
Latitude	40	58	19.97
Longitude	117	43	54.16
Altitude	4355.0 feet.		

The several steps in the longitude appear to be as follows:

	h.	m.	s.
Winnemucca west of Salt Lake City (Wheeler's Reports, Vol. II, p. 171)	0	23	20.751
Salt Lake City west of Washington	2	19	22.74
Washington west of Greenwich	5	8	12.12
	7	50	55.611

NEW MEXICO.

FORT BAYARD.—This post was occupied in 1878 by Mr. Miles Rock,* of Wheeler's survey, who gives the following location (see Report Chief of Engineers 1879, p. 2059, &c.):

Fort Bayard, New Mexico:	°	′	″
Latitude	32	47	40.3
Longitude	108	9	8.8
Altitude	6,097 feet.		

The several steps in the determination of the longitude of Fort Bayard appear to be as follows:

	h.	m.	s.
Fort Bayard west of Ogden observatory (see Ogden, Utah,)	0	15	23.058
Ogden, east pier transit room, west of Detroit Lake Survey Observatory (Report Chief of Engineers 1874, p. 437)	1	55	47.50
Detroit Lake Survey Observatory west of Washington	0	24	0.12
Washington west of Greenwich	5	8	12.12
Fort Bayard west of Greenwich	7 108	43 9	22.798 8.8

SILVER CITY is apparently about 9 miles WSW. of Fort Bayard, which makes its location: latitude 32° 43′, longitude 108° 15′.

OREGON.

THE DALLES.—This point was occupied by J. H. Clark, of Wheeler's survey, in 1878 (see Report Chief of Engineers 1879, pp. 1983–2026), with the following results:

The Dalles, Wheeler's astronomical monument on the bluff:	°	′	″
Latitude	45	36	17.8
Longitude	121	12	20.4
Altitude	180 feet.		

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* Observations of the eclipse will be found in Report Chief of Engineers for 1879, page 2247.

The several steps in the longitude of The Dalles are as follows:

		West of Greenwich.
	h. m. s.	h. m. s.
Ogden west of Greenwich (see Ogden under Utah, p. 915)		7 27 59.64
The Dalles west of Ogden (see Report Chief of Engineers 1879, p. 1983, &c	0 36 49.72	8 4 49.36

TEXAS AND INDIAN TERRITORY AND NEIGHBORING REGIONS.

In order to obtain the best possible results for the location of stations in Texas and Indian Territory, I undertook, in 1878, to compare several of the best maps that were accessible to me with each other and with the most recent results of astronomical determinations of latitude and longitude. In this way a system of corrections was determined by which to slightly increase the accuracy of the adopted locations of some of the stations. After completing the greater part of this work I received Waldo's report of the Fort Worth expedition, where a similar course seems to have been pursued by him, and with very similar resulting corrections.

The maps examined by me were as follows:

No. I.—Map of the State of Texas: Brevet Major G. L. Gillespie, dated 1865 and 1867; scale of about 10 miles to the inch.

No. II.—Map of Kansas, Texas, Indian Territory, &c.: prepared in the office of the Chief of Engineers in 1867; third edition in 1876; scale of 23.7 miles to the inch.

No. III.—Centennial map of the United States: published by the Land Office, Interior Department, 1876, Charles Roessler, draughtsman; scale 25 miles to the inch.

No. IV.—Post-route map of the State of Texas, by W. L. Nicholson, topographer to the Post-Office Department; first edition, October, 1878; scale about 10 miles to the inch.

No. V.—Military map of the Indian Territory: compiled by First Lieut. E. H. Ruffner, Corps of Engineers, dated January, 1875; scale about 8 miles to the inch.

According to information furnished by Lieut. Ruffner (O. C. S. O., 85 mis., 1879), the longitudes of this map depend upon those of Chetopa and Fort Hays as a base and the plotting of the Land Office Surveys; this latter process thus places the monument at the S. W. corner of the Chickasaw Nation in longitude 98° 0′.9, while the determination of D. G. Major, by means of moon culmination, gave him 98° 0′.

The table of comparison showing the latitudes and longitudes as given by these authorities will always be instructive, and is therefore here given, although for the immediate purpose for which it was compiled it is now superseded by the work to be next described.

Stations.	I. Gillespie.		II. Engineer Bureau.		III. Land Office.		IV. Nicholson.		V. Ruffner.	
	Latitude.	Longitude.	Latitude.	Longitude.	Latitude.	Longitude.	Latitude.	Longitude.	Latitude.	Longitude.
	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
Camp or Fort Stockton, Tex	30 52.7	102 31.7	30 53.6	102 52.7						
Stockton, Tex					30 51	102 51				
Camp Concho, Tex	31 38.4	100 28.1	31 40.0	100 31.7						
Fort Concho, Tex			31 32.3	100 19.3	31 24	100 15				
Ringgold Barracks, Tex	26 21.5	98 43.2	26 22.6	98 46.2						
Rio Grande City, Tex	26 22.3	98 36.6	26 21.4	98 48.6			26 23.0	98 50.7		
Fort McKavett, Tex	30 52.0	99 57.3	30 31.2	99 57.5	30 47	99 52				
Austin, Tex										
Corsicana, Tex	32 4.5	96 20.7	32 4.4	96 19.9	32 4	96 17	32 5.6	96 30.6		
Denison, Tex										
Decatur, Tex	33 8.4	97 31.0	33 8.6	97 30.0	33 10	97 33	33 12.7	97 35.5		
Fort Griffin, Tex			32 56.0	99 9.2	32 52	99 5	32 53.0	99 34.6		
Fort Richardson, Tex			33 9.8	97 58.8			33 11.3	98 7.6		
Jacksboro', Tex	33 9.5	98 0.5	33 10.5	98 0.6	33 9.5	98 1.5	33 10.0	98 10.4		
Henrietta, Tex			33 42.7	98 2.5	33 45	98 3	33 46.2	98 15.1	33 47	98 11
Sherman, Tex			33 36.3	96 30.7			33 37.6	96 40.4	33 36	96 36.8
Fort Worth, Tex	32 44.0	97 12.5	32 44.2	97 12.9	32 45	97 14	32 45.5	97 21.8		
Worth, Tex	32 43.8	97 11.7								
Graham, Tex	32 58.3	98 27.1			33	98	33 9.5	97 41.0		
McKinney, Tex	33 9.9	96 31.8	33 10.6	96 31.4	33 10	96 32	33 12.0	96 38.1		
Melissa, Tex							33 18.5	96 38.3		
Pilot Point, Tex	33 20.3	96 49.8	33 21.5	96 48.8	33 12	96 55	33 23.8	97 0.1		
Terrell, Tex					32 45	96 7	32 46.8	96 19.4		
Lake Charles, La					30 12	93 7				
Washington, D. C						76 59		77 3		
Fort Smith, Ark									35 22	94 25.4
Fort Dodge, Kans									37 46	99 56
Dodge City, Kans. (railroad station)									37 45	99 52
Fort Gibson, Ind. T			35 47.7	95 16.4					35 49.5	95 19
Gibson, Ind. T. (railroad station)			35 49.9	95 21.5					35 54.1	95 23.6
Fort Arbuckle, Ind. T			34 31.2	97 16.6					34 31.0	97 15.7
Intersection of land survey, Indian meridian and base, Ind. T.									34 30.0	97 15.5
Fort Sill, Ind. T			34 42.7	98 27.3	34 39	98 23			34 39.5	98 22.9
Camp Supply, Ind. T									36 34	99 34
Fort Leavenworth, Kans										
Leavenworth, Kans										
Chetopa, Kans										95 6.1
North Platte, Nebr										
Fort Hays, Kans										99 20.8
Sidney Barracks, Nebr										

During the interval between 1878 and the resumption in 1880 of my work upon this report, there has been published the following very important map, which is evidently, in general, of the highest accuracy, viz:

VI. "MAP OF TERRITORY WEST OF THE MISSISSIPPI: Compiled at the office of the Chief of Engineers, Washington, 1879"; scale about 30 miles to the inch.

I have therefore revised my preceding work relating to Texas and Indian Territory, which is now superseded by the adoption of this map (referred to as Engineer's of 1879), with possible small corrections. In the following table are given, first, the locations as read from map VI; second, all known astronomical or geodetic locations, with their authorities; third, the resulting corrections to map VI, as shown in sixth and seventh columns. In the column of authorities the following abbreviations have been used:

C. E.—Reports of Chief of Engineers, U. S. A.

C. S.—Reports of Superintendent of the United States Coast Survey.

W. G. S.—United States Geographical Surveys under Lieut G. M. Wheeler.

H. G. S.—United States Geographical Surveys under Dr. F. V. Hayden.

It is evident that, with rare exceptions, this map corresponds fully to the present state of our knowledge. An error of 0.03 inch in measures made upon this map entails upon the resulting latitude an error of one minute of arc; so that the probable error introduced by neglecting a distance of 0in.01 is ±0′.3.

Therefore, in general, we adopt the locations given by this map of 1879, when special determinations are not at hand. The following table gives additional details in regard to a few special stations.

Comparisons and corrections to maps of Texas, Indian Territory, &c.

Stations.	VI. Engineer's, 1879.		VII. Astronomical determinations.		Corrections to Engineer's.		Authority for astronomical determinations.
	Latitude.	Longitude.	Latitude.	Longitude.	Latitude.	Longitude.	
	° ′	° ′	° ′ ″	° ′ ″	′	′	
Camp or Fort Stockton, Tex.	30 53.2	102 52.4	......	102 52 26.6	......	0.0	C. E., 1877, pp. 1134, 1440.
Camp or Fort Concho, Tex	31 27.0	100 24.4	......	100 25 43.2	......	+1.3	C. E., 1877, pp. 1134, 1440.
Ringgold Barracks, Tex.	26 22.9	98 46.7	26 22 46.6	......	−0.1	......	C. E., 1877, p. 1440.
Rio Grande City, Tex.	26 22.3	98 48.2	......	......	......	......	
Fort McKavett, Tex	30 48.5	100 12.0	......	100 6 22.8	......	−5.6	C. E., 1877, pp. 1134, 1440.
Austin, Tex.	30 16.4	97 44.4	30 16 21	97 44 12	0.0	−0.2	C. S., 1874, p. 65.
Corsicana, Tex	32 6.2	96 26.5	......	......	......	......	
Denison, Tex	33 48.3	96 31.5	......	......	......	......	
Decatur, Tex	33 12.6	97 35.0	......	......	......	......	
Fort Griffin, Tex.	32 55.1	99 13.7	......	99 13 49.0	......	+0.1	C. E., 1877, pp. 1134, 1440.
Fort Richardson, Tex.	33 11.8	98 8.8	......	98 9 41.2	......	+0.9	C. E., 1877, pp. 1134, 1440,
Jacksboro', Tex	33 12.1	98 9.8	......	......	......	......	
Henrietta, Tex	33 45.7	98 10.8	......	......	......	......	
Sherman, Tex	33 38.4	96 36.1	......	......	......	......	
Fort Worth, Tex	32 45.2	97 19.8	32 45 19	97 19 55.35	+0.1	+0.1	Waldo Eclipse Report, p. 27, &c.
Graham, Tex	33 16.6	98 39.1	......	......	......	......	
McKinney, Tex	33 12.8	96 37.0	......	......	......	......	
Melissa, Tex	33 17.7	96 36.0	......	......	......	......	
Pilot Point, Tex	33 23.2	97 0.0	......	......	......	......	
Terrell, Tex	32 47.6	96 16.0	......	......	......	......	
Lake Charles, La	30 12.4	93 6.3	......	......	......	......	
Fort Smith, Ark	35 23.5	94 23.5	35 22 35	94 25 21	−0.9	+0.9	See Ruffner's map V, 1875.
Fort Dodge, Kans	37 45.1	99 17.6	......	......	......	......	
Dodge City, Kans	37 45.7	99 59.3	......	......	......	......	
Fort Leavenworth, Kans.	39 22.3	94 57.2	......	94 54 50.2	......	−2.4	C. E., 1872, p. 1138.
Leavenworth, Kans	39 19.1	94 57.0	......	......	......	......	
Chetopa, Kans	37 2.2	95 5.5	37 2 13.0	95 6 7.4	0.0	+0.6	C. S., 1871, p. 53.
Fort Hays, Kans	38 51.8	99 19.7	......	99 20 48.6	......	+1.1	C. E., 1873, p. 1223; Ruffner's map V, 1875.
Fort Wallace, Kans	......	......	......	101 34 58.65	......	......	C. E., 1873, p. 1223.
North Platte, Nebr.	41 8.1	100 46.0	41 8 18.3	100 45 53.14	+0.2	−0.1	C. E., 1875, p. 931; W. G. S., II, p. 489.
Sidney Barracks, Nebr.	41 8.3	102 58.9	41 8 36.75	102 58 13.32	+0.3	−0.7	W. G. S., II, p. 489; C. E., 1875, p. 931.

Comparisons and corrections to maps of Texas, Indian Territory, &c.—Continued.

Stations.	VI. Engineer's, 1879.		VII. Astronomical determinations.		Corrections to Engineer's.		Authority for astronomical determinations.
	Latitude.	Longitude.	Latitude.	Longitude.	Latitude.	Longitude.	
	° ′	° ′	° ′ ″	° ′ ″	′	′	
Fort Gibson, Ind. T.	35 49.4	95 19.4	35 47 35	95 15 13	—1.8	—4.2	J. C, Woodruff; see map II, Engineer's, 1876.
Gibson, Ind. T.	35 52.7	95 24.9	....	....	......	......	
Fort Arbuckle, Ind. T.	34 31.2	97 15.0	34 30	97 15	......	......	Land Office Surveys, prime meridian.
Fort Sill, Ind. T.	34 39.5	98 22.6	....	....	......	......	
Camp Supply, Ind. T.	36 35.1	99 33.1	....	....	......	......	

BELMONT FARM, NEAR MELISSA.—The approximate position, as given by the observer upon his monthly report, is latitude 33° 8′, longitude 96° 31′, altitude 722 feet. It is probable that this is intended to refer to the exact place of observation, for whose relation to the center of the town of Melissa I have no data, and have therefore adopted the center of the town, as given in the preceding table, subject to such further correction as may be needed to refer it to the place of observation.

TEXAS.

FORT WORTH.—This station was occupied by Dr. Leonard Waldo in 1878, and the observations for the determination of its location are given in his "Report on the observation of the total solar eclipse July 29, 1878, made at Fort Worth, Texas," Cambridge, 1879, where he gives, at page 27, the data for the following results.

City of Fort Worth, Tex., monument in Court-House Square:

	° ″ ′
Latitude	32 45 19
Longitude	97 19 55.5

The longitude depends upon the following details (see page 19 of Waldo's Report:)

		West of Greenwich.
	h. m. s.	*h. m. s.*
Washington Naval Observatory dome west of Greenwich	....	5 8 12.12
Saint Louis, Eimbeck's pier, west of Washington (See Washington Astronomical and Meteorological Observations, 1870, Appendix I.)	0 52 36.90	6 0 49.02
Saint Louis Observatory of Washington University west of Eimbeck's	0 0 0.13	6 0 49.15
Fort Worth, Waldo's transit pier west of Saint Louis	0 28 31.31	6 29 20.46
Fort Worth, Court-House monument east of transit pier	0 0 0.77	6 29 19.69

GRAHAM.—The observer reports his station as being 41.28 miles east of Fort Griffin, and 27.36 miles west of old Fort Richardson, both distances being measured by the line of telegraph poles and wire. Although these distances may not be measured in perfect straight lines, yet they are probably subject to very nearly the same relative percentages of error; I therefore convert them into differences of longitude as follows: Assuming the bearings to be as given on the maps of largest scales, such as Nicholson's Post-route Map, *i. e.*, Graham, west 8° south of Fort Richardson, and east 20° north of Fort Griffin. These figures give us the differences of longitude as follows, assuming that 1′ of longitude = 0.9969 miles for latitude 33°.

	′ *m. s.*
Graham, west of Fort Richardson	28.02 = 1 52.30
Graham, east of Fort Griffiin	40.12 = 2 15.18

Applying these differences to the longitude of Richardson and Griffin, as determined by

Captain Gregory in 1877 (see Report Chief of Engineers 1877, page 1440, and as given in preceding table), we have—

	h. m. s.	*h. m. s.*
Fort Richardson west of Greenwich	6 32 38.7	
Graham west of Fort Richardson	0 1 52.3	
		6 34 31.0
Fort Griffin west of Greenwich	6 36 55	
Graham east of Fort Griffin	0 2 15	
		6 34 40
Average of these two 98° 38′ 52″, or		6 34 35.5

This latter result, which is but 0′.2 less than the longitude already given in our table, as read off from the map of the Engineer Bureau 1879, is an additional confirmation of the accuracy of that map.

UTAH.

Coalville.—The center of this town, according to the surveys and manuscript maps of Lieut. Wheeler's surveys, and as kindly communicated from his office, is as follows:

		° ′ ″
Coalville—center of town.	Latitude	40 54 30
	Longitude	111 26 0

The center of the town is 5¼ miles south, 2¼ miles east of the railroad station at Echo, at the mouth of Echo Cañon and the junction of the Central Pacific Railroad and the Summit County Railroad. This railroad station is in latitude 40° 59′ 0″, longitude 111° 26′ 30″.

The eclipse observer had in 1877 written (O. C. S. O., 5320, V. R., 1877) that the county court-house at Coalville is a half mile northwest of his house, and that the altitude is 1,412 feet above Great Salt Lake, whence we have—

Coalville, observer's station:

	° ′
Latitude	40 53.5
Longitude	111 25
Altitude	5,630 feet.

Ogden.—The observatory erected by Lieutenant Wheeler at this place is one of the primary astronomical or "main" stations used as a base in his surveys west of the one hundredth meridian. The observations for the determination of its location were made in 1873 and 1874, and are given in full in Wheeler's Report upon United States Geographical Survey, Vol. II, p. 5-55; the results are as follows:

Ogden observatory, east pier of Transit Room (see W. G. S. II, p. 489):

	° ′ ″
Latitude	41 13 8.56
Longitude	111 59 54.64
Altitude	4,374 feet.

The steps in the longitude of Ogden are as follows:

		° ′ ″	
1873.	Ogden west of Salt Lake City	0 0 24.747	
	Salt Lake city west of Washington	2 19 22.740	
			2 19 47.487
1873.	Ogden west of Detroit	1 55 47.471	
	Detroit west of Washington	0 24 0.12	
			2 19 47.591
1874.	Ogden west of Washington (direct)		2 19 47.492
	Ogden west of Washington (adopted)		2 19 47.523
	Washington west of Greenwich		5 8 12.12
	Ogden west of Greenwich		7 27 59.643

The work of 1874 was also independently reduced and published in the volume of Washington Astronomical and Meteorological Observations, 1874, Appendix II, where Professor Eastman gives Ogden observatory east pier 2*h.* 19*m.* 47.41*s.* west of Naval Observatory, center of dome.

Salt Lake City.—In Temple Square the Mormon Church has erected a building known as the Mormon or the Salt Lake City Observatory, but which is simply an adobe covering in of the wooden observatory erected by the United States Coast Survey in 1869. This observatory has been one of the primary astronomical bases in all the surveys of the War and the Interior Departments. Its location, as determined by the Coast Survey in 1869 is as follows (see Coast Survey Report, 1869, pp. 44 and 49; 1874, p. 64; Wheeler's Report on Astronomical Co-ordinates, 1872 and 1873, page 45, and "Reports" 4to, Vol. II, pp. 55 and 89):

Salt Lake City, Mormon Observatory, Temple Square:

	° ′ ″
Latitude	40 46 3.76
Longitude	111 53 42.90
Altitude	4,330 feet.

The steps in the longitude of Salt Lake City appear to be as follows:

		West of Greenwich.
	h. m. s.	h. m. s.
Washington Observatory dome west of Greenwich	....	5 8 12.12
Salt Lake City west of Washington (Wheeler's Astronomical Co-ordinates, 1874, pp. 45, 55, &c)	2 19 22.74	7 27 34.86
This value of Salt Lake City Observatory, however, appears to be made up of the following steps:		
Salt Lake City Observatory west of Cambridge (C. S. Report, 1870, page 100, preliminary ?)	2 43 4.28	....
Cambridge Observatory east of Washington (old determinations.) (See C. S. Report, 1867, pp. 58 and 116)	0 23 41.54	....
Whence, Salt Lake west of Washington (old value)	2 19 22.74	....

But the most recent determinations of the Coast Survey give the longitude of Salt Lake City Observatory 111° 53′ 47″ (see C. S. Report, 1871, page 3, and 1874, page 64), which value results from the following steps:

		West of Greenwich.
	h. m. s.	h. m. s.
Washington Observatory west of Greenwich	....	5 8 12.12
Cambridge Observatory east of Washington (C. S. Report, 1870, p. 106, new determination)	0 23 41.11	4 44 31.01
Omaha Coast Survey station pier west of Cambridge (C. S. Report, 1870, p. 100)	1 39 15.069	6 23 46.079
Salt Lake City Observatory pier west of Omaha (C. S. Report 1870, p. 100)	1 3 49.101	7 27 35.180

This last longitude for Salt Lake City corresponds to 111° 53′ 47″.2.

WEST INDIES.

Havana, Cuba.—The station occupied by the observer appears to have been at No. 2 Aquacate street.

The position of Morro tower and light has been variously determined by Don J. J. de Ferrer in the years 1808–1812, Harkness 1868, and Green 1877.

The best results are for Morro light, as follows:

	° ′ ″
Latitude (Prof. Wm. Harkness, 1868, see Obs. U. S. N. Observatory 1868, Appendix)	23 9 21.0
Longitude (Lieut. Commander F. M. Green 1877, see Report U. S. Coast Survey 1875, page 156, note) 5h 29m 25s.94 west of Greenwich, or	82 21 30.0

I have no data by which to accurately refer the location of the eclipse observer to this well-determined point.

WISCONSIN.

MILWAUKEE.—The location of the observatory at which Professor Farrar seems to have made his observations has not as yet been ascertained by me, but the following data communicated by the Chief of Engineers, United States Army (see O. C. S. O., 2380 Mis., 1880), furnishes a base point to which the observatory may easily be referred at some future time.

Milwaukee court-house:

Latitude, 43° 2′ 33.69″ north.
Longitude, 4° 51′ 14.71″ west of Lake Survey Observatory at Detroit.
Longitude, 10° 51′ 16.51″ west of Naval Observatory at Washington.
" " 87° 54′ 18.31″ west of Greenwich.

WYOMING.

Little Sandy, Camp No. 4. The location of this temporary camp of Wilson's geodetic party forHayden's Survey was communicated by him (see O.C. S. O., 1951, Mis., 1880) in connection with the eclipse observations as follows:

Camp No. 4, Little Sandy, Western Wyoming:

	° ′ ″
Latitude	42 8 25
Longitude	109 9 52
Altitude	7,300 feet.

The longitude is said to be approximate; apparently it depends on the rates of chronometers carried from Ogden or Great Salt Lake City, Utah.

E.

CHANGES OF TEMPERATURE DURING THE ECLIPSE.

The amount of heat radiated to the earth, whether directly emanating from the corona or reflected by it from the sun, would, if measurable at all, as it probably is, be a subject of investigation by the pyrheliometer of Pouillet or Crova, or other equivalent instrument; possibly it could best be studied with the help of the thermoelectric pile.

But, without these delicate instruments, we should at least be able to derive some idea of the amount of heat radiated to the observer by the mass of air above and around him by a proper study of the fall in temperature due to the rapid obscuration of the sun by the moon.

These observations of temperature must be divided into two classes, according as they relate to the temperature of the air or to the temperature shown by the solar radiation thermometer, and are given in the following tables as copied from Chapter III.

Temperature by the solar thermometer.

Report number.	Station.	Observed fall in temperature.	Remarks.
		°	
16	Pike's Peak Summit	42	Ordinary thermometer in the sun.
45	Denver	32	Probably ordinary thermometer in the sun.
51	South Pueblo	22.5	Thermometer horizontal 4 feet above ground.
71 72	Virginia City Signal Service Station.	10	Apparently the S. S. thermometer in its double lattice-work shelter.
72	Virginia City	10	Ordinary thermometer in the sun.

Temperature of the air by sheltered thermometers.

Report number.	Station.	Fall in temperature.	
		As reported.	As corrected for diurnal variations.
		°	°
16	Pike's Peak Summit	10	7.5
29	Camp Grant	7	4
30	Camp Verde	4	....
32	New Westminster	5.3	2.6
36	Princeton	8	6
37	Red Bluff	6	3.5
38	Sacramento	3	....
39	Salinas	9	....
40	San Gorgonio	8	5
41	Santa Cruz	10	3
42	Colorado Springs	6	5.7
42	Manitou	8	6
42	Lake House	14.5	12
42	Monument	5	3.5
45	Denver	6.5	....
50	Kit Carson	10	....
52	Summit Peak, Belleview	6	....
55	Indianapolis	0	0
57	Vevay	0	0
61	Boonesboro'	6	4.5
65	Fort Leavenworth	9	....
66	Leavenworth	6	5
67	Louisville	4	2
69	Detroit	4	....
70	Frankfort	2	....
72	Virginia City (1)	10	9.5
72	Virginia City (4)	9.5	....
72	Old Baldy (5)	12	11.5
77	Emerson	7	8
78	Howard	9.8	6.8
79	North Platte	5	....
80	Winnemucca	6	4.7
81	Auburn	3	1
82	Silver City	3.2	....
83	Portland, Oreg	2	....
84	Umatilla	3	....
85	Austin	2	....
100	Terrell	17	....
103	Fort Walla Walla	6	....

NOTE.—Observations are said to have been made at Santa Fé, but have not come to hand. See report of Mr. Miles Rock, in Report Chief of Engineers, 1879, p. 2247.

F.

OBSERVATIONS OF THE SHADOW AND ITS FRINGES.

As every phenomenon in connection with a total eclipse of the sun demands careful study until its causes and bearings are fully understood, it will be interesting to collect together the observations upon the appearance of the colors attending the central shadow. This was a subject that especially interested General Myer, and in respect to which he particularly desired observations by those on the summit of Pike's Peak. The following is a summary of such observations as have come to hand relative to the shadow of the moon. I have arranged these extracts in the chronological order from Montana to Texas.

MONTANA TERRITORY.

VIRGINIA CITY.—Sergeant E. McGovern, in document 71, reports as follows: "At the first second of totality the whole horizon had the appearance of a beautiful sunset—a strong, yellowish, pale tint hung over everything, still lingering on the mountain side and far up on the horizon. At about the fifth second of totality a sudden transition from light to darkness took place, and the concluding interval of totality exhibited only the phases of an ordinary clear moonless evening just before full nightfall. A little while before the maximum density of darkness had settled upon the earth the eastern horizon was arrayed in a brighter light than the western horizon. There were only two small cumulus clouds visible at the time of the eclipse, one in the northern and the other in the western sky, and they both reflected very dark and pretty shadows [shade?] some time before and during totality."

NOTE.—Virginia City was very nearly in the axis of the path of totality. The above-observed greater brightness in the eastern horizon would go to show that the observer was east of the central axis of the path.

COLORADO.

SUMMIT STATION.—C. E. Robins (see document 53), at the triangulation monument altitude, 12,748 feet, remarks: "The light around us (during greatest obscuration) was a greenish yellow, yet objects, near and at a distance, could be seen almost as plainly as before contact. The day and weather were superb. I have never at the same elevation known it so warm and mild. Our outlook extended 150 miles."

The geodetic triangulation of Gardner and Wilson suggests that this limit of 150 miles should be considerably reduced, as in the case of Pike's Peak; the distance of the farthest peak visible to Gardner from Belleview seems to have been 45 miles, while the average distance of the farthest visible peaks is not likely to be over 50 miles.

On the summit of Mount Lincoln, 67 miles distant, and bearing north 32° west from Pike's Peak, the anonymous correspondent of the Denver Daily Tribune observed as follows (see document No. 27):

"Until a few moments before the total eclipse, when the unusual darkness of the sky in the northwest was in striking contrast to the yellow light in the southeast. * * * Then this darkness became more concentrated and seemed to draw up from the northwest horizon like a dark blue curtain, displaying in wide bands all the colors of the rainbow; bright yellow close to the northwest horizon, changing, as you ascend, to light yellow, pea green, purple, and so on, to the dark, almost black blue, marking the line of the total eclipse, now above us, and through which many stars were distinctly visible. During the time of total obscuration on Mount Lincoln, Gray's Peak seemed to be in the line of deepest darkness, the skies gradually brightening, as you looked both easterly and westerly, to the light yellow now lying on both easterly and westerly horizons."

Mount Lincoln, according to Wilson, in Hayden's Bulletin, III, page 713, is in latitude 39° 21′ 9″.1, longitude 106° 6′ 26″.8, altitude 14,296 feet, and was about 50 miles southwest from the axis of the path of totality.

Gray's Peak is two miles distant from Torrey's Peak, and bears SSW., and its altitude is 14,341. Torrey's Peak, about 70 miles SW. of the central axis, is 25 miles from Mount Lincoln, bearing N. 37°.6 E., and its altitude is 14,336; its latitude is 39° 38′ 37″.4, and its longitude 105° 48′ 1″.1.

The bearings and distances from Mount Lincoln, as given in Gardner & Wilson's primary triangulation, page 718, vol. iii, Hayden's Bulletin, are as follows:

	Miles.		Miles.
Pike's Peak, S. 58°.7 E	67	Holy Cross, W. 22°.0 N	21
Hunt's Peak, S. 7.7 E	67	Powell, W. 66.6 N	31
Princeton, S. 9.7 W	42	Park View, W. 88.9 N	68
Harvard, S. 21.0 W	32	Long's Peak, N. 22.8 E	68
La Plata, S. 41.3 W	29	Torrey, N. 37.6 E	25
Massive, S. 60.0 W	23	Evans, N. 56.7 E	30
Snow Mass, S. 72.9 W	54		

PIKE'S PEAK.—The extensive view obtained from the summit of this peak rendered it a peculiarly advantageous position for observation of the shadow of the moon. But the natural tendency to exaggerate the ordinary limits of vision renders it necessary that we should first inquire as to the probable extent of the visible horizon—an inquiry that is facilitated by the admirable topographical charts published in Hayden's Atlas of Colorado, Washington, 1878.

The bearings observed by J. T. Gardner from the summit in his primary triangulation of Colorado are recorded by Wilson in p. 719, No. 3, Vol. III, of the Bulletin of Hayden's Surveys. Among these are the following:

Peak.	Bearing.	Distance.	Peak.	Bearing.	Distance.
	°	Miles.		°	Miles.
Fisher's	S. 15.0 E.	124	Harvard	W. 5.2 N.	69
West Spanish	S. 1.6 E.	101	Lincoln	W. 31.9 N.	67
Reto Alto	S. 42.3 W.	58	Torrey	W. 53.3 N.	69
Hunt	S. 57.4 W.	58	Evans	W. 58.3 N.	61
Ouray	S. 66.1 W.	70	Long's	W. 72.8 N.	102
Princeton	S. 84.8 W.	65	Morrison's	W. 80.7 N.	58

From this table it is evident that the horizon in the north and west quadrant as observed from Pike's Peak must be in general limited by mountains at a distance of not more than 60 or 70 miles instead of "over a hundred"—those more distant being distinguishable only occasionally with a glass. The front and rear edges of the shadow would sweep over this distance of 65 miles in 2 minutes at the rate of 33 miles per minute. The summit of Pike's Peak was about 25 miles SW. of the axis of the central path, the width of which was about 120 miles in Colorado, having a general trend of from N. 40° W. to S. 40° E. Therefore, at the distance of 65 miles the shadow of the moon would subtend an angle of about 84° as measured on the horizon.

PIKE'S PEAK SUMMIT.—The column of shadow approaching the peak from the northwest was seen by those observers who were stationed at the edge of the peak, with the plains below in full view—similarly the departing column of shadow was seen by Mr. McCandless, moving southeastward after the totality had passed by; but Mr. McCandless, although a most careful man, "saw none of the rainbow hues spoken of by others." He describes the shadow in the air as having the appearance of a dark cloud, "like a great black ball with a bright zone of light, fading from bright yellow into a pale pea green, surrounding it. It was an almost black shadow distinctly rounded with bright orange yellow next to it, shading off through light yellow into the greenish hue of the plains. (See document No. 21.)

General Edward Hatch (see document No. 22), also at the northern edge of the summit, saw "an angry black cloud of inky blackness at the base, fading gradually into softer prismatic colors of the rainbow, not as well or clearly defined, the red particularly dull; the upper edges of this cloud of wavy orange. This cloud, advancing with startling rapidity, fading into colors, disappeared in the sunlight."

Col. C. B. Lamborn, also on the summit, reports (see documents 23 and 24), "with inconceivable rapidity the shadow swept towards us; its front was a clear black line, bordered with a fringe of yellow. When the shadow reached and enveloped us, the eye could dimly outline the nearer mountains and could single out with strange distinctness the houses and farms in the valley below. The horizon all around us was brightly illumined by flashing rays of red and yellow light, like those of the aurora. There was one peculiar phenomenon of color connected with the appearance and disappearance of the shadow. It was observed that along both lines of the shadow, and especially along its departing edge perhaps more distinctly than its advance line, there was a well-defined strip of yellow color shading off into orange and bright red. This appearance was well defined and bordered the dark lines like a fringe. The two colors of red and yellow, with an intermediate shade of orange, fringed the edges of the shadow as it swept over the peaks and plains below us. The colors did not appear to pervade the atmosphere between us and the ground, but lay flat along the surface and directly against the edge of the shadow. I saw no blue line, although the shading of red may perhaps have run into purple. The colors were visible only on the edges of the shadow as thrown on the ground. The movement of the shadow was so rapid as it swept across the landscape below my point of observation that I failed to note the sequence of the colors. What color, red or yellow, was next the black line of shadow I am unable to say.

Mrs. Aubrey H. Smith, also on the summit, in her report (see document 25) says: "When the shadow reached the plain it seemed to become a solid palpable body of darkness rising up in a great wall. * * * At the point of contact, as it were, of the retreating light and the advancing shadow the white light became yellow, which deepened into orange and red, while the edge of the gloom took on a bluish tinge, forming an iris fringe. The same colors were even more distinctly visible on the retreat of the shadow after totality. The corona of light around the dark body of the moon cast a ring of scintillating red and yellow light, like an aurora on the far-off horizon."

The distance from Pike's Peak to the limits of the region of total eclipse can be determined for the moment of mid-totality by describing an ellipse having this station on its minor axis, the dimensions of the ellipse being the mean of the dimensions of those that are represented on the accompanying map for the moments $5^h\ 0^m$ and $5^h\ 40^m$ Washington time. We thus find that for the moment of mid-totality the limits of the shadow had the following approximate bearings and distances from Pike's Peak:

	Miles.		Miles.
South	40	North	45
S. W	35	N. E	80
W	30	E	90
N. W	30	S. E	65

—while the center of shadow bore N. E., distant 28 miles.

It is therefore probable that the "far-off horizon" alluded to in the last line of the preceding extract refers to the western half of the horizon, which these observers had right before them. Moreover, the fact that no distant mountain peaks were noticed as illuminated during mid-totality suggests that probably the limit of distinct vision commented upon on the previous page should be further reduced from 65 miles to 30 miles.

Mr. Charles O. Shields, observing also at the summit of Pike's Peak (see document 26), reports as follows:

"I write you regarding the colors preceding the shadow. There was a band of clouds extending along the northern horizon, on which the colors were best shown. The first color I noticed was a very pale yellow, which gradually deepened into a dark orange. This was bordered by a pink which deepened to a light rose and assumed different shades to a very rich dark rose. Beyond the rose the color grew darker until it became a blue black. The colors were not arranged in bands, but were so beautifully blended I could not tell where one color ended and the other began."

COLORADO SPRINGS.—Professor Loud reports that the "diffraction bands at the edge of the shadow as seen by those on Pike's Peak summit were not noted" by any of the observers at the foot of the peak, 6,000 to 8,000 feet below the summit.

INDIAN TERRITORY.

FORT SILL.—Private John McCann (document No. 58) writes: "During the total phase the vicinity of the observer was a purple twilight, and the horizon for the complete circle, with the exception of about 30° of the western section, presented the appearance of the morning aurora as it appears 20 or 30 minutes before sunrise, with the exception of being of a more brilliant orange color. The western section for a distance of about 30°, as above referred to, was of a much brighter hue."

Of the phenomena of colors described in the previous quotations the following seem to be the most characteristic:

a. When enshrouded within the region of "totality" the observer sees on the horizon all around him an appearance as of the morning twilight, *i. e.*, deep red below surmounted by yellow, and that by brilliant orange. If, however, the area of totality be very large as when the duration of totality is very long, then at the base below the red is a deep dusky belt, surmounted by purple, above which the above-described red, yellow, and orange bands are seen. Around the observer the diffused light from all sides obliterates all shadows and spreads a tint of yellow and blue or of purple, depending on the extent of the totality.

b. When clouds or snow-covered mountains bound the horizon, the colors above enumerated become brighter, and are described, for instance, as pale yellow, dark orange, pink, light rose, rich dark rose, blue black.

c. When looking from a peak down upon the shadow on the plain below, it is seen that the darkest region is surrounded by a stripe or belt of a bluish tinge, outside of which, in order, come belts of red, orange, yellow, and white. These colors did not appear to pervade the atmosphere, but lay flat on the ground, alongside the shadow.

d. Observers quite outside of the totality, as for instance when it is approaching towards or departing from them, saw it as an angry black cloud or as an almost black shadow surrounded successively by exceedingly dull red, then by orange, bright orange, yellow, and light yellow, and thus shading off into the greenish hue of the plains. These colors apparently were seen on each side of the central shadow in the same order, reckoning from the inside; but with respect to the colors at the base of the approaching or retreating shadow, the following appears to be the order, viz, near the horizon bright yellow, next above light yellow, then pea-green, purple, &c., to dark blue or black blue. When on the approach of the shadow the bands of yellow, orange, red, and blue, or dusky purple, have successively passed over the observer, a sudden change to a uniform dark hue is observed, and the darkness suddenly increases, after which it very slowly increases until mid-totality, when the phenomena recur in a reverse order. At Virginia City, Mont., the observer estimated about five seconds to be the duration of this preliminary series of color bands corresponding to a width flat on the ground of four miles, which width would seem to accord well enough with what was seen from Pike's Peak.

The preceding phenomena have been explained as due, 1st, to chromatic dispersion of light within our atmosphere; 2d, to diffraction at the edge of the moon; 3d, to illumination by the red and orange layers of the sun's atmosphere; 4th, to selective absorption precisely such as cause the sunset tints or the salmon tints of distinct summer cumuli. Apparently the third of these hypotheses explains the phenomena described in paragraphs *a*, *b*, *c*, *d*, whence we should conclude that the area of totality as defined by ordinary astronomical calculations is appreciably encroached upon on all sides by the light of the solar corona and chromo-sphere.

G.

OBSERVATIONS AND SKETCHES OF THE SOLAR CORONA AND RAYS.

Of the observations relating to the general appearance of the solar corona and rays there have been reported twenty-eight sketches, and there are also some descriptions without sketches. The sketches have been reduced to uniform scale, giving the moon's diameter one and a quarter inches, and are here reproduced in white on a dark back ground; the originals were in black on a white ground, except Nos. 8 and 9. They are here numbered and arranged in chronological order, beginning with 5^h 6^m 0^s, Washington mean time, at Baldy Mountain, Montana, and ending with 5^h 58^m 10^s, at Havana, Cuba. The top of each diagram is to be marked 0°, and represents the apparent vertex of the sun at the place and time of mid-totality, and the division lines representing 30° each are to be counted from the top toward the right as in sketch No. 9.

The text and the notes accompanying each sketch will give all details needed for elucidation. The sketch of Prof. C. A. Young, at Denver, is given in the text of his report No. 48. The following is a list of these sketches, with the author's name and location:

No of sketch.	Location.	Author.	Washington time of mid-totality.	
			h.	m.
1	Old Baldy Mountain summit, near Virginia City, Mont.	William Martin	5	6
2	Virginia City, Mont	A. J. Bennet	5	6
3	......do	F. Kellegher	5	6
4	Coalville, Utah	T. Bullock	Not total.*	
5	Denver, Colo	J. M. Bagley	5	22
6	Little Sandy, Wyoming	W. H. Holmes	5	41
7	Pike's Peak summit, Colo	H. T. Crosby	5	24
8	......do	H. H. C. Dunwoody	5	24
9	Pike's Peak, Lake House, Colo	C. Abbe	5	24
10	......do	W. Wiley	5	24
11	Manitou, Colo	W. W. Nichols	5	24
12	Colorado Springs, Colo	J. H. Kerr	5	24
13	......do	A. R. Byrd	5	24
14	......do	A. Stewart	5	24
15	......do	L. Ratliff	5	24
16	......do	E. Curtis	5	24
17	South Pueblo, Colo	E. S. Nettleton	5	26
18	Clear Creek, Nebr	A. F. Bryant	Not total.*	
19	Fort Sill, Ind. T	S. R. Whithall	5	32
20	Henrietta, Tex	J. J. Mullen	5	36
21	......do	J. D. Harston	5	36
22	......do	M. Harrold	5	36
23	Jacksboro', Tex	P. M. Wilson	5	36
24	Graham, Tex	A. B. Grant	5	38
25	Pilot Point, Tex	C. F. Reeves		
26	Belmont Farm, near Melissa, Tex	T. M. Scott	5	44(?)
27	Corsicana, Tex	N. Cumming	5	41
28	Havana, Cuba	C. Hasselbrink	5	58

* These observers were entirely outside of the belt of totality, but they report beams visible and which correspond well to our other descriptions, and especially to the visibility of the coronal beams observed at Pike's Peak for five minutes after third contact. These observations must be considered among the most remarkable and interesting of the whole series.

The first impression upon examining these sketches must be that the corona and rays were subject to great changes during the fifty-five minutes within which they passed under the inspection of these different observers, but further reflection will considerably modify this conclusion.

First. The four projections distinctly recorded by Abbe, in No. 9, also appear more or less distinctly in Nos. 1, 4, and 28. [See also Document 43.]

Second. The positions of the rays or beams seen by the different observers all agree with each other within the limits of accuracy of the sketches.

Third. However various may have been the impressions received by the different observers, yet each failed to see and record any material change during the two or three minutes that the corona was visible to him. We thus have twenty-five little intervals of two or three minutes each, many of which overlap each other so that in effect there is a continuous line of testimony to the permanence of the appearance of the corona.

Fourth. Some observed a twinkling of the small rays, a flickering of the large ones, or a movement among the small rays near the sun's limb. Similar movements among the rays surrounding a bright star as seen in a telescope are usually attributed to our own atmosphere or are classed among the subjective phenomena peculiar to each observer; it is as yet too early to decide how much of these minute changes are real and how much atmospheric or subjective, but the present indications are that almost all were due to the motion of the moon which, by uncovering or covering the corona, produced an appearance of changes in the latter that were not really taking place. This remark applies especially to the coronal rays close to the sun's surface.

The conclusion is, then, decidedly in favor of the permanence of the coronal phenomena. This, however, is not necessarily a positive conclusion as to their material existence. Such phenomena as rainbows, and halos, and probably the aurora, each have a certain degree of permanence and are not subjective, but neither are they material objects.

The suggestion, made by Professor Abbe, that the long rays or beams must be streams of meteoric matter near to but beyond the sun has already been recorded in his special Pike's Peak report, and has met with general acceptance on the part of those to whom it has been mentioned.

H.

THE BRIGHTNESS OF THE CORONA.

Photometric observations looking to the determination of the brightness of the coronal light have been reported from Dr. I. C. Smith, of Virginia City. His apparatus consisted of the Bunsen photometer precisely as constructed and employed by Prof. E. C. Pickering on the occasion of the eclipse of 1870, December 22. The candle used by Dr. Smith was therefore, by Professor Abbe, referred to Professor Pickering for comparison with his own, and, on account of the general interest in these results, it will be best to refer to his letter as given in full in reports No. 73 and 74, Chapter III, from which it will be seen that in general the total light of the corona in 1870 was possibly eight times as great in 1878.

A very considerable amount of uncertainty attaches to this determination, but does not invalidate the conclusion that in 1878 the amount of light received from the corona was comparatively small. On the other hand, the general experience of the observers seems to have been that the darkness during totality in 1878 was not so great as in 1869.

Although such an estimate cannot have very great weight, yet it may be added that on Friday, November 1, 1878, at 5^h 45^m p. m., the sky being perfectly clear, the sun 45 minutes below the horizon and the moon about six days old, Professor Abbe, at Washington, estimated that, to the best of his remembrance, the illumination due to the twilight and the moonlight of a sheet of paper held in his hand was equal to that which fell upon his drawing-paper during the total phase of July 29. Photometric observations repeated under such circumstances, with an apparatus similar to that of Professor Pickering, may at some future time enable us to obtain an approximation to the total light of the corona.

The brightness deduced above from Dr. I. C. Smith's observations conforms perfectly to the result announced by Prof. W. Harkness, Bulletin Philosophical Society of Washington, vol. iii, p. 118, who concludes that the total light of the corona was in 1878 equivalent to 0.072 times that given by a standard candle at a distance of one foot or to 3.8 times the brightness of the full moon. And, again, that the total light received from the corona of December 22, 1870, was 7¼ times greater than that received on July 29, 1878.

Photometric observations were made during totality of the eclipse of August 7, 1869, by Mr. James Haines, of the observing party, at Sioux Falls City, Dak., but by a different method, such that the comparative brilliancy of the corona can only be said to have been in general less than in 1878.

Table showing inclination of sun's axis of rotation to the horizon at different locations along the line of totality, July 29, 1878.

Washington mean time.	Location along line of totality.		Inclination.
	Latitude.	Longitude.*	
h. m.	° ′	° ′	° ′
4 50	+50 23.1	41 29.9	50 17
5 0	47 10.7	37 10.8	42 13
5 10	43 49.9	33 5.1	34 26
5 20	40 18.5	29 0.2	27 54
5 30	36 33.1	24 40.7	22 7
5 40	32 26.4	19 42.7	17 3
5 50	27 40.6	13 16.8	12 40
6 0	+20 43.0	0 48.7	8 44

*From Washington.

[Addendum made August, 1881, according to computations by Frank Waldo, Computer, O. C. S. O.]

V.

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Photometric observations 883–885

Pike's Peak, Signal Service expedition:
  Historical 824–831
  Observations .... 831——

Polarization of diffuse light 844

Protuberances. (*See* Chromosphere.)

Shadows on clouds and atmosphere and ground 834, 835, 836, 838, 839, 879, 918–921

Spectroscope, corresponding simultaneous observations with 849, 850

Stars, visible 840, 866, 867, 871, 879, 890, 893, 896

Stations and reports, general summary and distribution of.......................... 853–860

Stations, geographical location of.....849, 863, 869, 871, 878, 897, 900–917

Temperatures, observations of 835 (15, 16), 852, 860–897, 917, 918

Time-signals, telegraphic 849, 850, 880

Totality, duration of..............864, 877, 878–884, 889, 890, 891, 892, 894, 895, 896, 900

Transparency of the earth's atmosphere. 828, 844, 846, 849

Weather, probabilities of.................. 813
  General condition of................ 897, 898

VII.

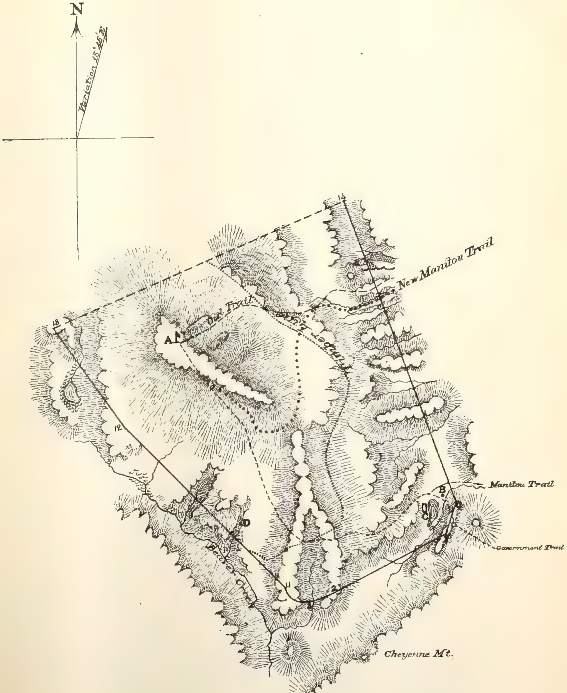
ILLUSTRATIONS.

1. Map of Pike's Peak, Military Reservation.
2. Diagram of location of instruments at Pike's Peak.
3. Diagram of temperature at Colorado Springs.
4. Diagram of temperature at Lake House.
5. Sketch of corona by Prof. C. A. Young.
6. Map illustrating the stations and weather.

U.S. MILITARY RESERVATION

ON

PIKE'S PEAK.



Scale 1000 feet to an Inch.

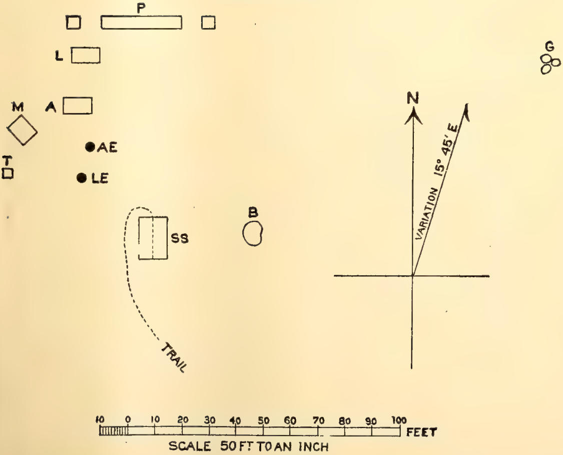
NOTE—Figures 0 to 15, indicate the bounds of the Military Reservation.

The Signal Station is on the highest point of the Mountain.

REFERENCES:

A—Signal Station.
B—Abbe's Site.
C—Lake House.
D—Camp Howgate.

LOCATIONS ON THE SUMMIT
OF
PIKE'S PEAK,
July 28, 1878.



P. Photometric Apparatus.
L. Langley's Tent.
A. Abbe's Tent.
M. Merriman's Tent.
B. Boehmer's Bed (rock) in 1873.

AE. Abbe's Equatorial.
LE. Langley's Equatorial.
T. Thermographic Apparatus.
SS. Signal Service Station.
G. Gardner's Monument.

Gardner's monument is a point in his primary triangulation, and its location as given by him is: Latitude, N. 38° 50′ 27″.3; longitude, W. 105° 2′ 25″.6; altitude, 14,147 feet

Diagram A.

Thermometer Chart, Colorado Springs. Altitude 6038 feet.

——————— Observed thermometer, July 29.
··················· " " July 30.
— — — — — " " mean of five days, July 26, 27, 28, 30, 31.

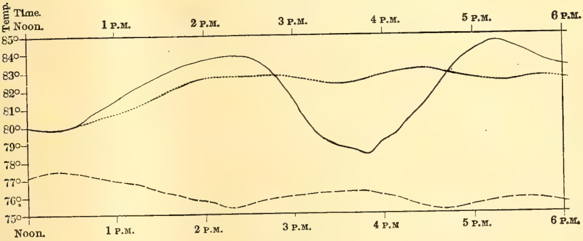
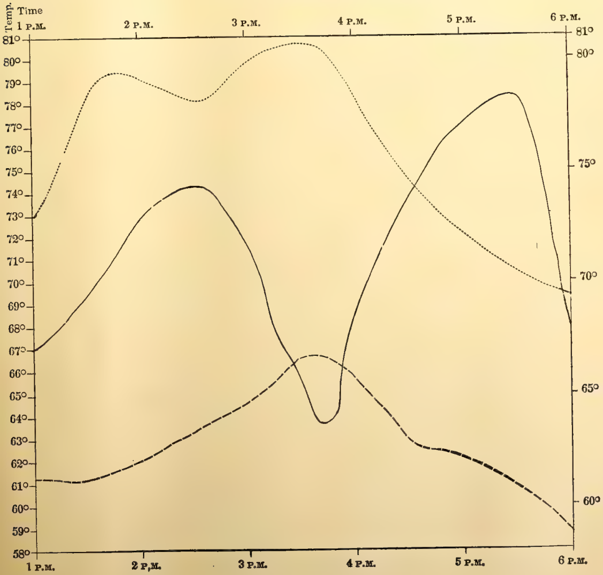


Diagram B.

Thermometer Chart, Lake House. Altitude 10,230 feet.

——————— Observed thermometer, July 29.
··················· " " July 30.
— — — — — " " mean of five days, July 26, 27, 28, 30, 31.



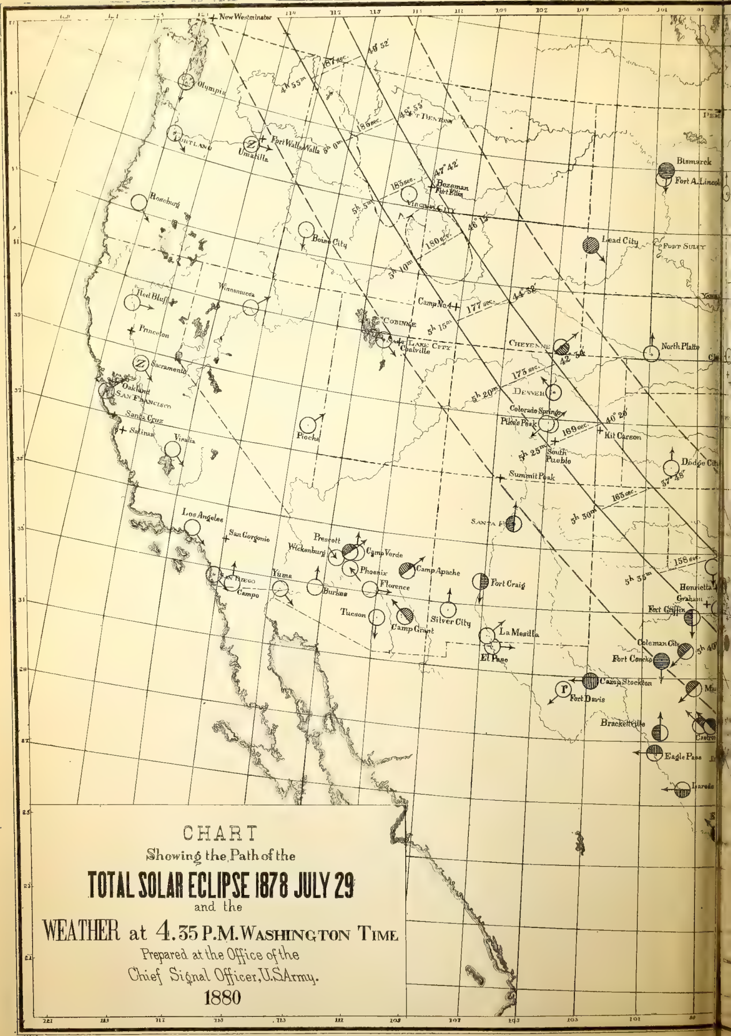
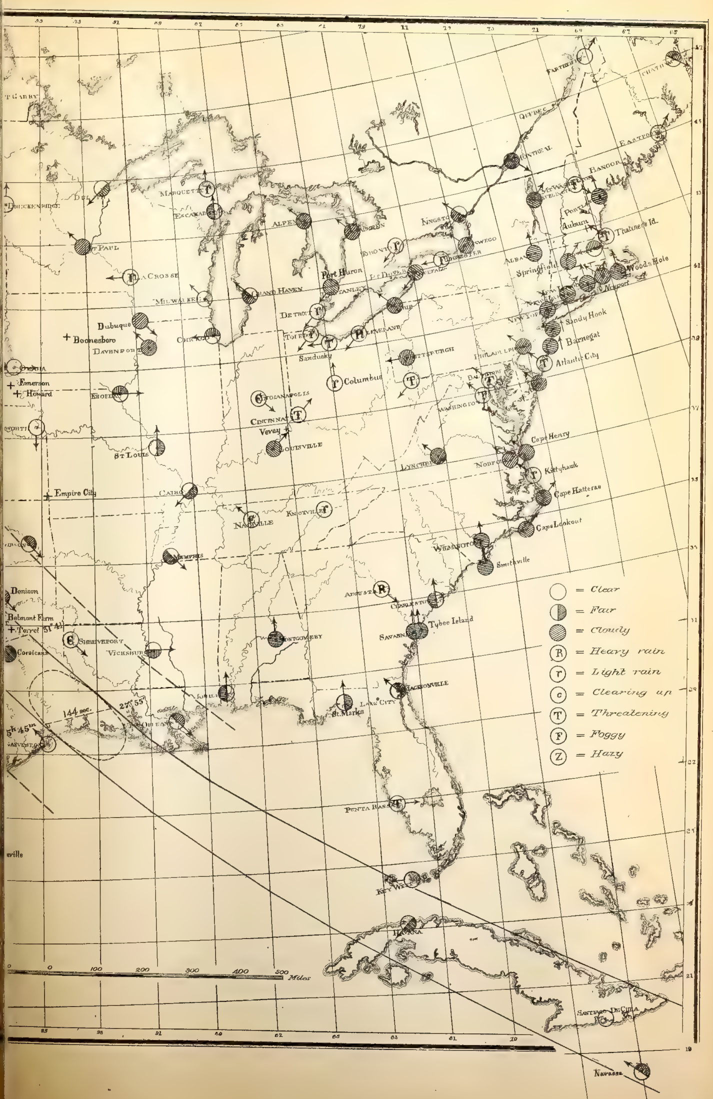


CHART
Showing the Path of the
TOTAL SOLAR ECLIPSE 1878 JULY 29
and the
WEATHER at 4.35 P.M. WASHINGTON TIME
Prepared at the Office of the
Chief Signal Officer, U.S. Army.
1880



○ = Clear
◐ = Fair
● = Cloudy
R = Heavy rain
r = Light rain
c = Clearing up
T = Threatening
F = Foggy
Z = Hazy
0 100 200 300 400 500 Miles
Quebec
Montreal
Fartherpt
Chatham
Eastport
Bangor
Mt Washington
Portland
Auburn
Thatcher's Id.
Woods Hole
Newport
Springfield
Albany
Kingston
Oswego
Rochester
Buffalo
Toronto
Pt Dover
Alpena
Marquette
Escanaba
Duluth
Breckenridge
St Paul
La Crosse
Milwaukee
Grand Haven
Port Huron
Stanley
Detroit
Toledo
Sandusky
Cleveland
Erie
Pittsburgh
Columbus
Chicago
Dubuque
Boonesboro
Davenport
Keokuk
Omaha
Emerson
Howard
Indianapolis
Cincinnati
Vevay
Louisville
St Louis
Cairo
Nashville
Knoxville
Memphis
Empire City
Denison
Belmont Farm
Torrel 31° 4′
Corsicana
Shreveport
Vicksburg
Montgomery
Mobile
New Orleans
Galveston
27° 55′
144 sec.
5h 45m
St. Marks
Lake City
Jacksonville
Savannah
Tybee Island
Charleston
Augusta
Wilmington
Smithville
Cape Lookout
Cape Hatteras
Kittyhawk
Norfolk
Cape Henry
Lynchburg
Washington
Baltimore
Philadelphia
Atlantic City
Barnegat
Sandy Hook
New York
New Haven
Punta Rassa
Key West
Havana
Santiago De Cuba
Navassa

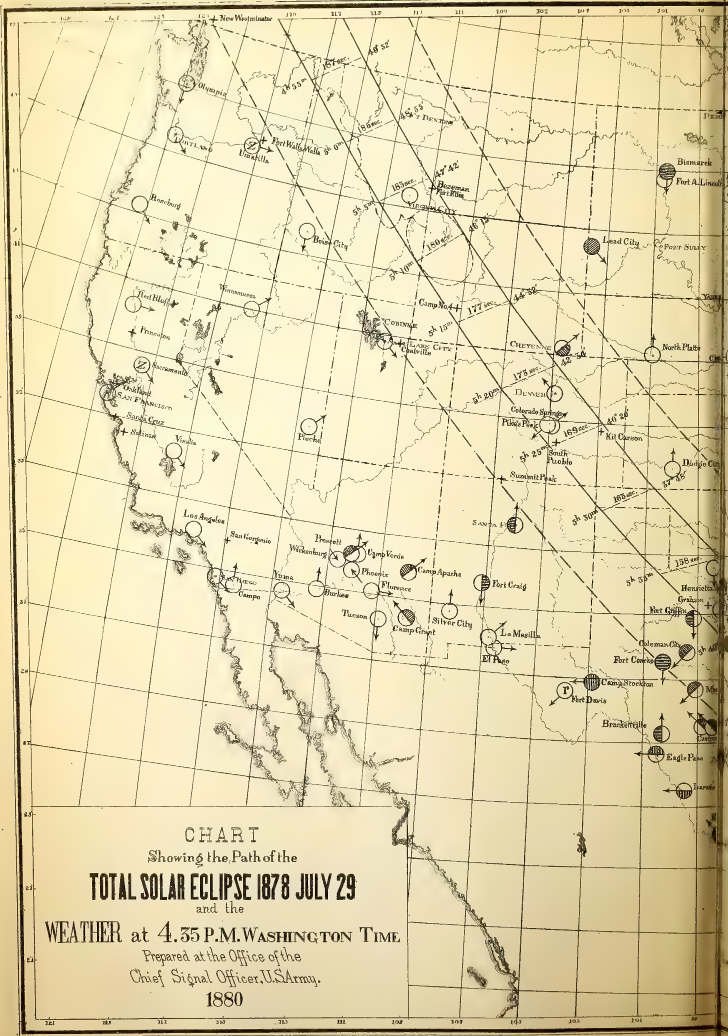


CHART
Showing the Path of the
TOTAL SOLAR ECLIPSE 1878 JULY 29
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WEATHER at 4.35 P.M. WASHINGTON TIME
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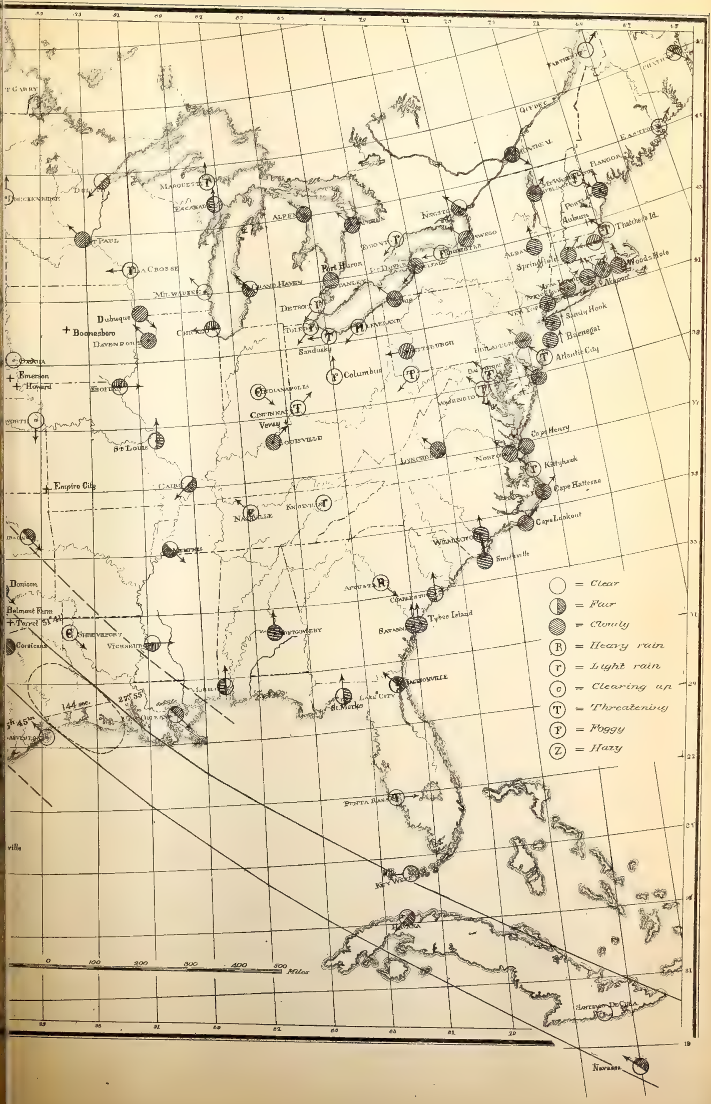
1880


= Clear
= Fair
= Cloudy
R = Heavy rain
r = Light rain
c = Clearing up
T = Threatening
F = Foggy
Z = Hazy
0
100
200
300
400
500 Miles
144 sec.
27°55'
31°41'
45m
Quebec
Montreal
Father Point
Chatham
Eastport
Bangor
Mt Washington
Portland
Auburn
Thatcher's Id.
Woods Hole
Newport
Springfield
Albany
New London
New York
Sandy Hook
Barnegat
Atlantic City
Philadelphia
Baltimore
Washington
Cape Henry
Norfolk
Kittyhawk
Cape Hatteras
Cape Lookout
Wilmington
Smithville
Charleston
Augusta
Savannah
Tybee Island
Jacksonville
Lake City
St. Marks
Punta Rassa
Key West
Havana
Santiago De Cuba
Navassa
Kingston
Oswego
Rochester
Buffalo
Port Dover
Toronto
Erie
Cleveland
Toledo
Sandusky
Detroit
Port Huron
Stanley
Alpena
Grand Haven
Milwaukee
Chicago
Escanaba
Marquette
Duluth
St Paul
La Crosse
Dubuque
Davenport
Boonesboro
Omaha
Emerson
Howard
Keokuk
St Louis
Cairo
Empire City
Memphis
Nashville
Knoxville
Louisville
Vevay
Cincinnati
Indianapolis
Columbus
Pittsburgh
Lynchburg
Montgomery
Mobile
Shreveport
Vicksburg
New Orleans
Denison
Belmont Farm
Terrel
Corsicana
Galveston
Breckenridge
Fort Garry
ville

VIII.

DRAWINGS OF THE CORONA.

1. Old Baldy, Mont	W. Martin.
2. Virginia City, Mont	A. J. Bennet.
3. Virginia City, Mont	F. Kellegher.
4. Coalville, Utah	T. Bullock.
5. Denver, Colo	J. M. Bagley.
6. Little Sandy, Wyo	W. H. Holmes.
7. Pike's Peak, Colo	H. T. Crosby.
8. Pike's Peak, Colo	H. H. C. Dunwoody.
9. Lake House, Colo	C. Abbe.
10. Lake House, Colo	W. Wiley.
11. Manitou, Colo	W. W. Nichols.
12. Colorado Springs, Colo	J. H. Kerr.
13. Colorado Springs, Colo	A. R. Byrd.
14. Colorado Springs, Colo	A. Stewart.
15. Colorado Springs, Colo	L. Ratliff.
16. Colorado Springs, Colo	E. Curtis.
17. South Pueblo, Colo	E. S. Nettleton.
18. Clear Creek, Nebr	A. F. Bryant.
19. Fort Sill, Ind. T	S. R. Whitall.
20. Henrietta, Tex	J. J. Mullen.
21. Henrietta, Tex	J. D. Harston.
22. Henrietta, Tex	M. Harrold.
23. Jacksboro', Tex	P. M. Wilson.
24. Graham, Tex	A. B. Grant.
25. Pilot Point, Tex	C. F. Reeves.
26. Belmont Farm, Tex	T. M. Scott.
27. Corsicana, Tex	N. Cumming.
28. Havana, Cuba	C. Hasselbrink.

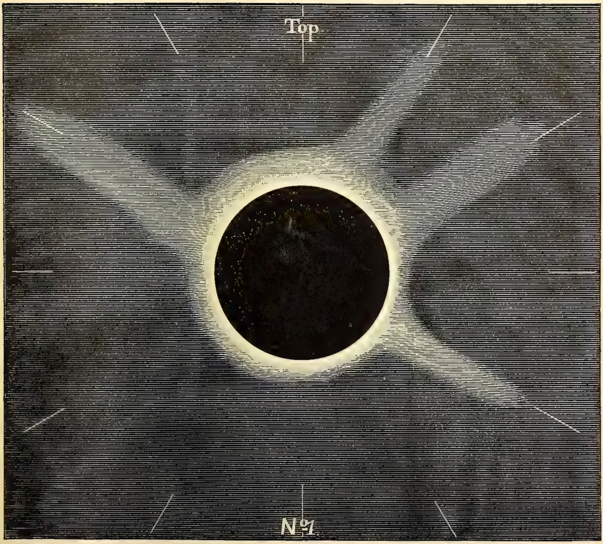
SKETCH No. 1.

Station, Old Baldy Mountain, Montana ....Observer, William Martin.
Latitude, 44° 57′ ....Instrument, naked eye.
Longitude, 111° 0′..........................Duration of totality, 170 seconds.
Altitude, 10,000 feet........................Middle of totality, $5^{h}\ 6^{m}\ 0^{s}$, W. M. T.

NOTES.

(See letter Obs. 4470, encl. 5.) No red prominences were seen. The original represents the outline of the upper right-hand beam as being extremely faint as compared with the beams lying in the ecliptic.

See report No. 71 and 72 § XI.


Top
Nº1

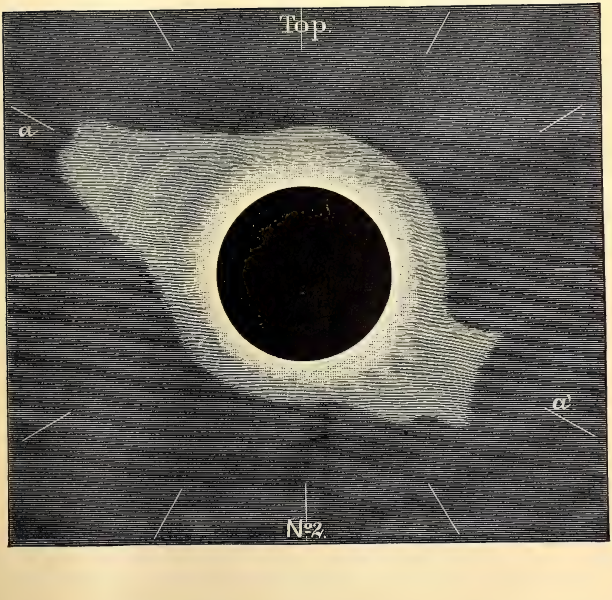
SKETCH No. 2.

Station, Virginia City, Mont..................Observer, A. J. Bennet.
Latitude, 45° 0′..........................Instrument, naked eye.
Longitude, 111° 3′..........................Duration of totality, 178 seconds.
Altitude, 5,700 feet..........................Middle of totality, $5^h\ 6^m$, W. M. T.

NOTES.

(See letter Obs. 4470, encl. 6.) Sketch made with the help of a sketching frame. At A and A′ the corona faded gradually away and was broken up in streaks; elsewhere the outer edge was sharply defined.

(See reports No. 71 and 72 § VI.)


Top.
a
a'
No. 2.

SKETCH No. 3.

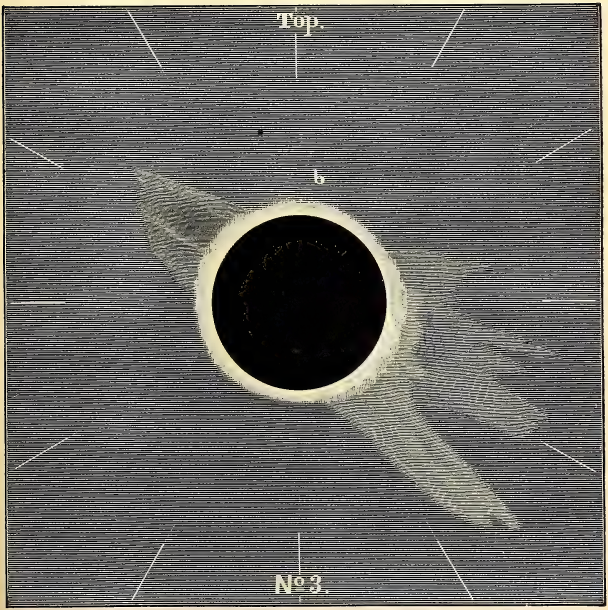
Station, Virginia City, Mont................Observer, F. Kellegher.
Latitude, 45° 0′.........................Instrument, naked eye
Longitude, 112° 3′........................Duration of totality 178 seconds.
Altitude, 5,700 feet........................Middle of totality, $5^h\ 6^m$, W. M. T.

NOTES.

(See letter Obs. 4470, encl. 8.) Sketch made with the help of a sketching frame.

At *b* an almost opaque spot in the corona, which gradually disappeared; the rays, as represented, did not appear all at once, but by degrees, obtaining their greatest extent towards the third minute.

See reports Nos. 71 and 72, § IV.


Top.
b
Nº 3.

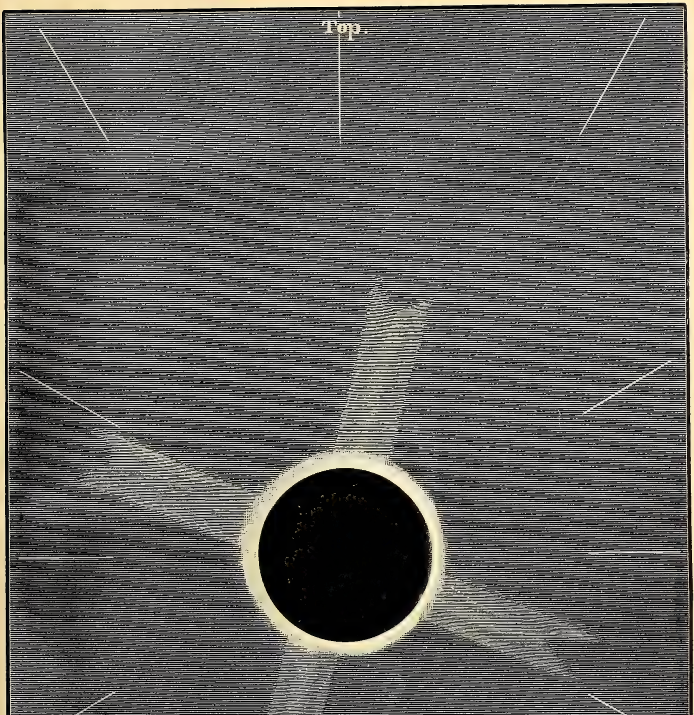
SKETCH No. 4.

Station, Coalville, Utah	Observer, T. Bullock.
Latitude, 40° 54′	Instrument, naked eye.
Longitude, 111° 26′	Duration of totality, not total.
Altitude, 5,630 feet	Greatest obcuration about 5h 10m W. M. T.

NOTES.

(See letter V. R. 4373.) States that others, like himself, saw the eclipse as given in this diagram.

See reports Nos. 101 and 102.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Nº4.

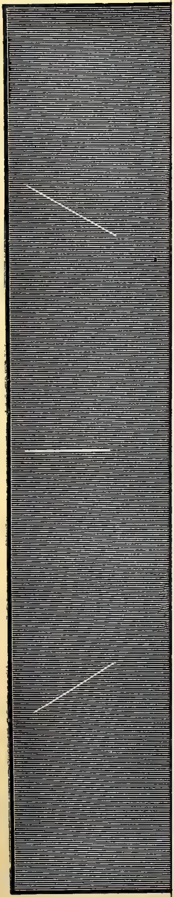
SKETCH No. 45.

Station, Denver, Colo .... Observer, J. M. Bagley.
Latitude, 39° 44′ .... Instrument, naked eye.
Longitude, 105° .... Duration of totality, 179 seconds.
Altitude, 5,300 feet .... Middle of totality, 5^h 22^m, W. M. T.

NOTES.

(See letter Obs. 4290, encl. 3, and also 5358.) States that he saw no stars within or near to the coronal rays; no lines nor striæ were seen; width of the corona one-third the diameter of the sun.

See report No. 46.



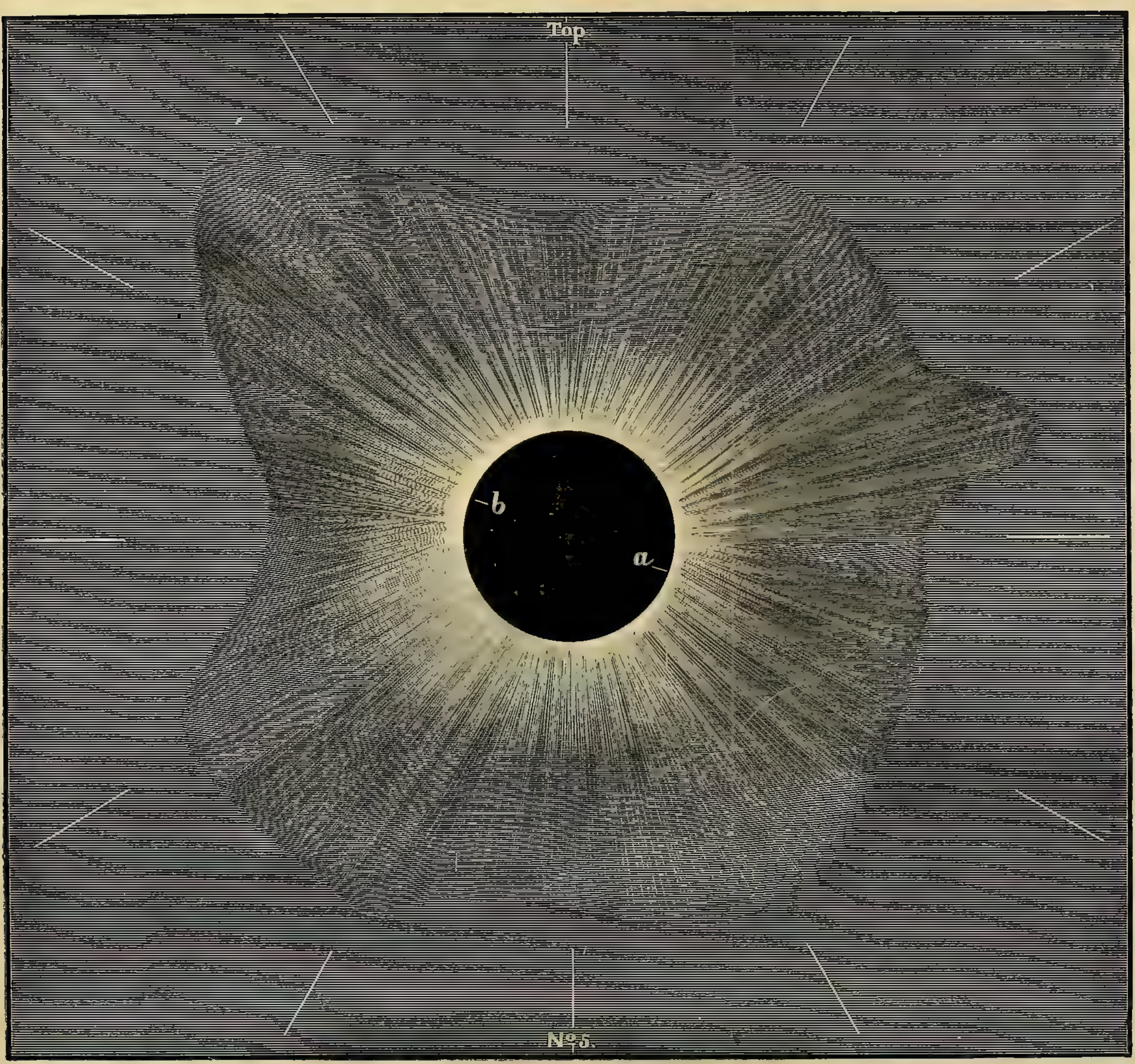
SKETCH No. 45.

Station, Denver, Colo .... Observer, J. M. Bagley.
Latitude, 39° 44′ .... Instrument, naked eye.
Longitude, 105° .... Duration of totality, 179 seconds.
Altitude, 5,300 feet .... Middle of totality, 5^h 22^m, W. M. T.

NOTES.

(See letter Obs. 4290, encl. 3, and also 5358.) States that he saw no stars within or near to the coronal rays; no lines nor striæ were seen; width of the corona one-third the diameter of the sun.

See report No. 46.


Top
b
a
Nº 5.

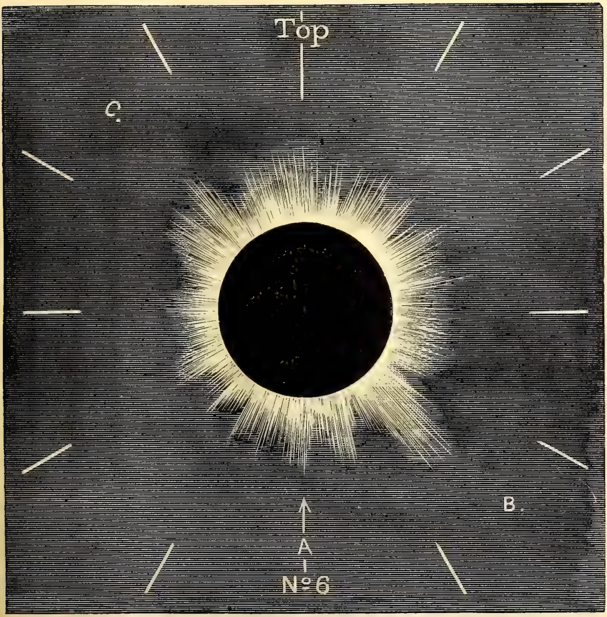
SKETCH No. 6.

Station, Camp No. 4, Little Sandy, Wy.....Observer, W. H. Holmes.
Latitude, 42° 08′ ....Instrument, small telescope.
Longitude, 109° 10′ ....Duration of totality, 147 seconds.
Altitude, 7,300? feet ....Middle of totality, 5^h 14^m, W. M. T.

NOTES.

(See letters Nos. 19 and 151, misc., 1880.) This sketch was made with the help of a telescope of 1.2 inches aperture; the sun was surrounded with minute brilliant pencils of light of many colors. At A, B, and C, the sketch represents the rays and colors very nearly as seen. The rest of the sketch is approximate.

See report No. 108.


Top
C.
B.
A
Nº 6

SKETCH No. 7.

Station, Pike's Peak Summit, Colo	Observer, H. T. Crosby.
Latitude, 38° 50′	Instrument, naked eye.
Longitude, 105° 2′	Duration of totality, 160 seconds.
Altitude, 14,150 feet	Middle of totality, $5^h\ 24^m$, W. M. T.

NOTES.

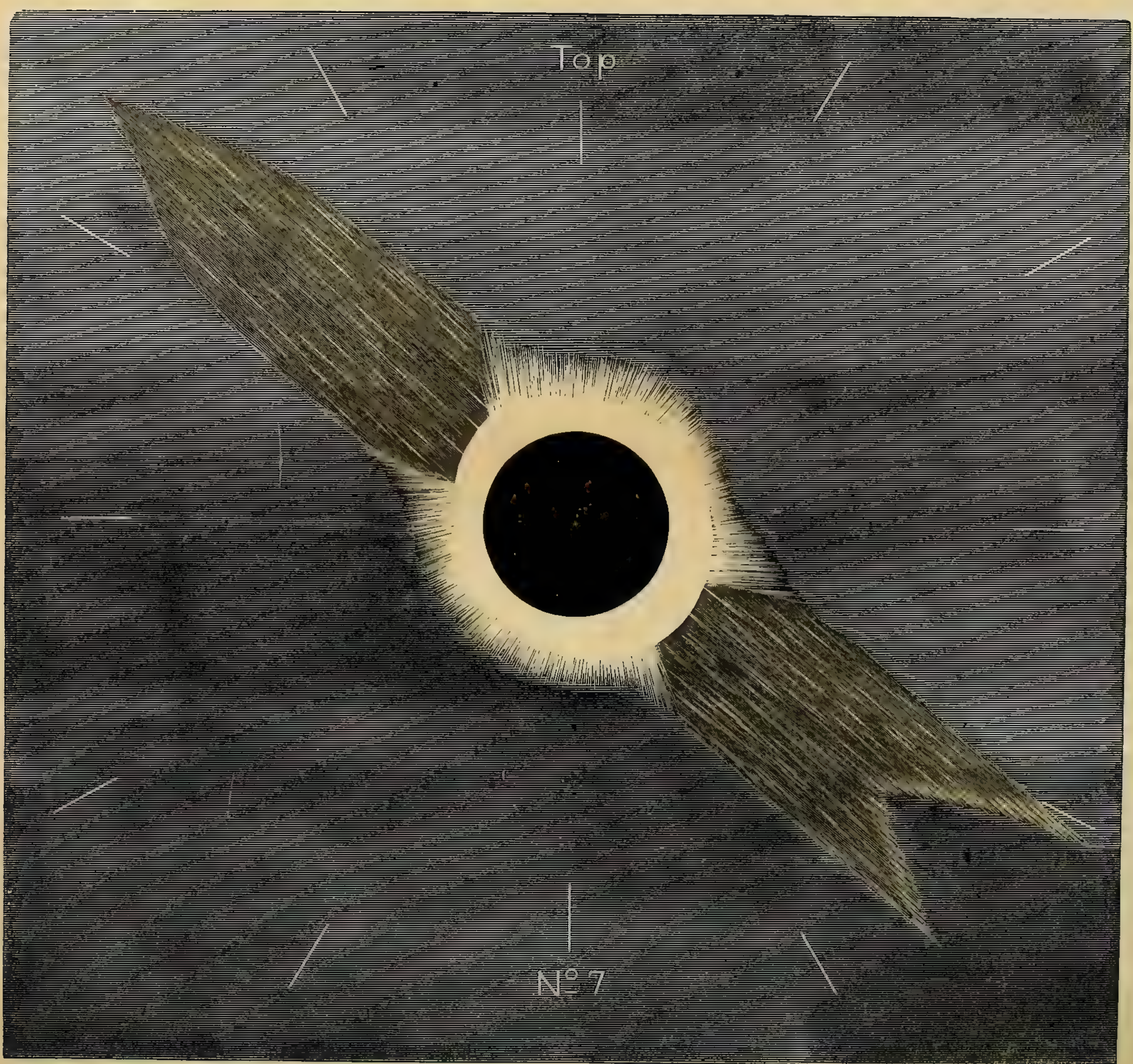
(See letter No. 2054, misc., 1880.) The extent of the brilliant inner corona of golden light, as given by this sketch, was about 8′ above the surface of the sun, but was greater in the upper left-hand and lower right-hand quadrants; the long silvery rays were traced to 3° from center of the sun, according to the text of report No. 19,—but this engraving follows Mr. Crosby's drawing, in which the extension from sun's center is limited to 3 and 3½ diameters for each ray respectively.

SKETCH No. 7.

Station, Pike's Peak Summit, Colo........Observer, H. T. Crosby.
Latitude, 38° 50'...........................Instrument, naked eye.
Longitude, 105° 2'.........................Duration of totality, 160 seconds.
Altitude, 14,150 feet......................Middle of totality, $5^h\ 24^m$, W. M. T.

NOTES.

(See letter No. 2054, misc., 1880.) The extent of the brilliant inner corona of golden light, as given by this sketch, was about 8' above the surface of the sun, but was greater in the upper left-hand and lower right-hand quadrants; the long silvery rays were traced to 3° from center of the sun, according to the text of report No. 19,—but this engraving follows Mr. Crosby's drawing, in which the extension from sun's center is limited to 3 and 3½ diameters for each ray respectively.


Top
N° 7

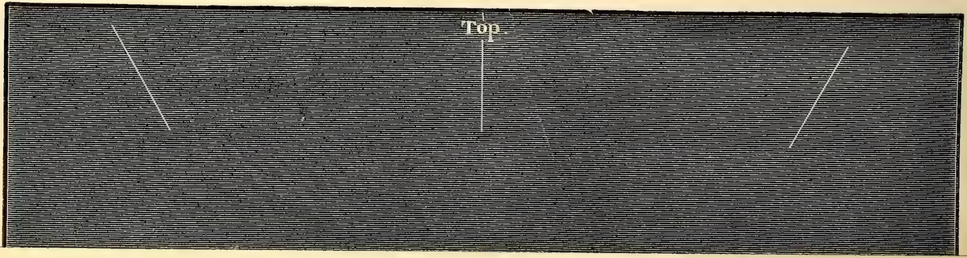
SKETCH No. 8.

Station, Pike's Peak Summit, Colo........Observer, H. H. C. Dunwoody.
Latitude, 38° 50′........................Instrument, naked eye.
Longitude, 105° 2′.......................Duration of totality, 158 seconds.
Altitude, 14,150 feet....................Middle of totality, $5^h\ 24^m$, W. M. T.

NOTES.

(See letter 1748, misc., 1878.) The sketch from which the engraving was made was from memory in October, 1878. The narrow ring of orange-yellow light appeared broader on the right-hand side.

See report No. 15.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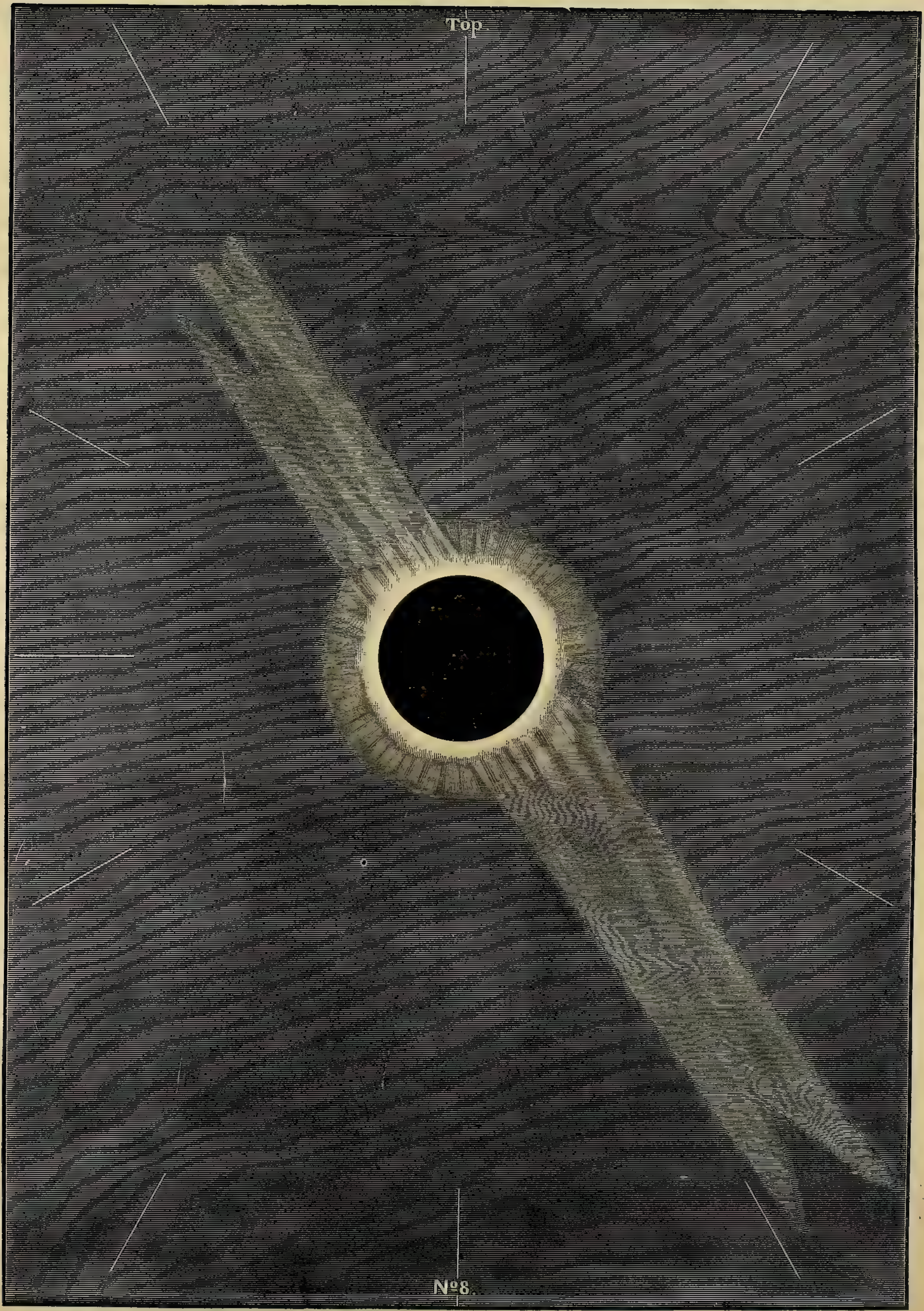
SKETCH No. 8.

Station, Pike's Peak Summit, Colo	Observer, H. H. C. Dunwoody.
Latitude, 38° 50′	Instrument, naked eye.
Longitude, 105° 2′	Duration of totality, 158 seconds.
Altitude, 14,150 feet	Middle of totality, $5^h 24^m$, W. M. T.

NOTES.

(See letter 1748, misc., 1878.) The sketch from which the engraving was made was from memory in October, 1878. The narrow ring of orange-yellow light appeared broader on the right-hand side.

See report No. 15.


Top
Nº8.

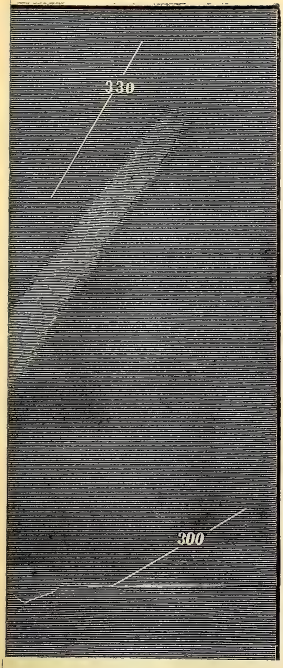
SKETCH No. 9.

Station, Pike's Peak Lake House, Colo.....Observer, C. Abbe.
Latitude, 38° 49′.5.............................Instrument, naked eye.
Longitude, 105° 0′.4...........................Duration of totality, 160 seconds.
Altitude, 10,230 feet...........................Middle of totality, $5^h\ 24^m$, W. M. T.

NOTES.

See letter (misc., 1287, encl. 3) for complete description. Professor Loud states that the ray perpendicular to the ecliptic, as seen by Mr. Abbe at the Lake House, was also distinctly seen by an intelligent observer at Colorado Springs, of which fact he first became aware on the 20th of August.

See reports No. 28, § d, and No. 43.



330
300

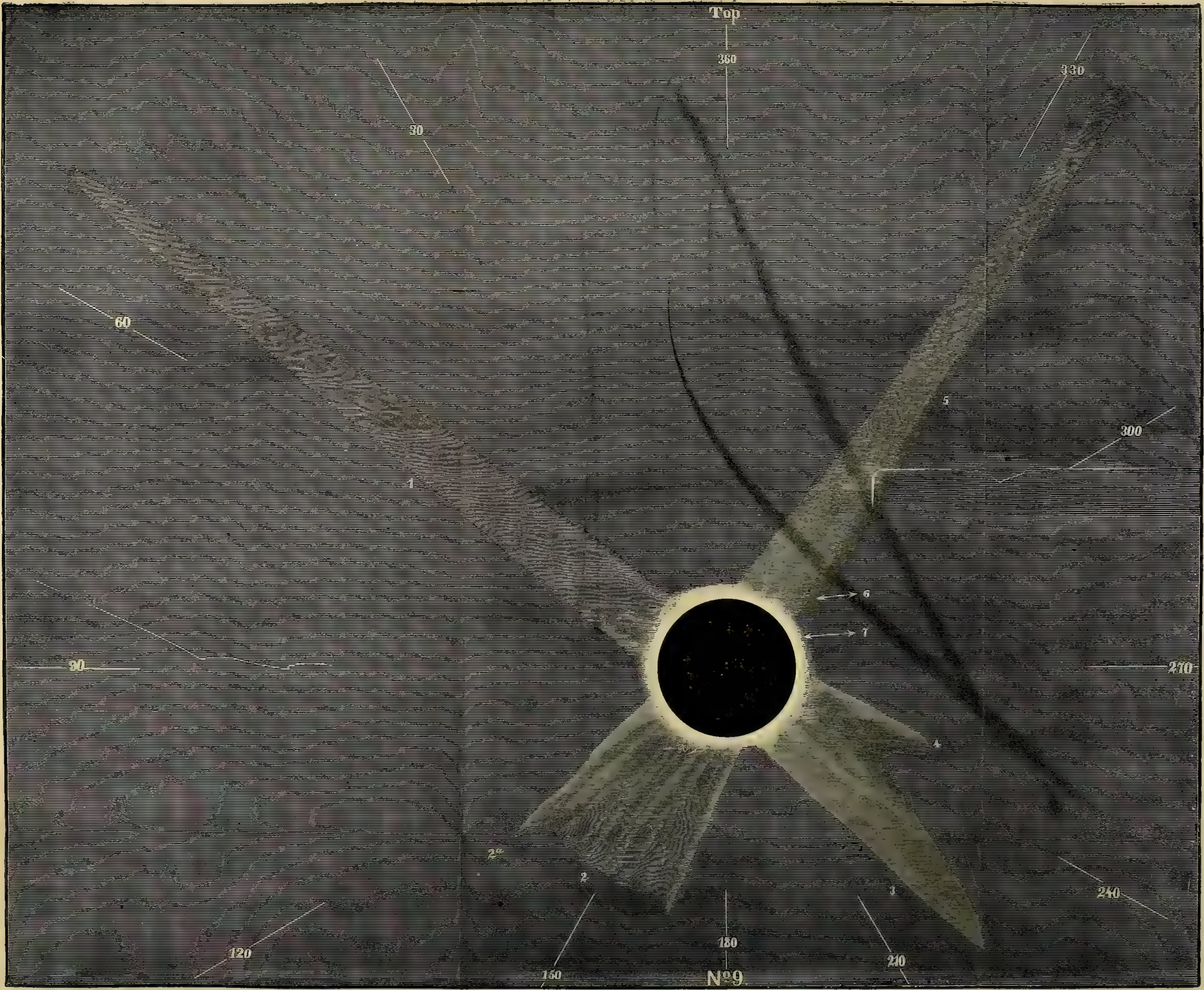
SKETCH No. 9.

Station, Pike's Peak Lake House, Colo.....Observer, C. Abbe.
Latitude, 38° 49′.5..............................Instrument, naked eye.
Longitude, 105° 0′.4...........................Duration of totality, 160 seconds.
Altitude, 10,230 feet...........................Middle of totality, 5^{h} 24^{m}, W. M. T.

NOTES.

See letter (misc., 1287, encl. 3) for complete description. Professor Loud states that the ray perpendicular to the ecliptic, as seen by Mr. Abbe at the Lake House, was also distinctly seen by an intelligent observer at Colorado Springs, of which fact he first became aware on the 20th of August.

See reports No. 28, § d, and No. 43.



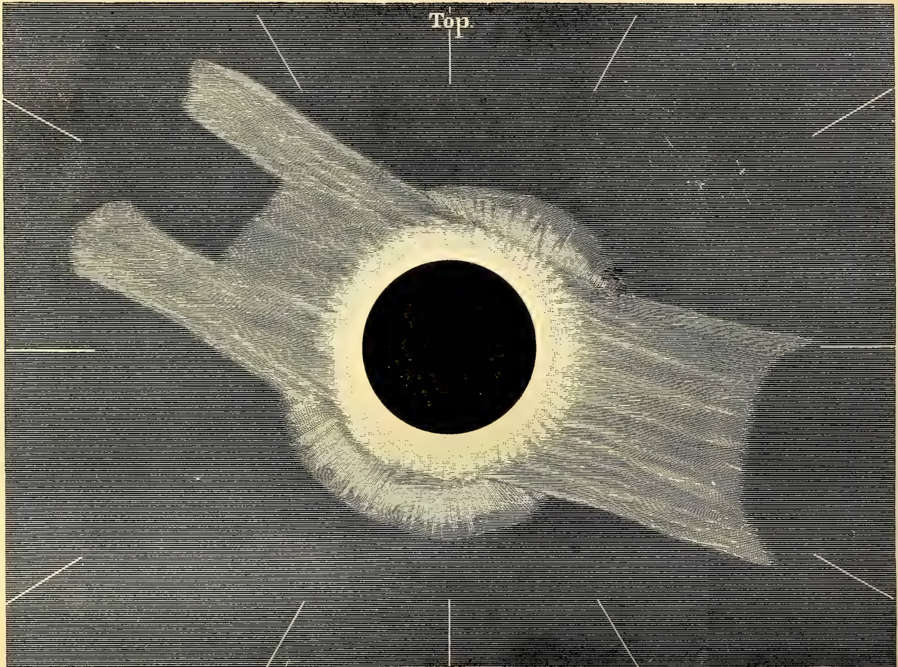
Nº9.

SKETCH No. 10.

Station, Pike's Peak, Lake House, Colo....Observer, W. Wiley.
Latitude, 38° 49'.5..........................Instrument, naked eye.
Longitude, 105° 0'.4.........................Duration of totality, 162 seconds.
Altitude, 10,230 feet.........................Middle of totality, 5^h 24^m, W. M. T.

NOTES.

See letter (3696 V. R., encl. 3).
See report No. 42.



Nº10.

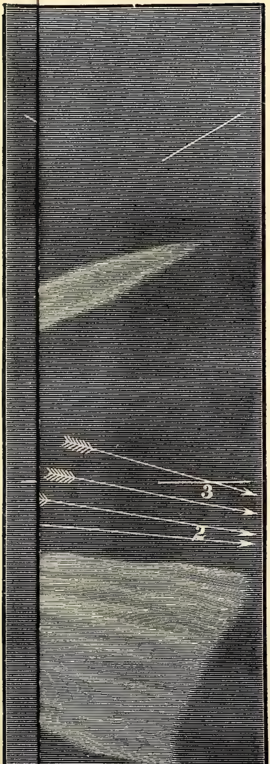
SKETCH No. 11.

Station, Manitou, Colo ....Observer, W. W. Nichols.
Latitude, 38° 51′.8.............................Instrument, opera-glass.
Longitude, 104° 54′.7 ....Duration of totality, 165 seconds.
Altitude, 6,300 feet ....Middle of totality, $5^h\ 24^m$, W. M. T.

NOTES.

See letter (3696 V. R., encl. 4). The stars were added to the sketch after the clos of totality.

See report No. 42.


3
2

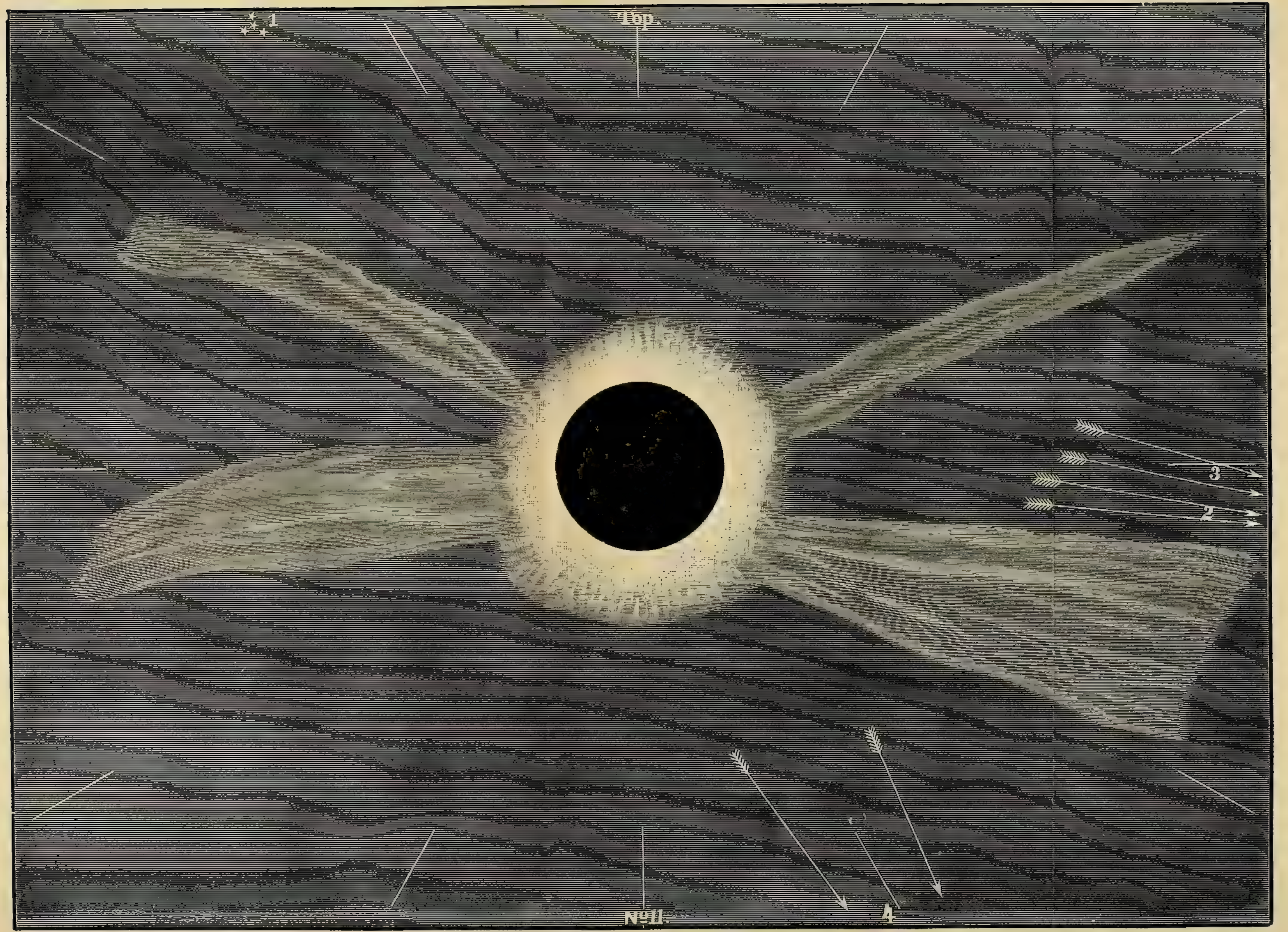
SKETCH No. 11.

Station, Manitou, Colo ....Observer, W. W. Nichols.
Latitude, 38° 51′.8........................Instrument, opera-glass.
Longitude, 104° 54′.7 ....Duration of totality, 165 seconds.
Altitude, 6,300 feet ....Middle of totality, 5^h 24^m, W. M. T.

NOTES.

See letter (3696 V. R., encl. 4). The stars were added to the sketch after the close of totality.

See report No. 42.


Top.
1
3
2
4
Nº II.

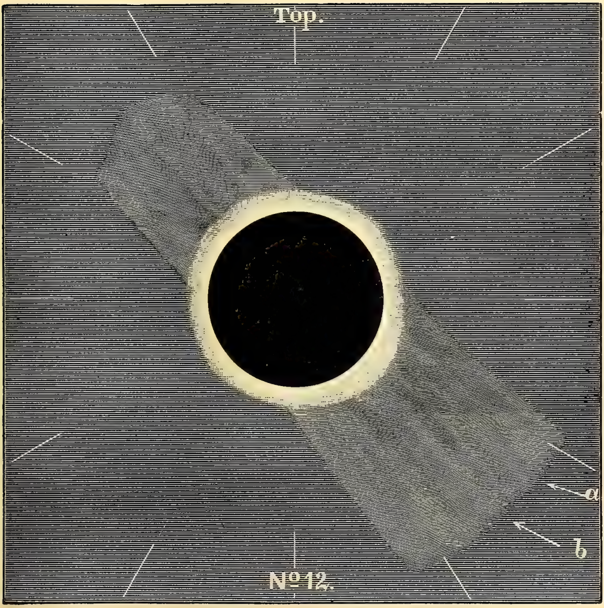
SKETCH No. 12.

Station, Colorado Springs, Colo............Observer, J. H. Kerr.
Latitude, 38° 50′.5 ....Instrument, 2-inch Signal Service glass.
Longitude, 104° 49′..........................Duration of totality, 160 seconds.
Altitude, 6,038 feet ....Middle of totality, 5^{h} 24^{m}, W. M. T.

NOTES.

See letter (3696 V. R., encl. 8). The coronal beams were striated as shown in the figure. It was brighter near its edges, but faint nearer the middle line, and remote from the sun. A blue light, invisible with telescope, was seen with the naked eye.

See report No. 42.

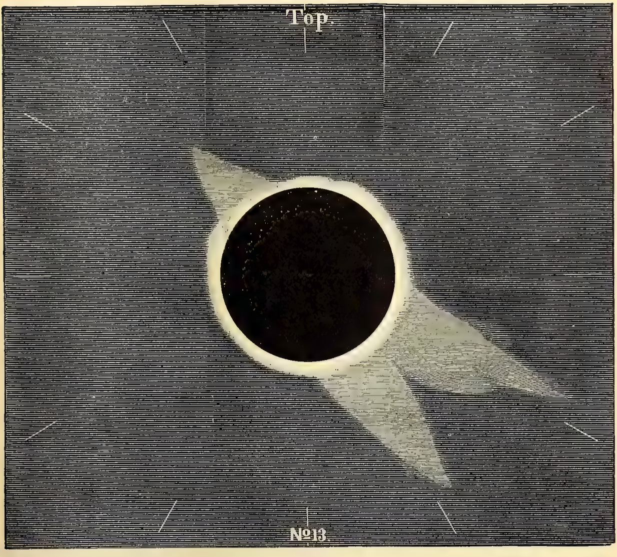

Top.
a
b
Nº 12.

SKETCH No. 13.

Station, Colorado Springs, Colo	Observer, A. R. Byrd.
Latitude, 38° 50′	Instrument, naked eye.
Longitude, 104° 49′	Duration of totality, 160 seconds.
Altitude, 6,038 feet	Middle of totality, $5^h\ 24^m$, W. M. T.

NOTES.

See letter (3696 V. R., encl. 7).
See report No. 42.


Top.
№13.

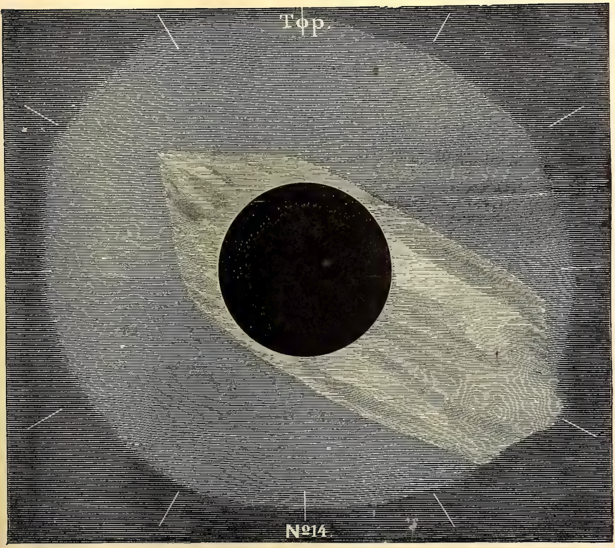
SKETCH No. 14.

Station, Colorado Springs, Colo	Observer, Alice Stewart.
Latitude, 38° 50′	Instrument, naked eye.
Longitude, 104° 49′	Duration of totality, 160 seconds.
Altitude, 6,038 feet	Middle of totality, $5^h\ 24^m$, W. M. T.

NOTES.

See letter (3696 V. R., encl. 6). The original drawing presents an indefinite light surrounding the sun at a distance of about 2 diameters on all sides, and slightly elongated in the direction of the ecliptic; within this the beams to the east and west are entirely contained; both faded away indefinitely at the extremities, but had sharply-defined edges.

See report No. 42.


Top.
Nº14.

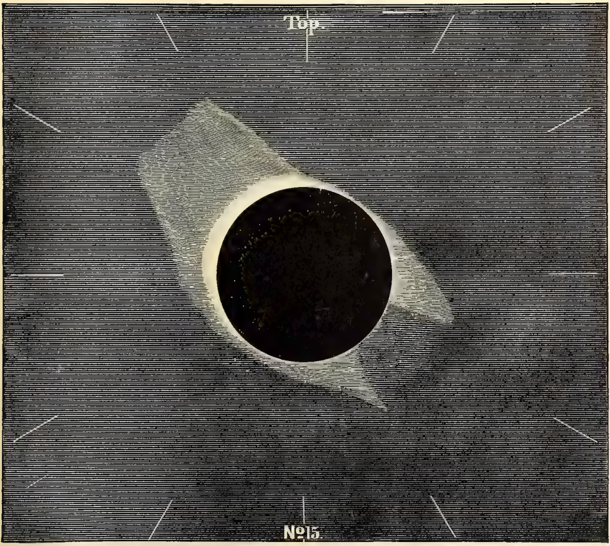
SKETCH No. 15.

Station, Colorado Springs, Colo. .... Observer, L. Ratliff.
Latitude, 38° 50′ .... Instrument, naked eye.
Longitude, 104° 49′ .... Duration of totality, 160 seconds.
Altitude, 6,038 feet .... Middle of totality, 5^{h} 24^{m}, W. M. T.

NOTES.

(See letters 3696 V. R., encl. 5.) The right-hand or southwest portion of this sketch was unfinished. Observer began at bottom and sketched around the sun in the direction, bottom, left, top, right. The upper left-hand coronal beam had an indefinite ending; all other portions were sharply defined in the original.

See report No. 42.



No 15.

SKETCH No. 16.

Station, Colorado Springs, Colo	Observer, E. Curtis.
Latitude, 38° 50′	Instrument, naked eye.
Longitude, 104° 49′	Duration of totality, 160 seconds.
Altitude, 6,038 feet	Middle of totality, $5^h\ 24^m$, W. M. T.

NOTES.

(See letter 3696 V. R., encl. 9.) Observer began at the top of the sun and sketched around in the order, top, right, bottom, left. Definite edges are given everywhere to the coronal beams except at the upper left-hand extremity.

See report No. 42.

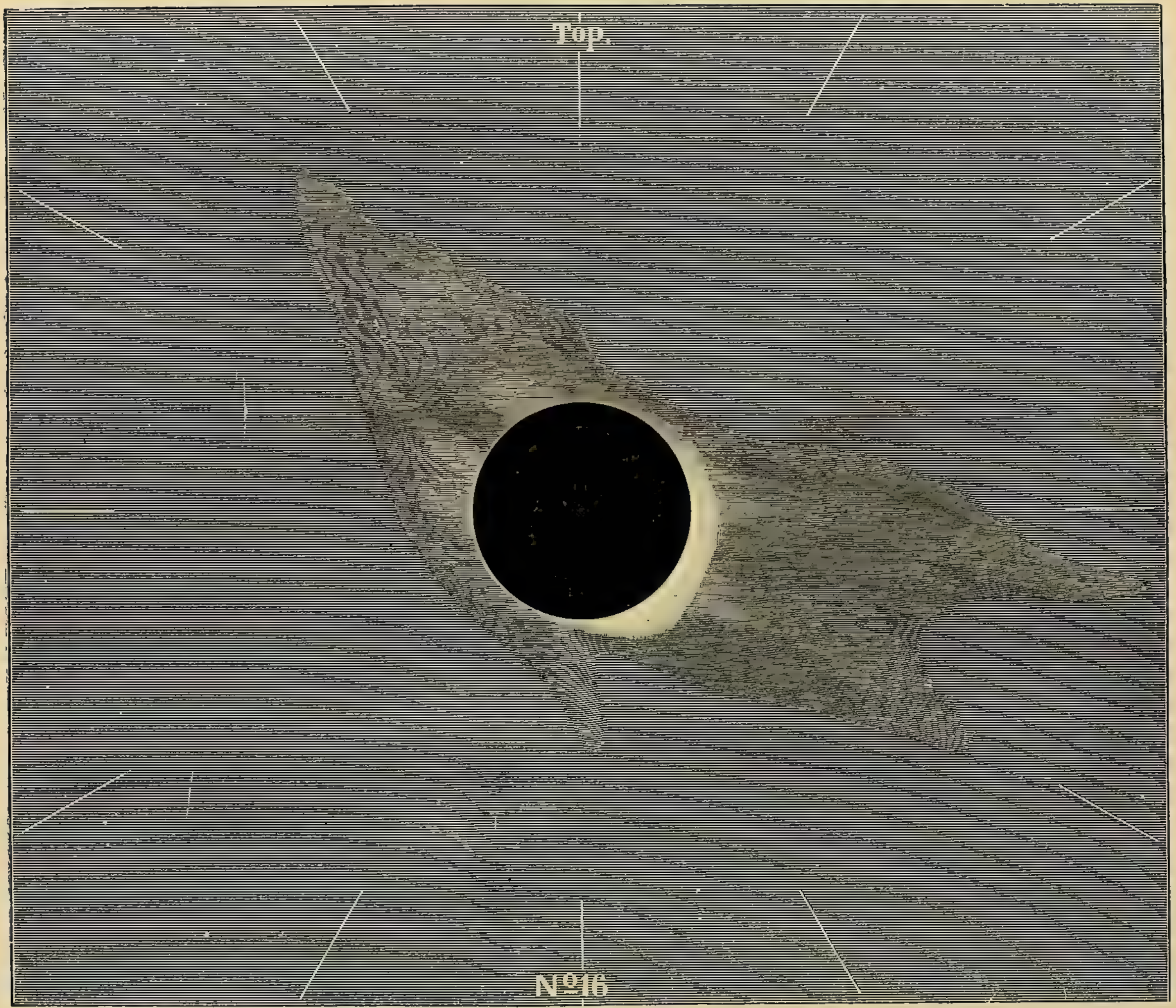
SKETCH No. 16.

Station, Colorado Springs, Colo............Observer, E. Curtis.
Latitude, 38° 50′ ....Instrument, naked eye.
Longitude, 104° 49′.........................Duration of totality, 160 seconds.
Altitude, 6,038 feet........................Middle of totality, 5^h 24^m, W. M. T.

NOTES.

(See letter 3696 V. R., encl. 9.) Observer began at the top of the sun and sketched around in the order, top, right, bottom, left. Definite edges are given everywhere to the coronal beams except at the upper left-hand extremity.

See report No. 42.


Top.
Nº16

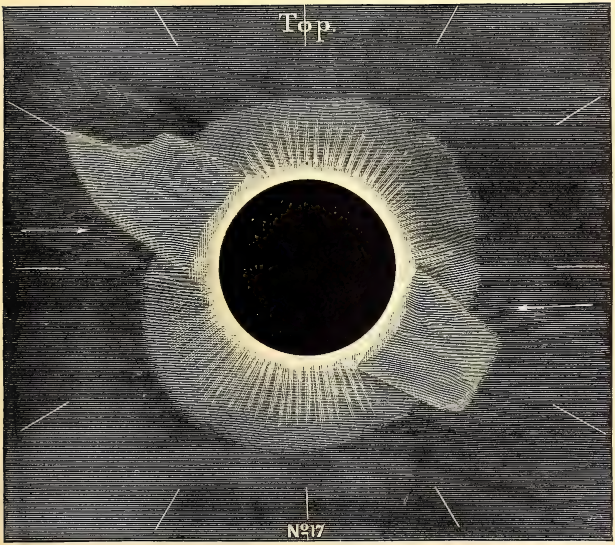
SKETCH No. 17.

Station, South Pueblo, Colo	Observer, E. S. Nettleton.
Latitude, 38° 16′	Instrument, 1-inch telescope ?
Longitude, 104° 37′	Duration of totality, 153 seconds.
Altitude, 4,630 feet	Middle of totality, $5^h 26^m$, W. M. T.

NOTES.

(See letter 3556 V. R., encl. 1.) Saw no protuberances. First and last contacts occurred at A and B. Saw four or five stars; were plainly visible.

See report No. 51.


Top.
No 17

SKETCH No. 18.

Station, Clear Creek, Nebr ....Observer, A. F. Bryant.
Latitude, 41° 13′ ....Instrument, naked eye.
Longitude, 96° 24′.......................Duration of totality, not total.
Altitude, 1,200 feet ....Greatest obscuration, ——

NOTES.

(See letter 4809, V. R. 1878.) Himself and daughter saw the appearance of a long beam like a pine tree hanging down from the sun; length 2½ or 3 diameters, fading off gently; width 1 diameter, fading off sharply. The spots on the drawing located to give the general effect. The sketch was made November 3, 1878, from memory; the first record on his monthly report of July, 1878, was apparently written at the time of observation.

See reports Nos. 75 and 76.

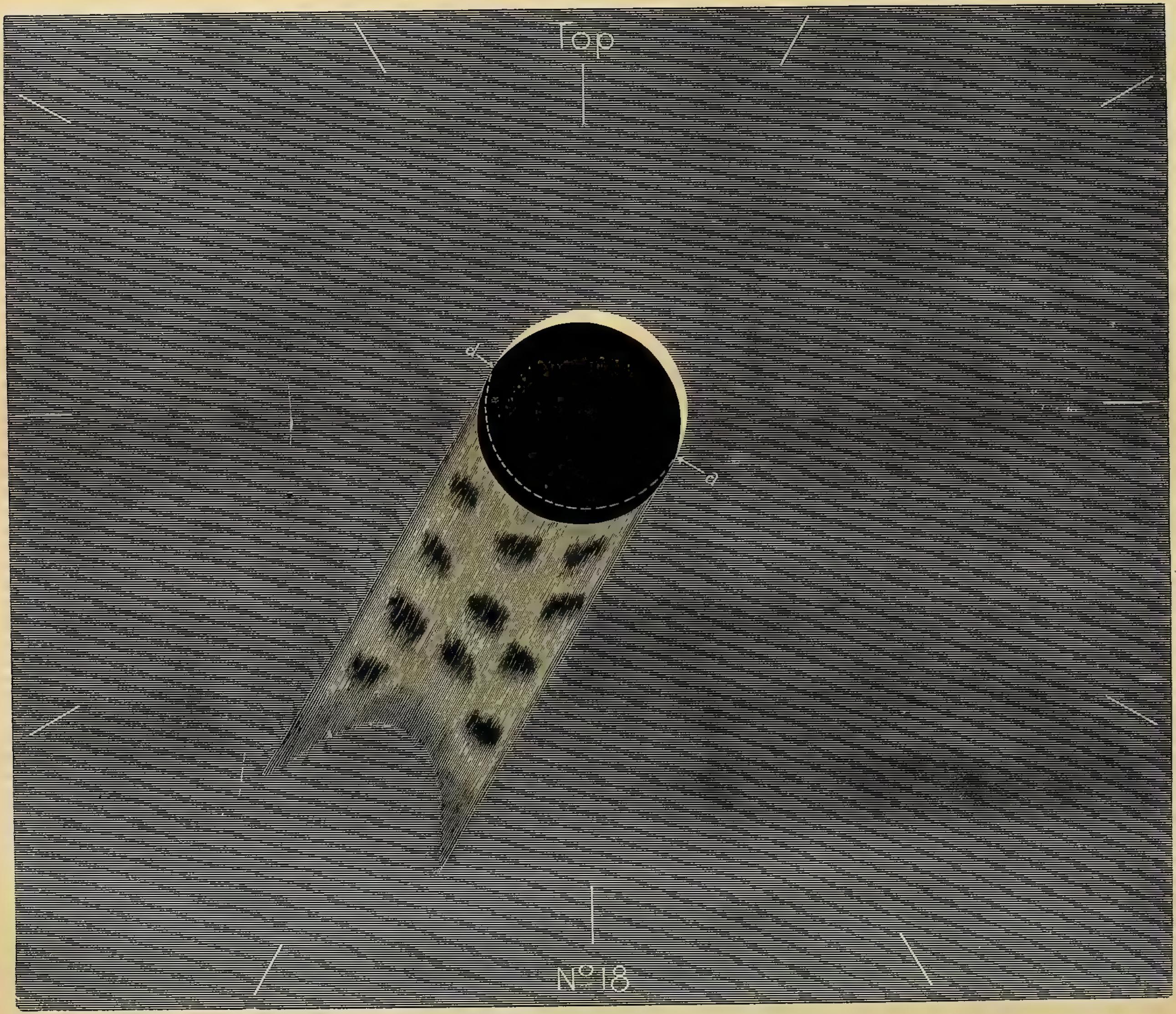
SKETCH No. 18.

Station, Clear Creek, Nebr	Observer, A. F. Bryant.
Latitude, 41° 13′	Instrument, naked eye.
Longitude, 96° 24′	Duration of totality, not total.
Altitude, 1,200 feet	Greatest obscuration, ——

NOTES.

(See letter 4809, V. R. 1878.) Himself and daughter saw the appearance of a long beam like a pine tree hanging down from the sun; length 2½ or 3 diameters, fading off gently; width 1 diameter, fading off sharply. The spots on the drawing located to give the general effect. The sketch was made November 3, 1878, from memory; the first record on his monthly report of July, 1878, was apparently written at the time of observation.

See reports Nos. 75 and 76.


Top
a
a
Nº 18

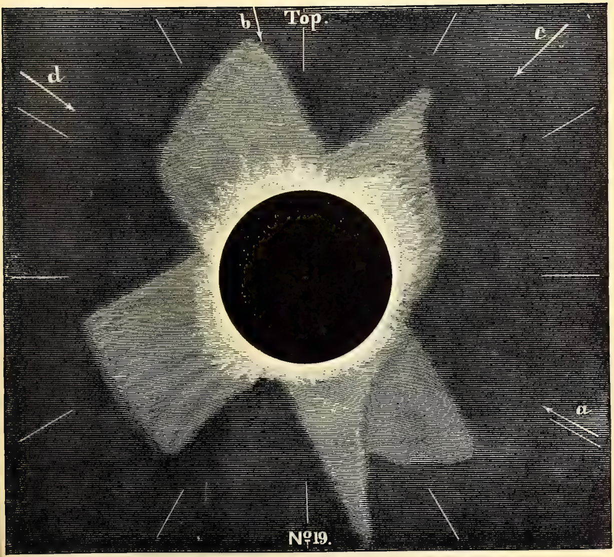
SKETCH No. 19.

Station, Fort Sill, Ind. T ....Observer, S. R. Whitall.
Latitude, 34° 39′ ....Instrument, naked eye.
Longitude, 98° 25′.......................Duration of totality, 148 seconds.
Altitude, 1,700 ? feet......................Middle of totality, 5^h 32.5^m, W. M. T.

NOTES.

See letter (4389 Obs., encl. 2 and 3). Bright lines shot out and flickered uniformly. The inner circle was of a purple hue, around which a circle of pale yellow, skirted with a circle of orange, from the edge of which the irregular striæ of white with yellow tint were observed; no appreciable change in the color during totality. The four points of contact are approximately indicated by the arrows A, B, C, D. Certain blurs on the original ink drawing are omitted in this copy, although they may have been intended to represent the red protuberances.

See reports Nos. 58, 59, 60.


b
Top.
c
d
a
Nº19.

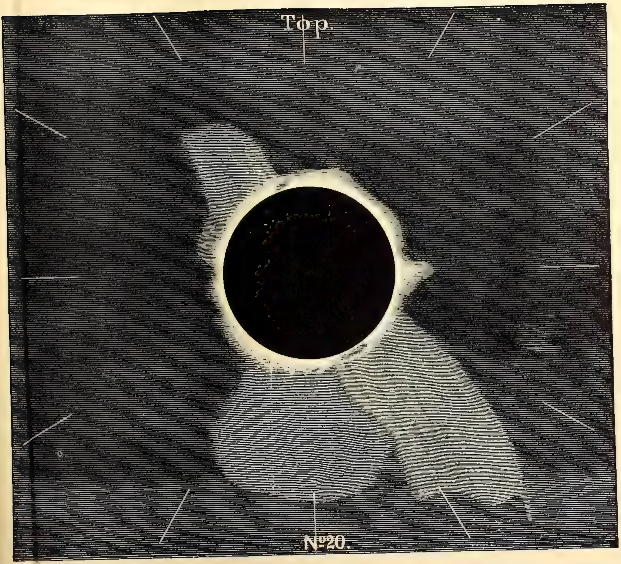
SKETCH No. 20.

Station, Henrietta, Tex ....Observer, J. J. Mullen.
Latitude, 33° 45′ ....Instrument, naked eye.
Longitude, 98° 3′...........................Duration of totality, 157 seconds.
Altitude, 915 feet..........................Middle of totality, $5^{h}\ 36^{m}$, W. M. T.

NOTES.

See letter (4577 Obs., encl. 1). Halo of a blue-gray tint; two red spots, both apparently within the edge of the moon; one seen at 30 degrees west of the bottom of the sun's limb, and the other at about 15 to 30 degrees east of the top of the sun.

See report No. 96, § I.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Nº20.

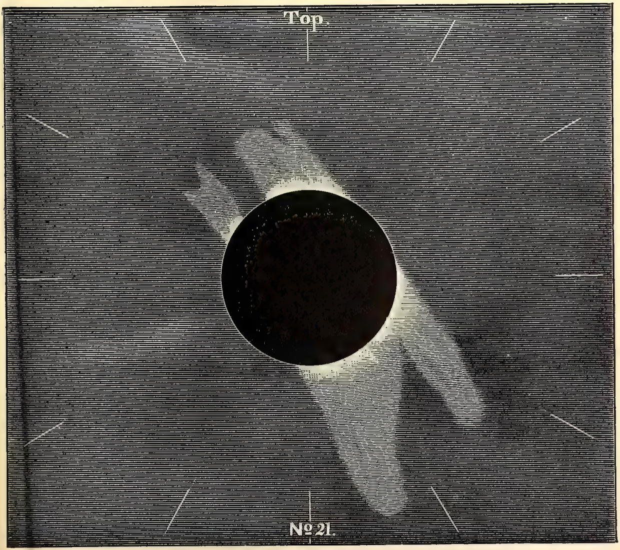
SKETCH No. 21.

Station, Henrietta, Tex......................Observer, J. D. Harston.
Latitude, 33° 45′ ....Instrument, naked eye.
Longitude, 98° 3′.............................Duration of totality, 157 seconds.
Altitude, 915 feet ....Middle of totality, $5^h 36^m$, W. M. T.

NOTES.

See letter (4577 Obs., encl. 2).
See report No. 96, § III.

No notes accompanying this sketch.


Top.
№ 21.

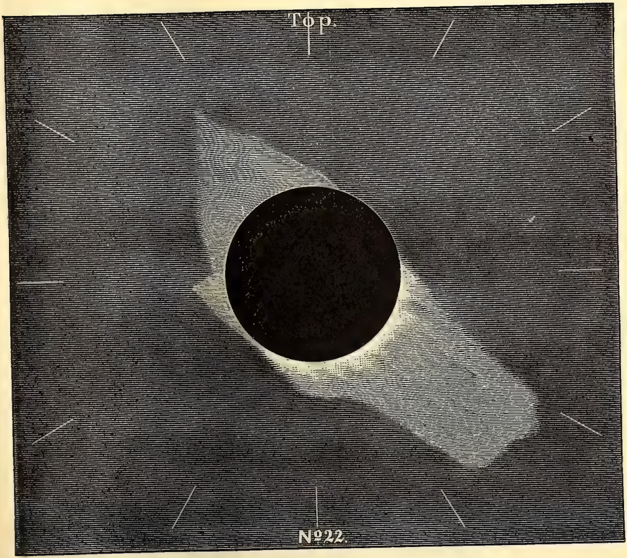
SKETCH No. 22.

Station, Henrietta, Tex	Observer, Dr. M. Harrold.
Latitude, 33° 45′	Instrument, naked eye.
Longitude, 98° 3′	Duration of totality, 157 seconds.
Altitude, 915 feet	Middle of totality, 5^{h} 36^{m}, W. M. T.

NOTES.

See letter (4577 Obs., encl. 3). The upper left hand and lower right hand extremities of the coronal beam are represented as fading away indefinitely.

See report No. 96, § II.



No 22.

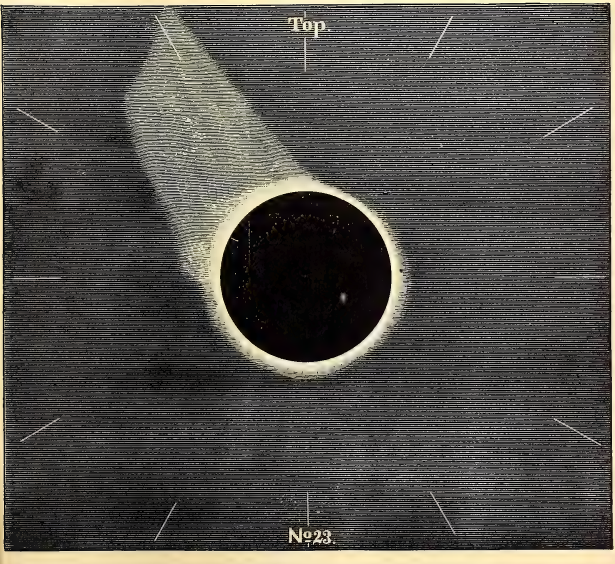
SKETCH No. 23.

Station, Jacksboro', Tex	Observer, P. M. Wilson.
Latitude, 33° 10′	Instrument, 2-inch Signal Service glass.
Longitude, 98° 8′	Duration of totality, ——
Altitude, 1,119 ? feet	Middle of totality, $5^h\ 37^m$, W. M. T.

NOTES.

See letter (4314 Obs., encl. 1). Heavy cumuli interrupted observations, but "a beautiful silvery corona could be seen around the edge and a few lines were seen to shoot out steadily to the northwest, beaming steadily, not waving at all." The first and last contacts were at the points A and B. By northwest is to be understood the direction corresponding to 300° or 330° and therefore perpendicular to the ecliptic.

See report No. 97.


Top.
№23.

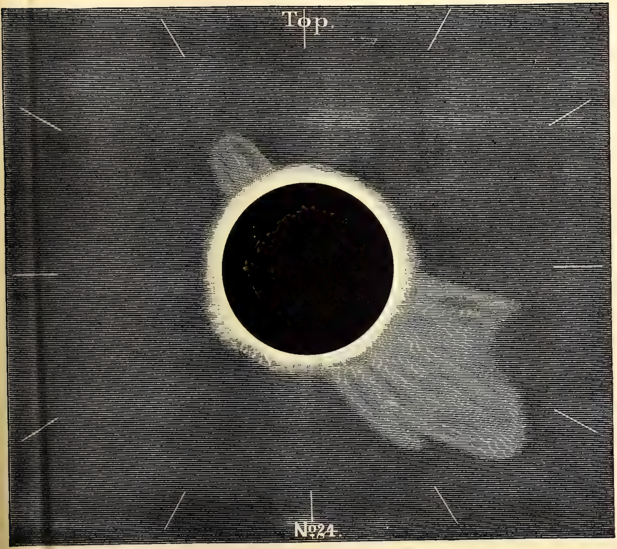
SKETCH No. 24.

Station, Graham, Tex	Observer, A. B. Grant.
Latitude, 33° 8′	Instrument, naked eye.
Longitude, 98° 40′	Duration of totality, 120 seconds.
Altitude, 1,040 ? feet	Middle of totality, $5^h\ 39^m$, W. M. T.

NOTES.

See letter (4489 Obs., encl. 2). No notes accompanying this sketch, except the remarks of Mr. Floyd Shock, who says, "though it is rough in appearance, it is entirely accurate."

See reports Nos. 93, 94, and 95.



Top.
No 24.

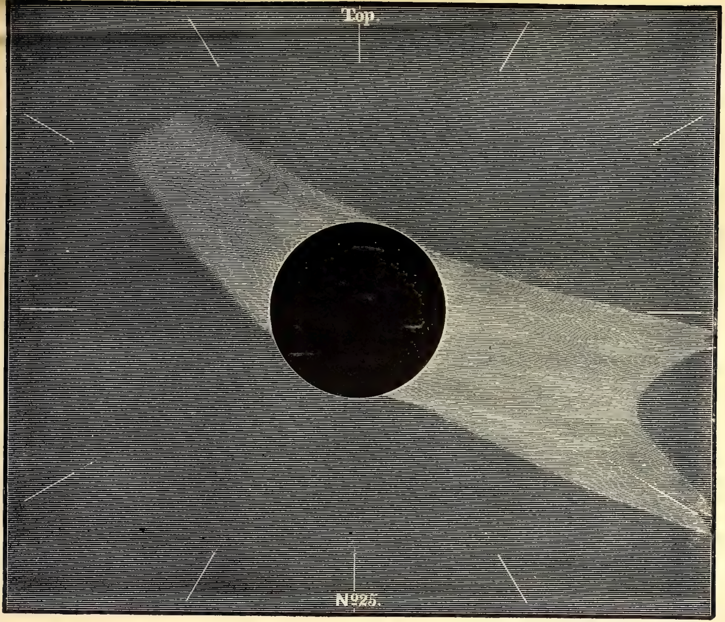
SKETCH No. 25.

Station, Pilot Point, Tex ....Observer, E. F. Reeves.
Latitude, 33° 22′ ....Instruments, 2-inch Signal Service glass.
Longitude, 96° 55′..........................Duration of totality, 102 seconds.
Altitude, 800 ? feet ....Middle of totality, 5^{h} 39^{m}.

NOTES.

See letter (5291 Obs., encl. 1). No notes accompanying this sketch except the following: The corona was a light pale color.

See reports Nos. 98, 99.


Top.
No 25.

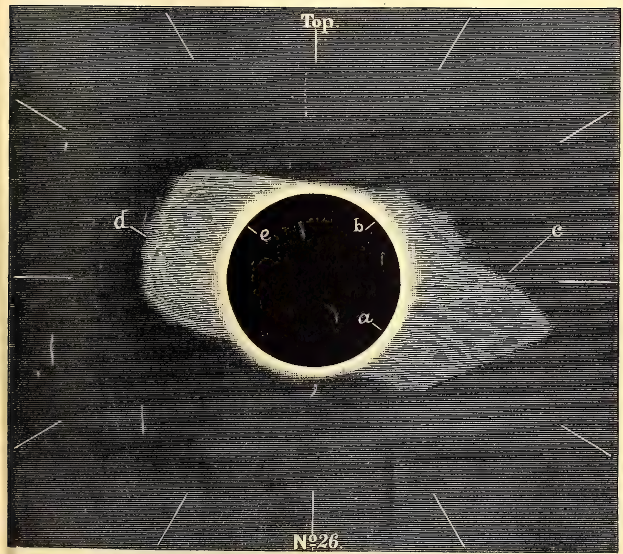
SKETCH No. 26.

Station, Belmont Farm, *near* Melissa, Tex...Observer, T. M. Scott.
Latitude, 33° 8′............................Instrument, naked eye.
Longitude, 96° 31′..........................Duration of totality, 60 seconds.
Altitude, 722 feet..........................Middle of totality, 5^h 44^m, W. M. T.

NOTES.

See letter (3445 Obs.). The points of first and last contact were at A and E; a bright halo surrounded the moon; bright red rays or protuberances were at B; bright white rays lasting during totality were at C; at D the ray was rounded on the opposite side; "it terminated in rays."

See reports Nos. 86, 87.


Top.
d
e
b
e
a
No 26.

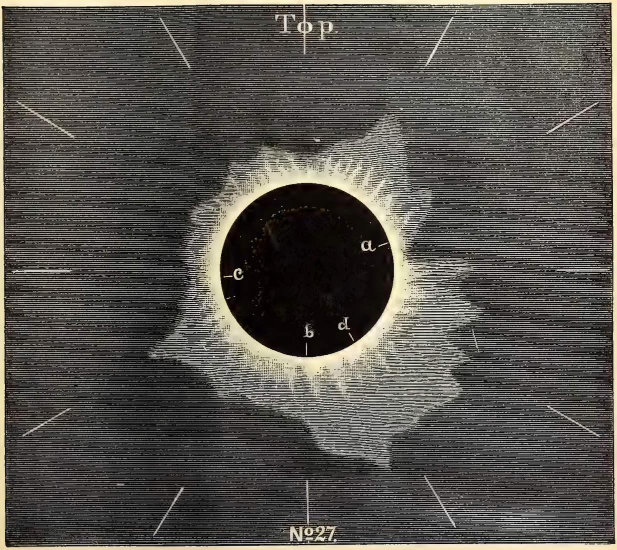
SKETCH No. 27.

Station, Corsicana, Tex .... Observer, N. Cumming.
Latitude, 32° 4′ .... Instrument, naked eye.
Longitude, 96° 20′ .... Duration of totality, 151 seconds.
Altitude, 445? feet .... Middle of totality, 5^{h} 41^{m}, W. M. T.

NOTES.

See letter (4357 Obs., encl. 2 and 3). Stratus clouds much obscured the sun. At the moment of the beginning of totality a sheet of flickering whitish light flashed from the western limb of the sun, continued a few seconds, and disappeared; during the whole of totality reddish flames issued from the sun's northern limb, in width one-twelfth the sun's diameter, in height one-sixth diameter. Thirty seconds before the end of totality the same phenomena occurred on the sun's western limb between the points A and B. Our engraving gives all the items depicted on the observer's four drawings. The lunar protuberances described were at C before totality and at D after totality.

See reports Nos. 88, 89.


Top.
a
c
b
d
№27.

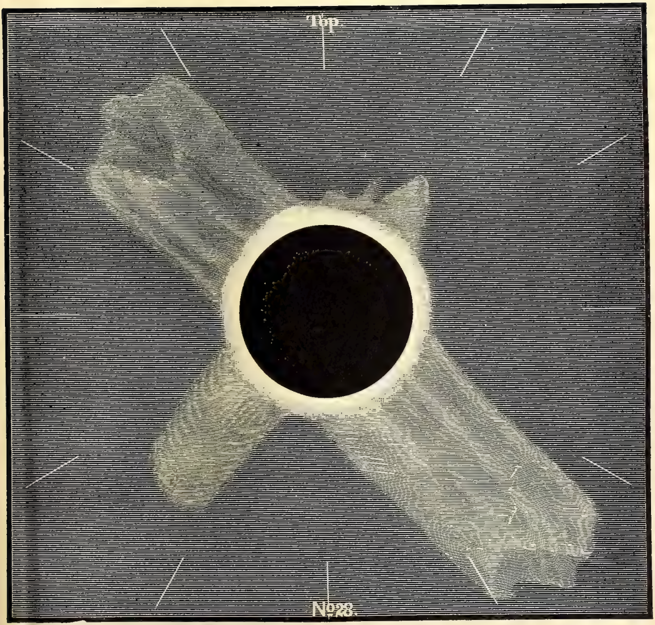
SKETCH No. 28.

Station, Havana, Cuba	Observer, C. Hasselbrink.
Latitude, 23° 9′	Instrument, opera-glass.
Longitude, 82° 22′	Duration of totality, 114 seconds.
Altitude, 50 feet	Middle of totality, 5^h 58^m, W. M. T.

NOTES.

For a full description see letter (4451 Obs., encl. 1). The rays parting from an interior bright halo were exceedingly light, not forming a dense mass, but a delicate translucent film-like unpolished silver. The striæ and lines at the edge of the moon's disk were mostly straight, but some curved.

See reports Nos. 104, 105.


Top.
No 28.

PAPER 49.

TORNADOES.

OFFICIAL LETTER.

WAR DEPARTMENT,
OFFICE OF THE CHIEF SIGNAL OFFICER,
Washington, D. C., September 25, 1879.

GENERAL: In compliance with your instructions, as detailed in Special Orders No. 88, Office of the Chief Signal Officer, I have the honor to present herewith the report of my investigations of the tornadoes of May 29th and 30th, in the states of Kansas, Missouri, Nebraska, and Iowa.

While pursuing my labors, unexpected and unusual difficulties forced themselves in the way of as complete and satisfactory a prosecution of the work as I had contemplated, a result in part, from the occurrence of almost incessant rains, accompanied by some of the most severe wind and hail storms that ever visited the Lower Missouri valley. Hardly three days out of an entire month was the weather at all pleasant or conducive to good work. Bridges were washed away, streams swollen to rushing rivers, and roads turned into soft, sinking morasses, almost impassable to man or beast, yet in twenty days I traveled (exclusive of railroad transit) over 500 miles with horse and buggy, and also did considerable walking.

This condition of the country made it at times impossible to visit portions of the storm tracks from which I could have gathered valuable information, thus compelling me to rely too often upon second-hand evidence, although in every instance I did not fail to make strenuous efforts in every possible manner to verify it.

The heavy winds and rains which prevailed over this section of country from the 1st to the 12th of June obliterated much of the evidence distinguishing the tracks of the several tornadoes, causing destruction in the vicinity of and at times over the same paths which they had pursued, making the work of investigation often perplexing in the extreme.

Again, the lateness at which I arrived at the first storm track (ten days after its formation, and, of course, correspondingly later at the others) is a matter which might seem of very little moment to the casual observer, but which made no inconsiderable difference concerning the ease and completeness with which the work was prosecuted. People had commenced to rebuild their houses; fences with hardly an exception, were replaced; fields were recultivated; the *débris* was picked up in piles or entirely removed, all of which rendered it quite difficult to obtain the truth in every instance.

I have endeavored to the best of my ability to collect nothing but the facts, under a condition of mind free from predisposition to any theory, and in their presentation to confine myself to an intelligible arrangement of them. In several instances results have been presented that naturally offered themselves, and really demanded utterance as a completion of the sense.

Very respectfully,

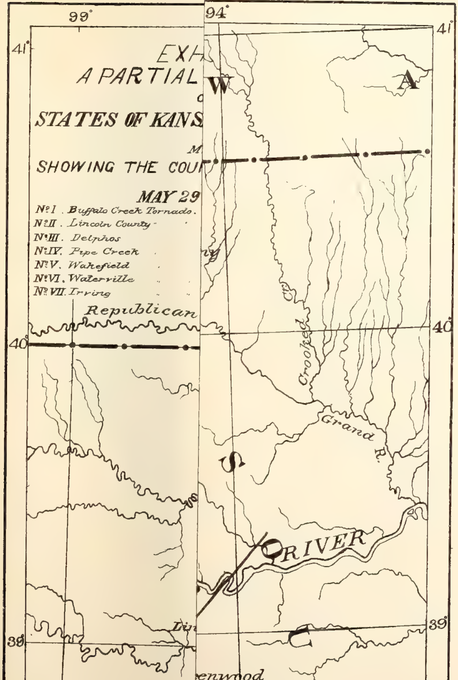
JOHN P. FINLEY,
Private, Signal Corps, U. S. A.

ALBERT J. MYER,
Brigadier-General (Brevet Assigned) and Chief Signal Officer, U. S. A.

THE TORNADOES OF MAY 29 AND 30, IN THE STATES OF KANSAS, MISSOURI, NEBRASKA, AND IOWA.

INTRODUCTION.

In order to obtain a reasonable knowledge of the general atmospheric conditions preceding and accompanying the development of this remarkable series of storms, it becomes necessary to review the successive changes as presented in the accompanying Signal Service weather maps, which explain themselves, and to which little can be added in a descriptive sense to make the presentation of the central truth more apparent. In consulting the same it will be observed that two areas of low pressure accompanied the formation and continuation of the local storms. The first of these appeared on the morning of the 28th to the west of Manitoba, attended by light rains and warm southerly winds over the northern portion of Dakota and southeastward throughout Minnesota, the western portion of Wisconsin, and the northern portion of Iowa. Clear


99°
94°
41°
41°
EXH
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STATES OF KANS
M
SHOWING THE COU
MAY 29
Nº I . Buffalo Creek Tornado.
Nº II . Lincoln County
Nº III . Delphos
Nº IV . Pipe Creek
Nº V . Wakefield
Nº VI . Waterville
Nº VII . Irving
ny
Republican
W
A
Crooked Cr.
40°
40°
Grand R.
S
O
RIVER
Lin
39°
39°
U
enwood
R
K
I
River
38°
99°
94°

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I have endeavored to the best of my ability to collect nothing but the facts, under a condition of mind free from predisposition to any theory, and in their presentation to confine myself to an intelligible arrangement of them. In several instances results have been presented that naturally offered themselves, and really demanded utterance as a completion of the sense.

Very respectfully,

JOHN P. FINLEY,
Private, Signal Corps, U. S. A.

ALBERT J. MYER,
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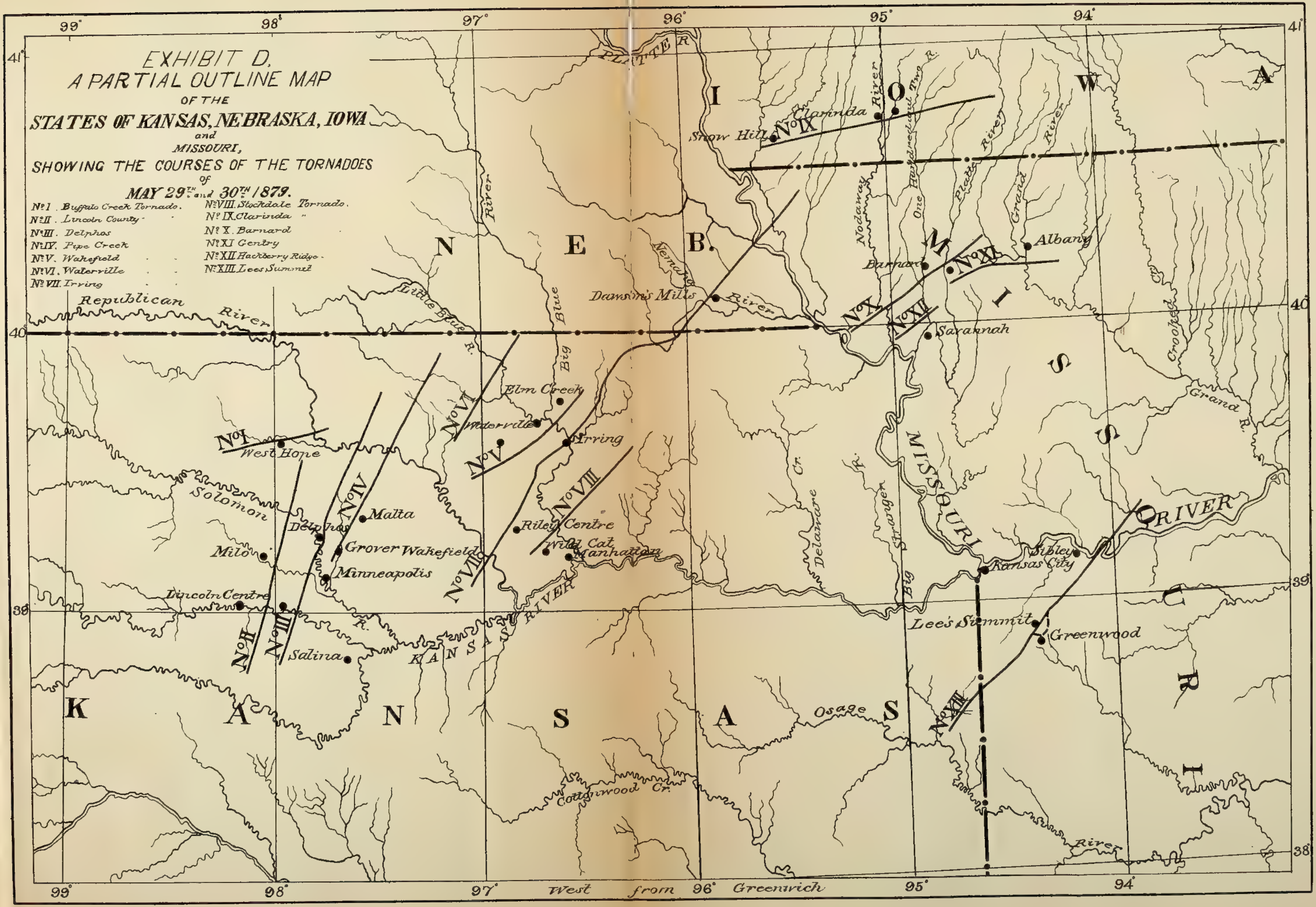
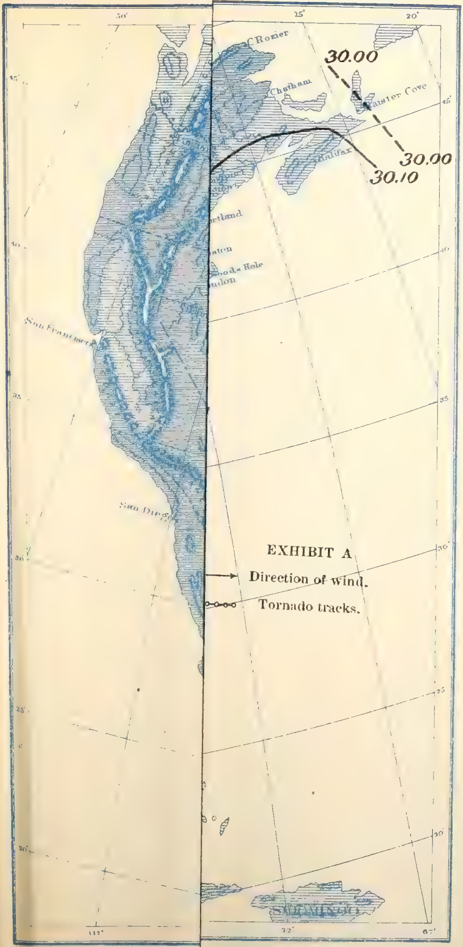


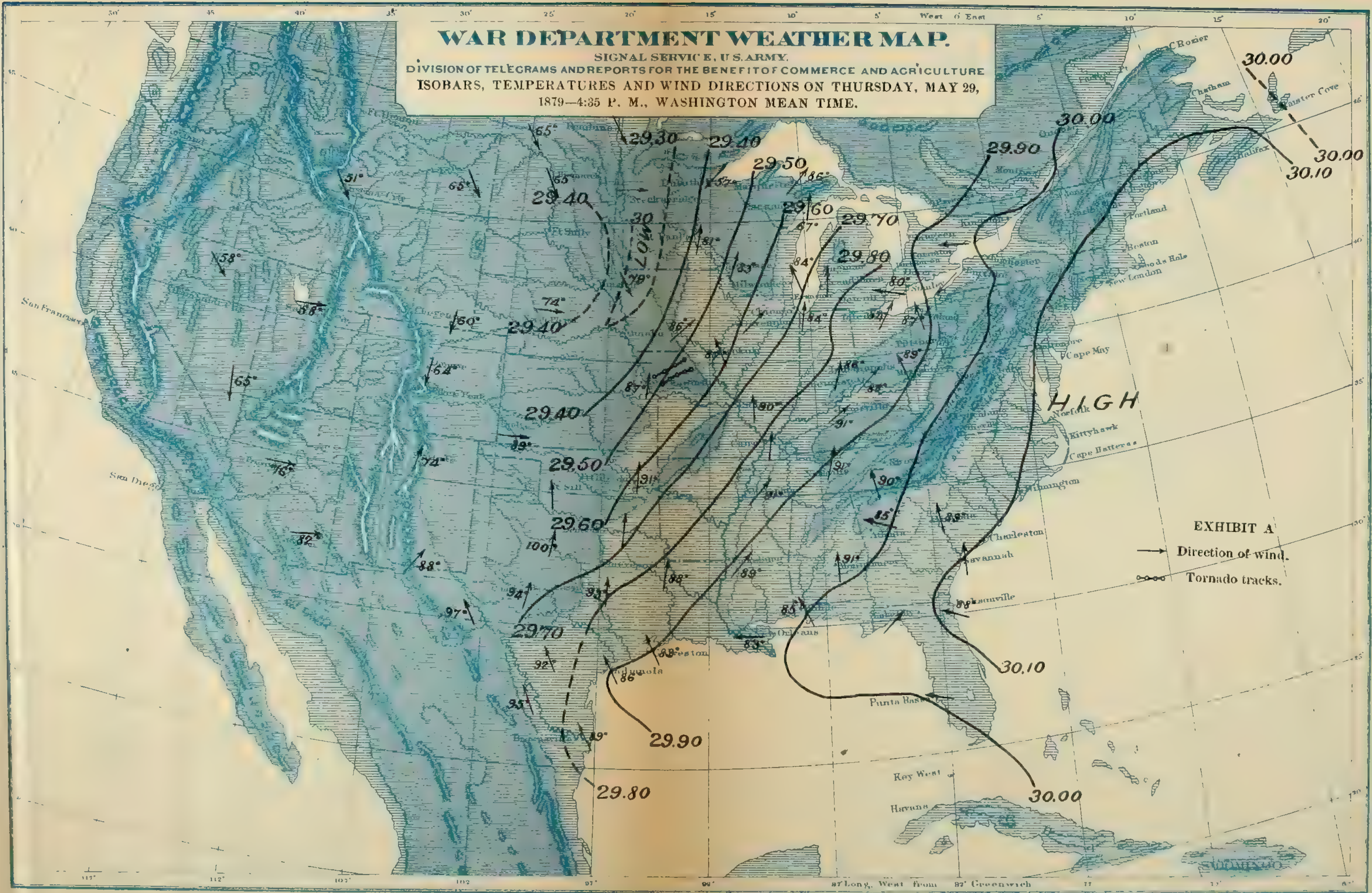
EXHIBIT D.
A PARTIAL OUTLINE MAP
OF THE
STATES OF KANSAS, NEBRASKA, IOWA
and
MISSOURI,
SHOWING THE COURSES OF THE TORNADOES
of
MAY 29TH and 30TH 1879.

- No. I. Buffalo Creek Tornado.
- No. II. Lincoln County "
- No. III. Delphos
- No. IV. Pipe Creek
- No. V. Wakefield
- No. VI. Waterville
- No. VII. Irving
- No. VIII. Stockdale Tornado.
- No. IX. Clarinda "
- No. X. Barnard
- No. XI Gentry
- No. XII Hackberry Ridge
- No. XIII Lees Summit

No. I.


30.00
30.00
30.10
C Rozier
Chatham
Paisler Cove
Halifax
rtland
ston
oods Hole
San Francisco
San Diego
SANTO DOMINGO
EXHIBIT A
Direction of wind.
Tornado tracks.
50°
25°
20°
45°
40°
35°
30°
25°
20°
117°
72°
67°

No. I.



WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE

ISOBARS, TEMPERATURES AND WIND DIRECTIONS ON THURSDAY, MAY 29, 1879—4:35 P. M., WASHINGTON MEAN TIME.

EXHIBIT A

→ Direction of wind.

○○○ Tornado tracks.

No. II.

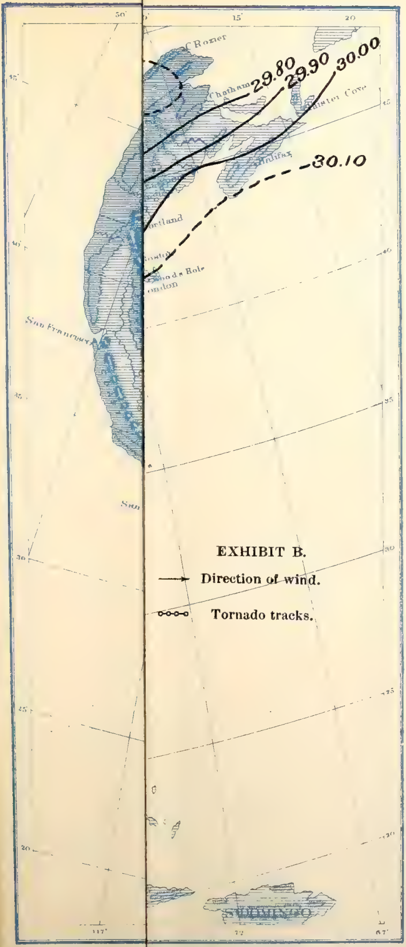
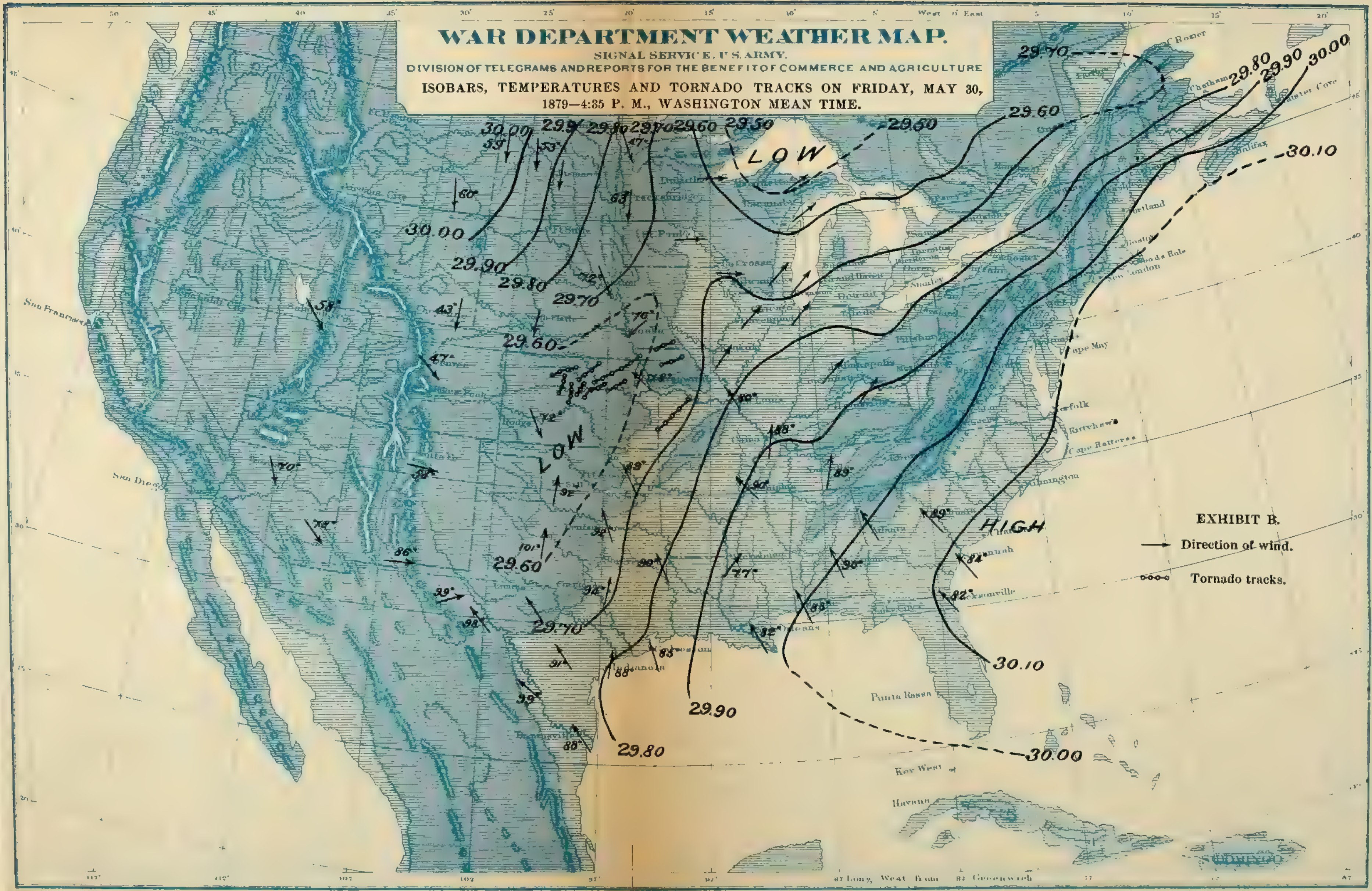


EXHIBIT B.
Direction of wind.
Tornado tracks.
29.80
29.90
30.00
30.10
C Rozier
Chatham
Cove
Halifax
Portland
Woods Hole
San Francisco
S. DOMINGO
45
40
35
30
25
20
50
15
20
117
72
67

No. II.



WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE

ISOBARS, TEMPERATURES AND TORNADO TRACKS ON FRIDAY, MAY 30, 1879—4:35 P. M., WASHINGTON MEAN TIME.

EXHIBIT B.

→ Direction of wind.

o-o-o-o Tornado tracks.

No. III.

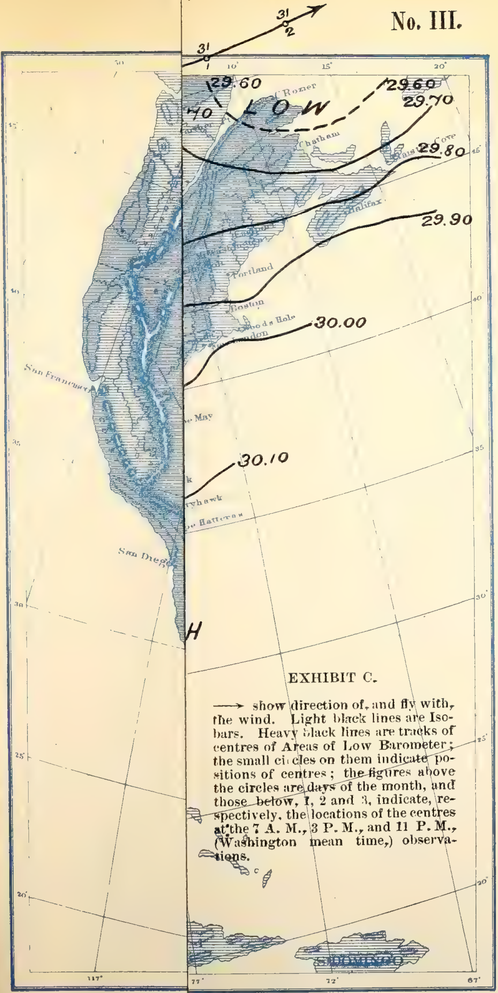
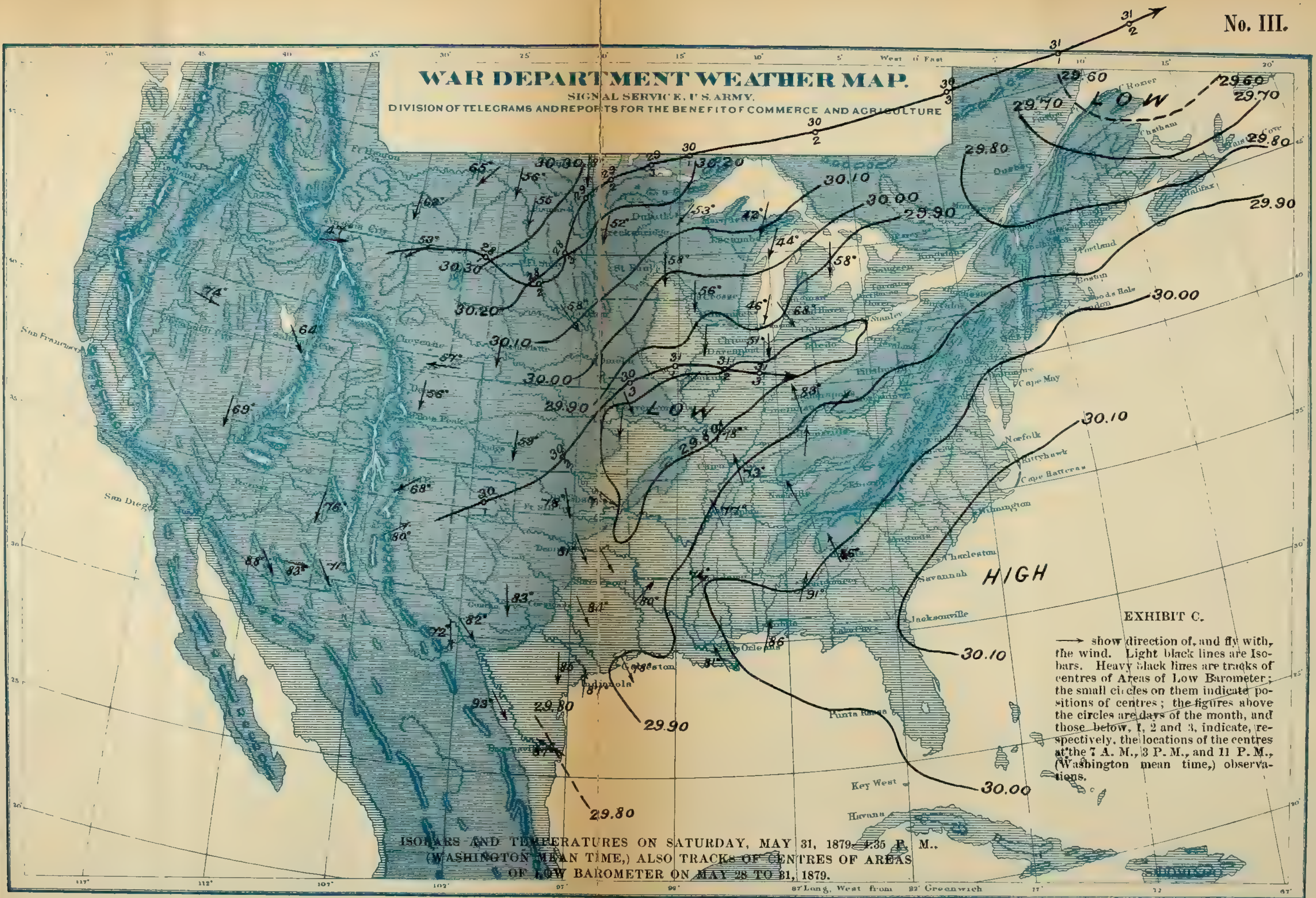


EXHIBIT C.

⟶ show direction of, and fly with, the wind. Light black lines are Isobars. Heavy black lines are tracks of centres of Areas of Low Barometer; the small circles on them indicate positions of centres; the figures above the circles are days of the month, and those below, 1, 2 and 3, indicate, respectively, the locations of the centres at the 7 A. M., 3 P. M., and 11 P. M., (Washington mean time,) observations.

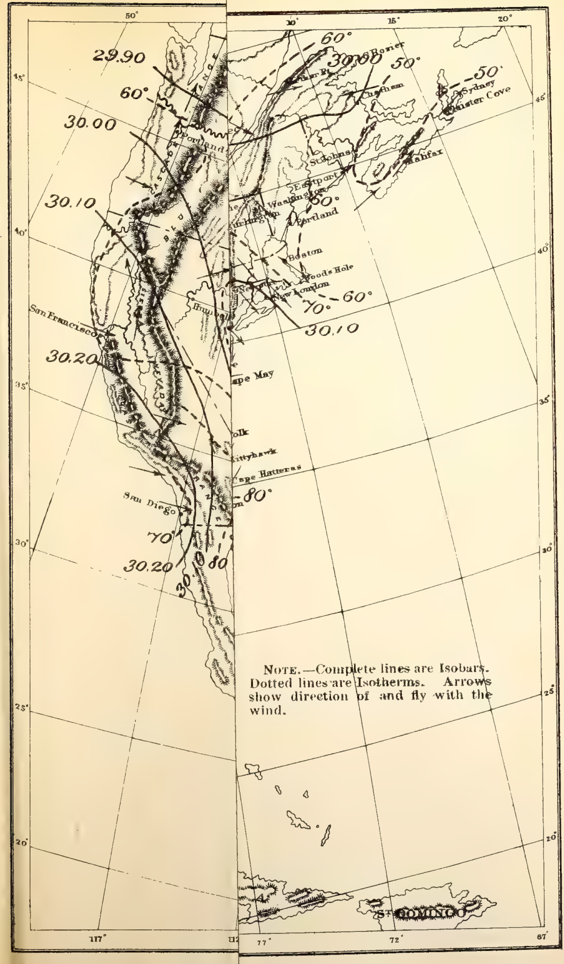
No. III.



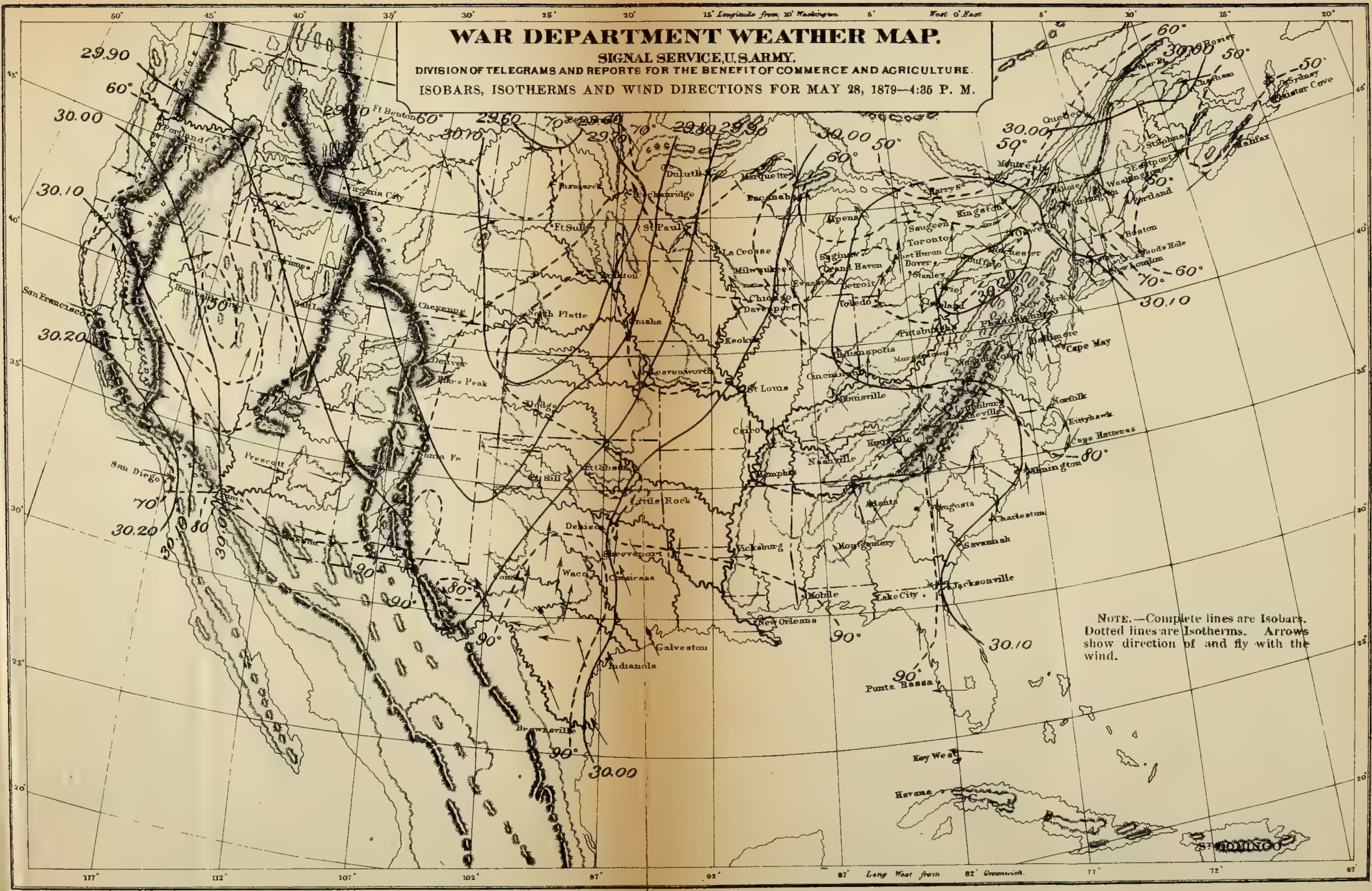
ISOBARS AND TEMPERATURES ON SATURDAY, MAY 31, 1879, 4.35 P. M., (WASHINGTON MEAN TIME,) ALSO TRACKS OF CENTRES OF AREAS OF LOW BAROMETER ON MAY 28 TO 31, 1879.

EXHIBIT C.

⟶ show direction of, and fly with, the wind. Light black lines are Isobars. Heavy black lines are tracks of centres of Areas of Low Barometer; the small circles on them indicate positions of centres; the figures above the circles are days of the month, and those below, 1, 2 and 3, indicate, respectively, the locations of the centres at the 7 A. M., 3 P. M., and 11 P. M., (Washington mean time,) observations.



NOTE.—Complete lines are Isobars. Dotted lines are Isotherms. Arrows show direction of and fly with the wind.



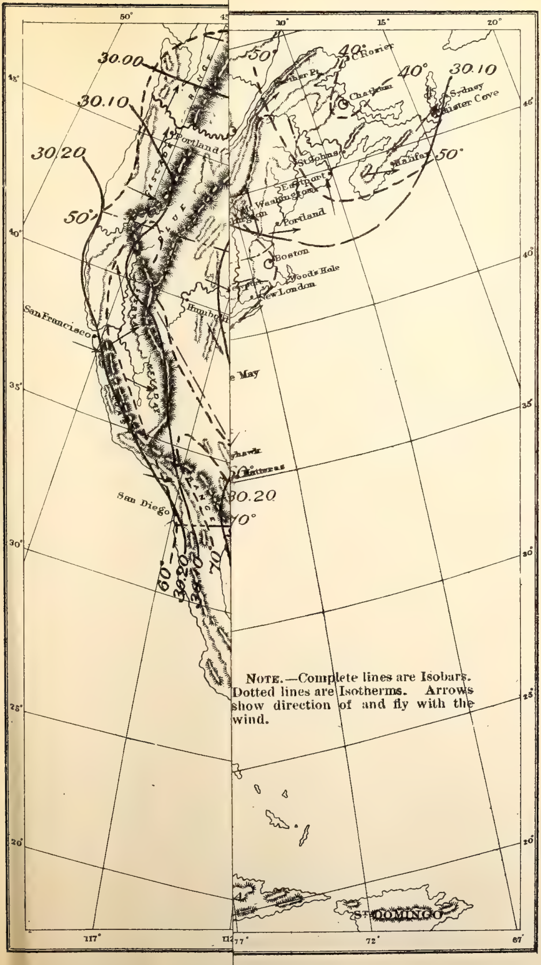
WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

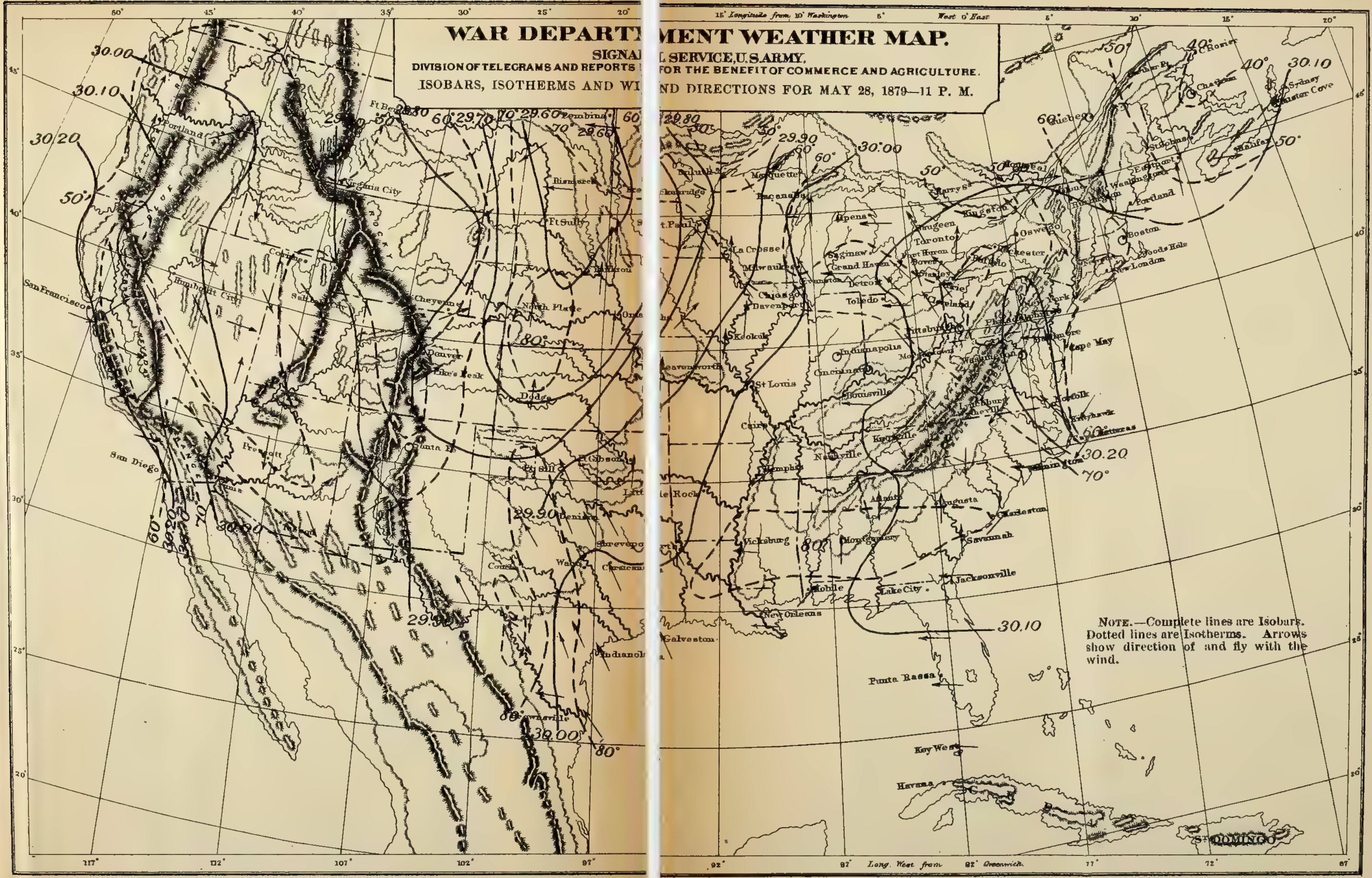
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

ISOBARS, ISOTHERMS AND WIND DIRECTIONS FOR MAY 28, 1879—4:35 P. M.

NOTE.—Complete lines are Isobars. Dotted lines are Isotherms. Arrows show direction of and fly with the wind.



Note.—Complete lines are Isobars. Dotted lines are Isotherms. Arrows show direction of and fly with the wind.


WAR DEPARTMENT WEATHER MAP.
SIGNAL SERVICE, U.S. ARMY.
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.
ISOBARS, ISOTHERMS AND WIND DIRECTIONS FOR MAY 28, 1879—11 P. M.
NOTE.—Complete lines are Isobars. Dotted lines are Isotherms. Arrows show direction of and fly with the wind.
15° Longitude from 10° Washington
West 0° East
Long. West from Greenwich.
30.00
30.10
30/20
50°
60°
70°
80°
29.70
29.60
29.80
29.90
30.20
40°
Portland
Virginia City
Ft Benton
Pembina
Bismarck
Breckenridge
Duluth
Marquette
Escanaba
Ft Sully
St. Paul
Corinne
Humboldt City
Salt Lake
San Francisco
Cheyenne
North Platte
Omaha
Yankton
La Crosse
Milwaukee
Chicago
Davenport
Keokuk
Denver
Pike's Peak
Dodge
Leavenworth
St Louis
Santa Fe
Prescott
San Diego
Yuma
Ft Sill
Ft Gibson
Little Rock
Cairo
Memphis
Nashville
Knoxville
Louisville
Cincinnati
Indianapolis
Denison
Shreveport
Corsicana
Concho
Waco
Vicksburg
Mobile
New Orleans
Galveston
Indianola
Brownsville
Montgomery
Atlanta
Augusta
Charleston
Savannah
Jacksonville
Lake City
Punta Rassa
Key West
Havana
ST DOMINGO
Alpena
Saugeen
Toronto
Saginaw
Grand Haven
Port Huron
Detroit
Toledo
Cleveland
Erie
Buffalo
Rochester
Oswego
Kingston
Pittsburg
Morgantown
Washington
Lynchburg
Norfolk
Kittyhawk
Hatteras
Wilmington
Cape May
Baltimore
Philadelphia
New York
New London
Woods Hole
Boston
Portland
Eastport
Montreal
Quebec
Father Pt
Chatham
Sydney
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77°
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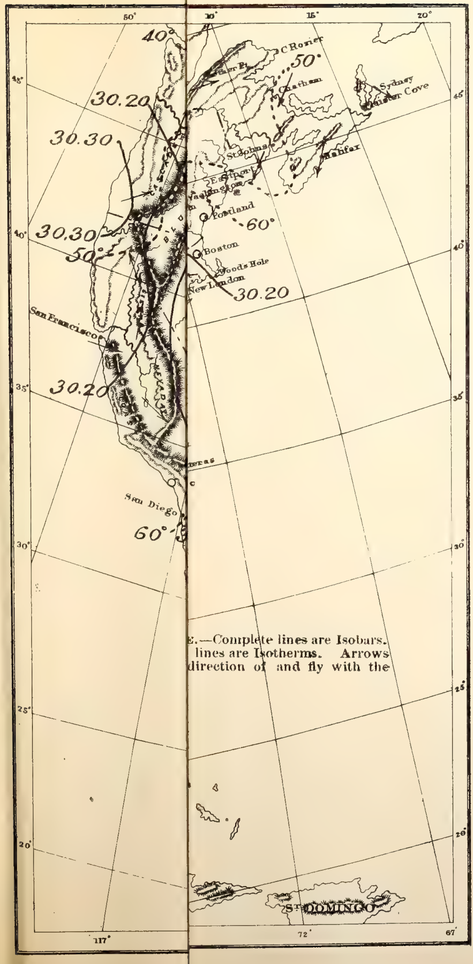
67°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Chatham
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Cove
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Eastport
Washington
Portland
Halifax
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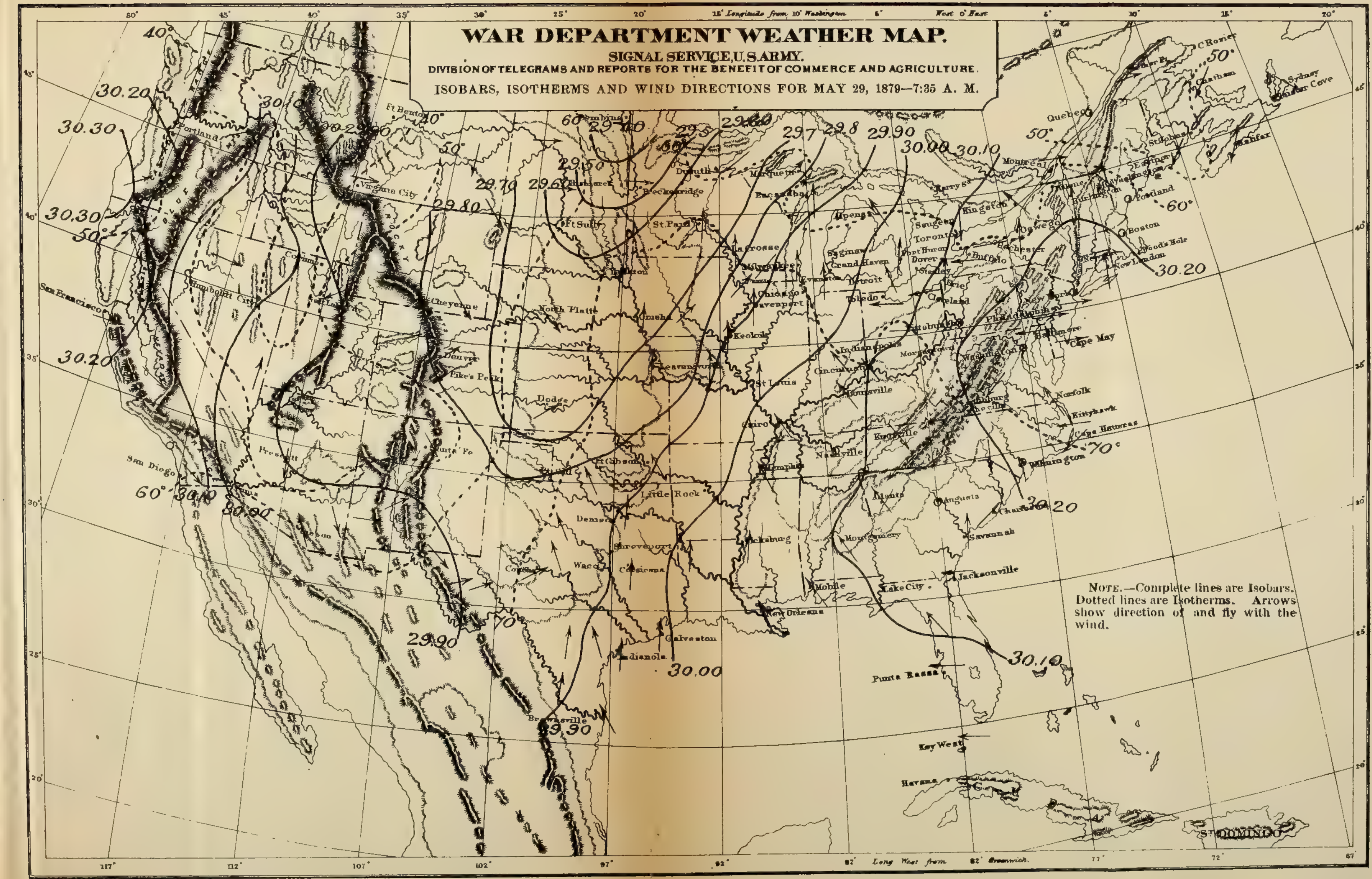
Wood's Hole
New London
San Francisco
San Diego
St DOMINGO
E.—Complete lines are Isobars.
lines are Isotherms. Arrows
direction of and fly with the



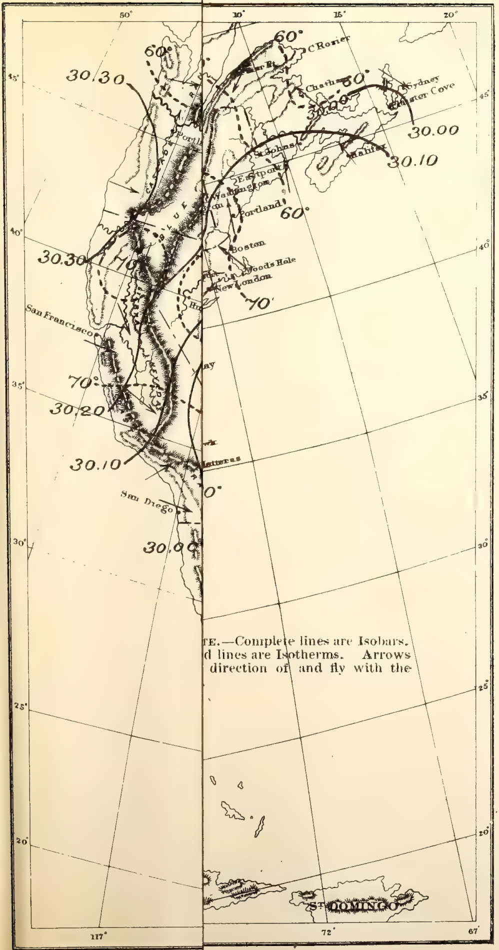
WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

ISOBARS, ISOTHERMS AND WIND DIRECTIONS FOR MAY 29, 1879—7:35 A. M.

NOTE.—Complete lines are Isobars. Dotted lines are Isotherms. Arrows show direction of and fly with the wind.


50°
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Washington
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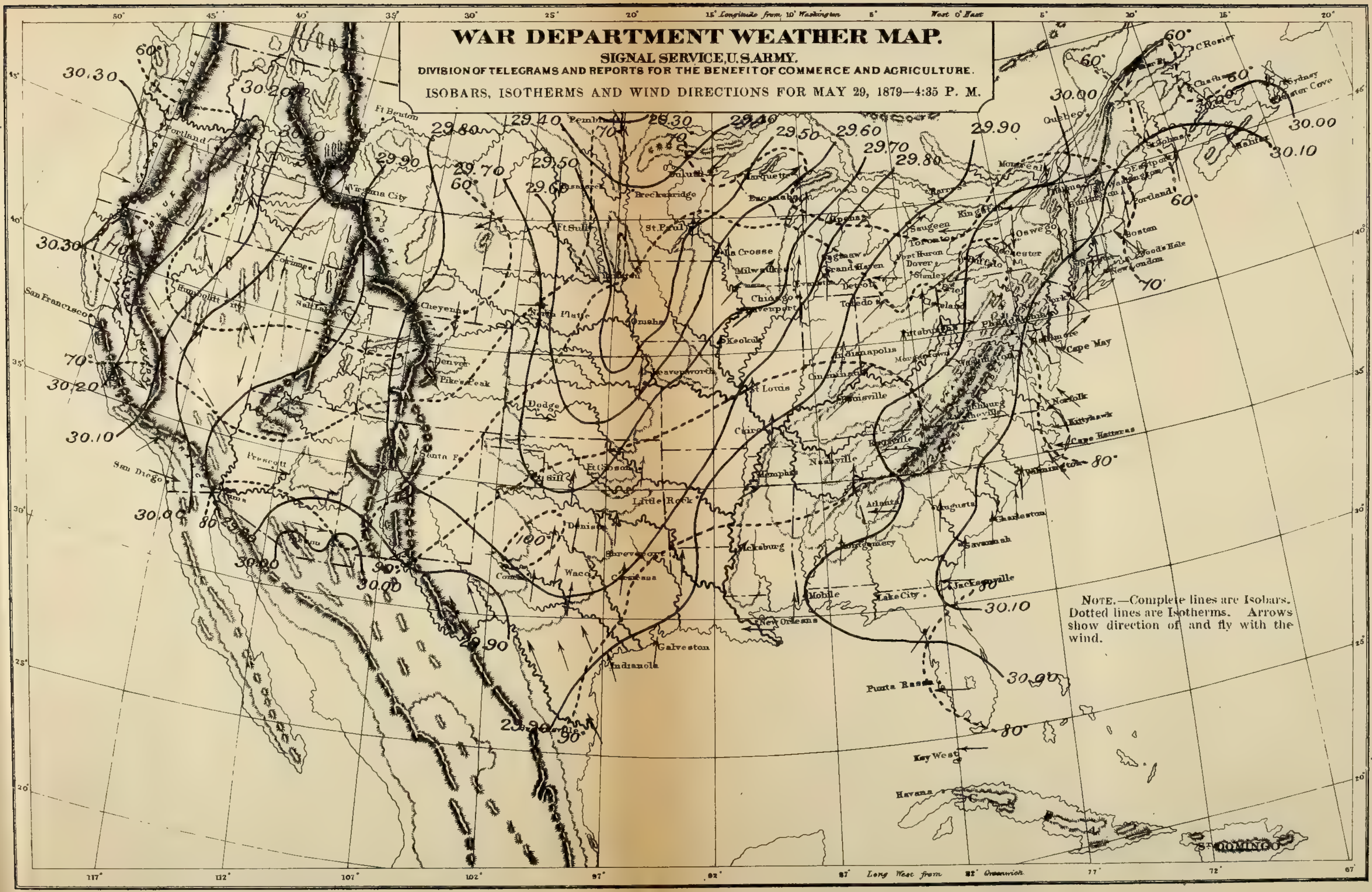

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

ISOBARS, ISOTHERMS AND WIND DIRECTIONS FOR MAY 29, 1879—4:35 P. M.

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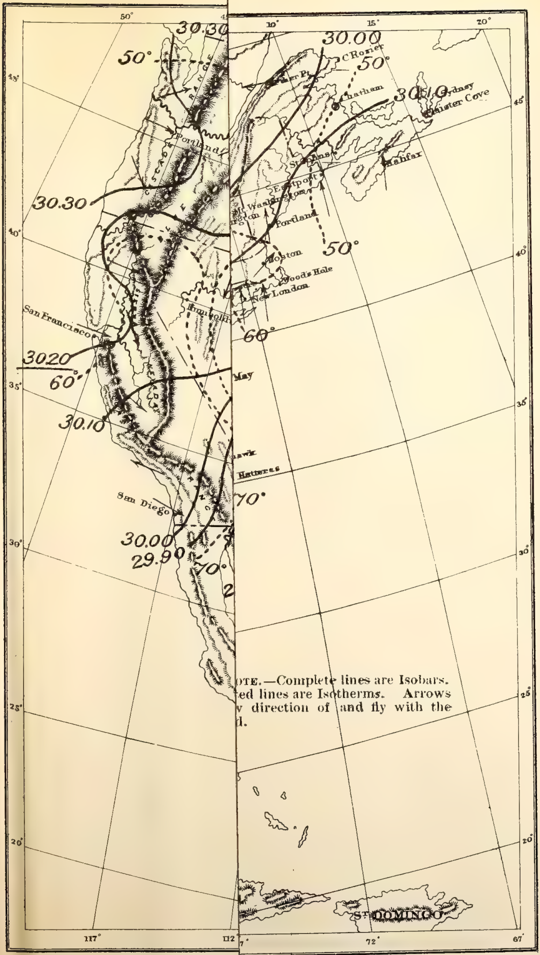

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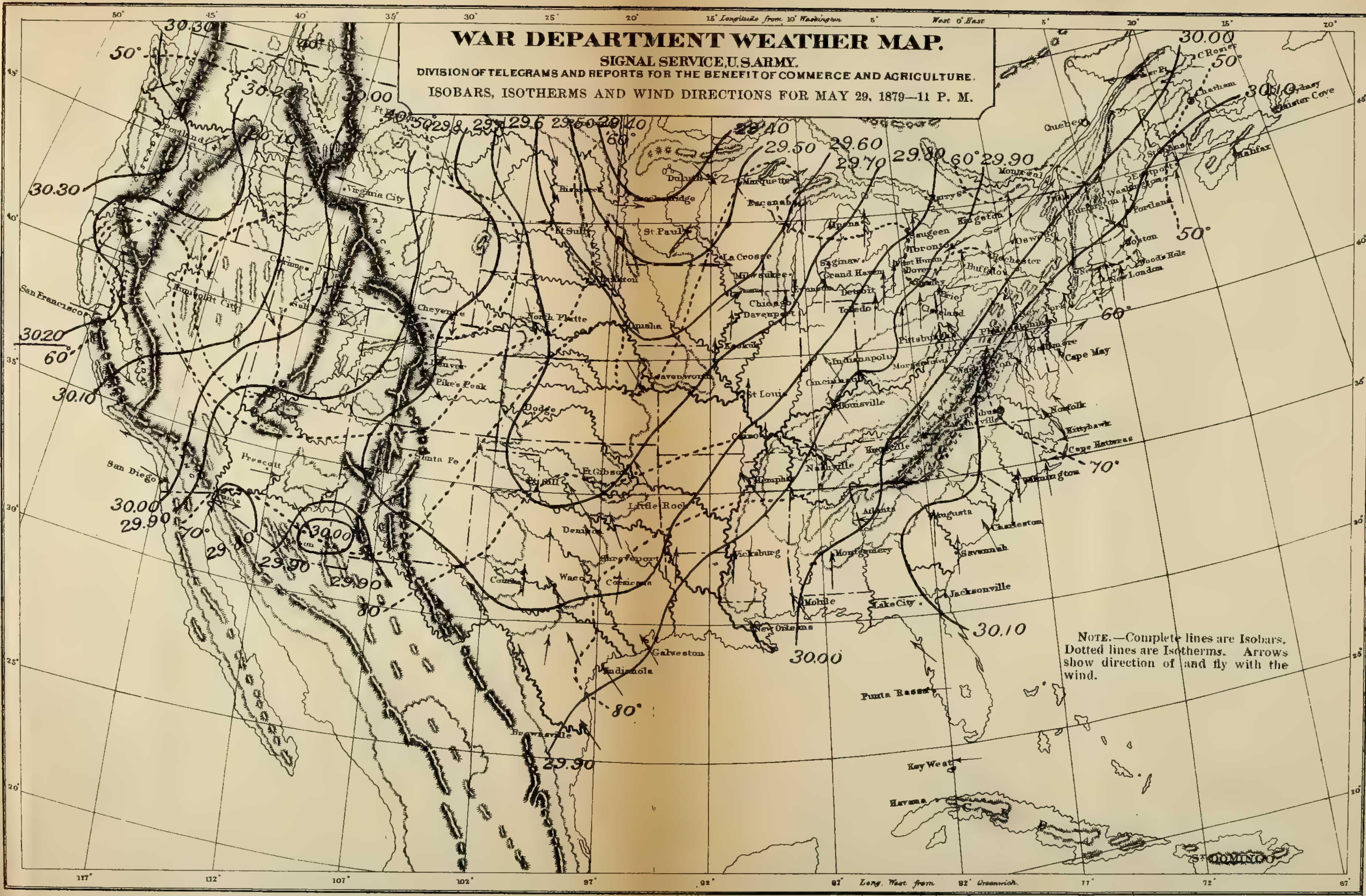

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

ISOBARS, ISOTHERMS AND WIND DIRECTIONS FOR MAY 29, 1879—11 P. M.

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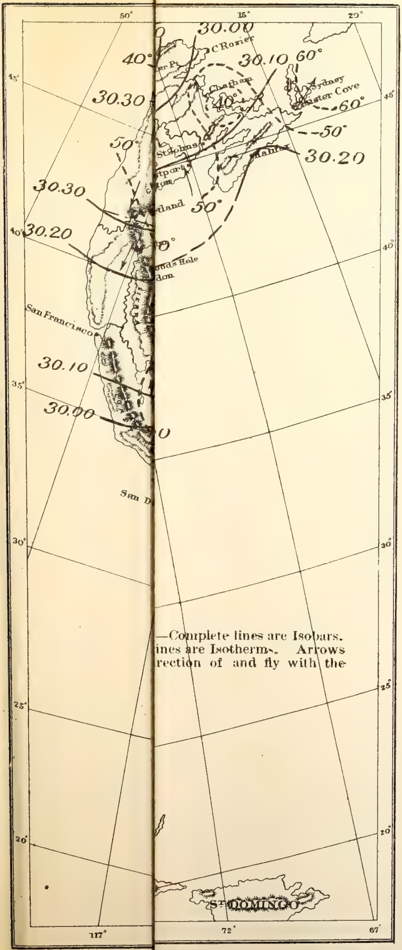

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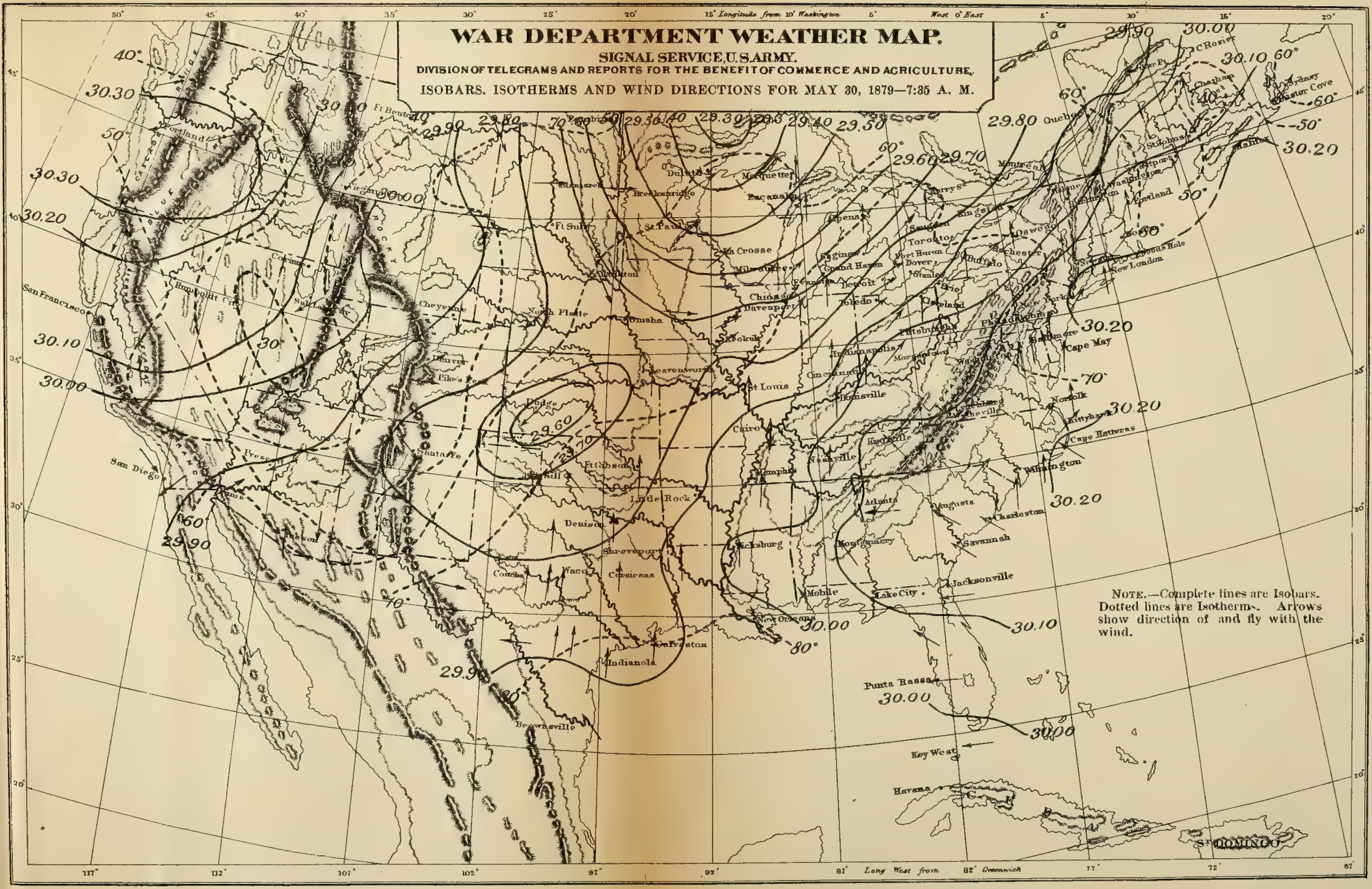

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

ISOBARS, ISOTHERMS AND WIND DIRECTIONS FOR MAY 30, 1879—7:35 A. M.

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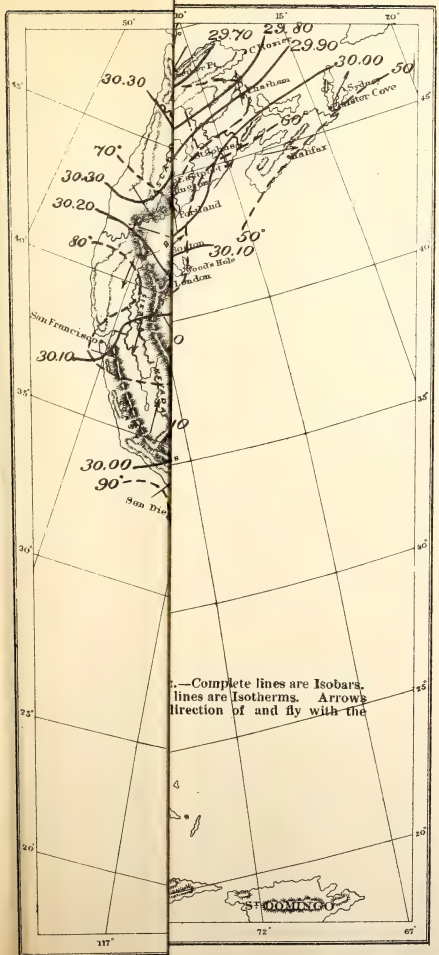

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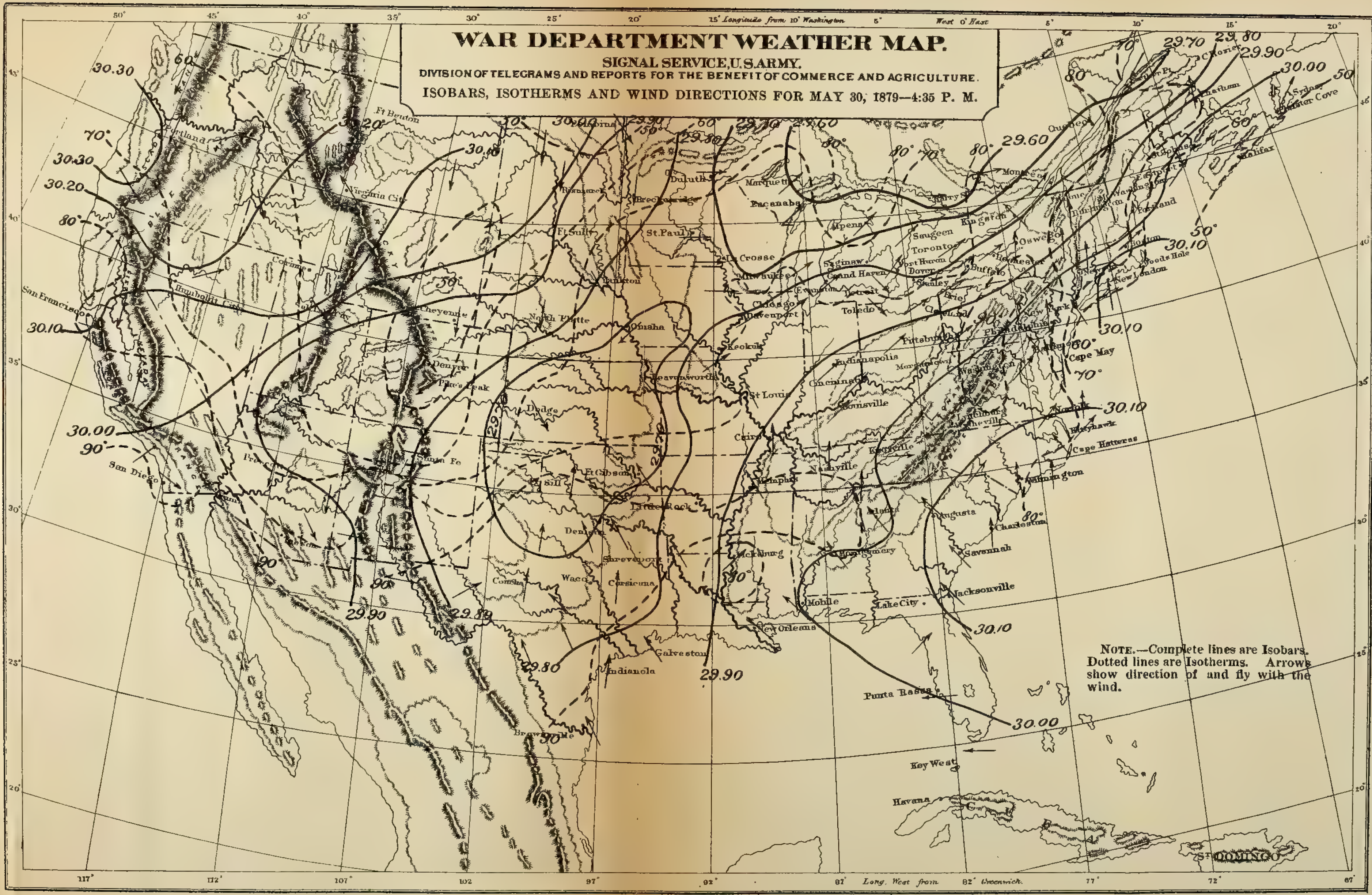


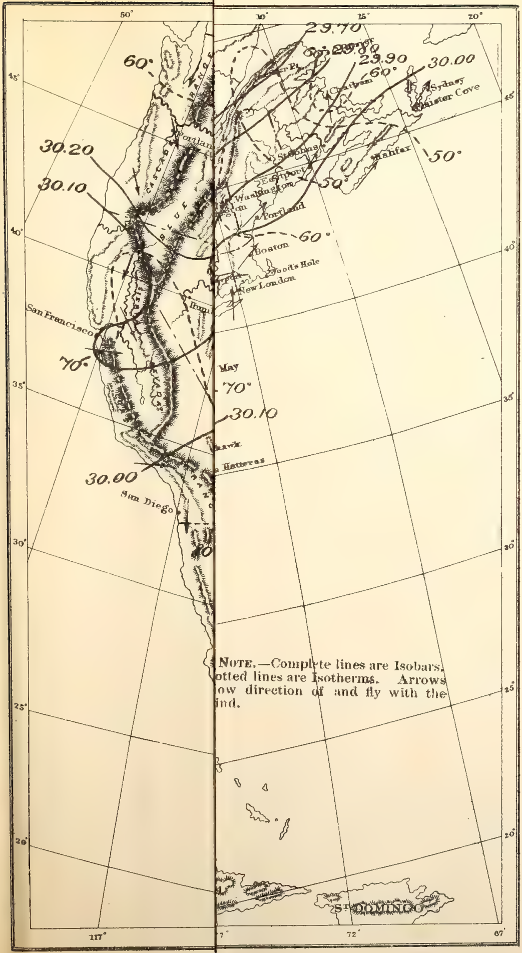
WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S.ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

ISOBARS, ISOTHERMS AND WIND DIRECTIONS FOR MAY 30, 1879—4:35 P. M.

NOTE.—Complete lines are Isobars. Dotted lines are Isotherms. Arrows show direction of and fly with the wind.



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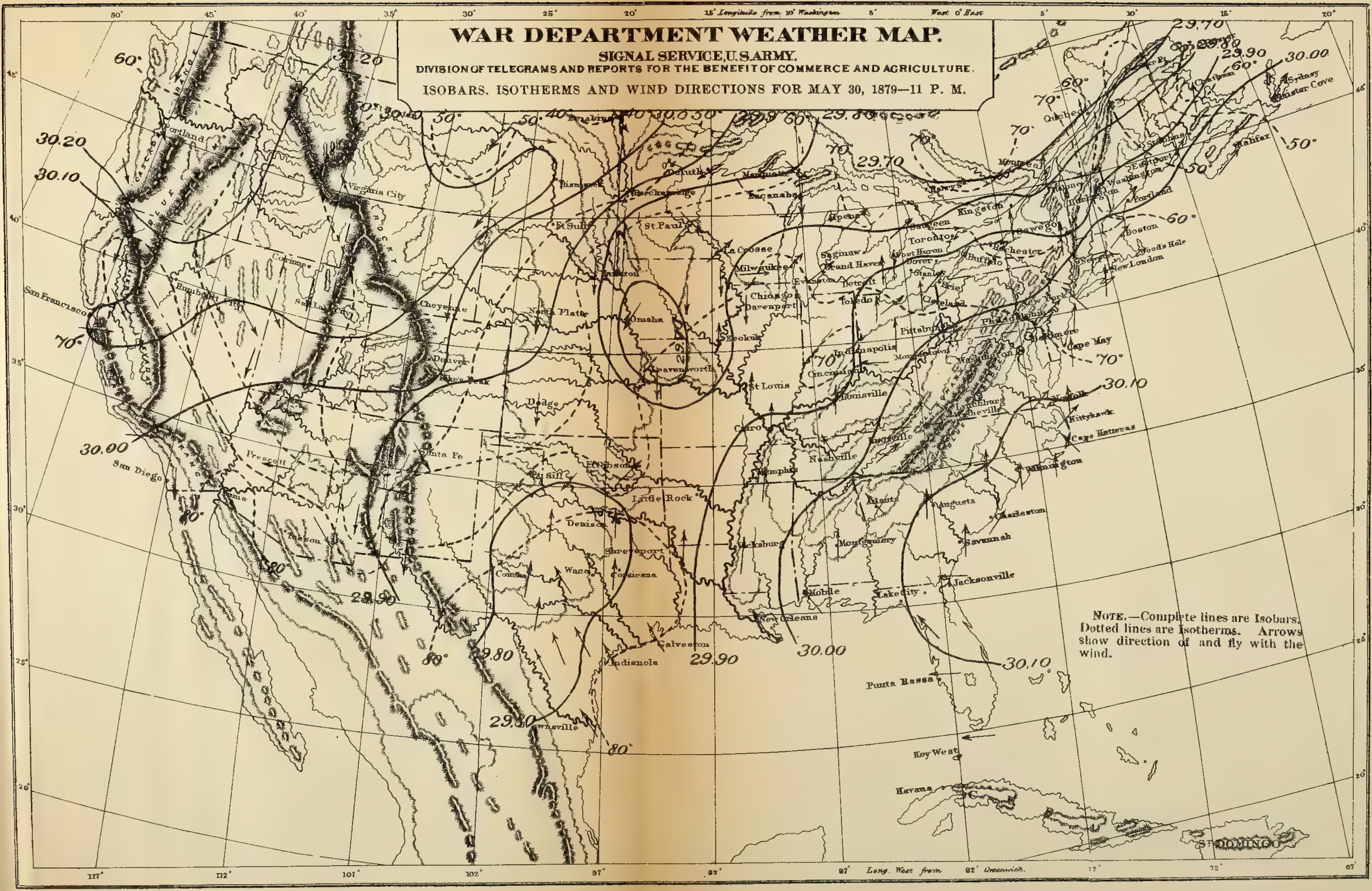

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

ISOBARS, ISOTHERMS AND WIND DIRECTIONS FOR MAY 30, 1879—11 P. M.

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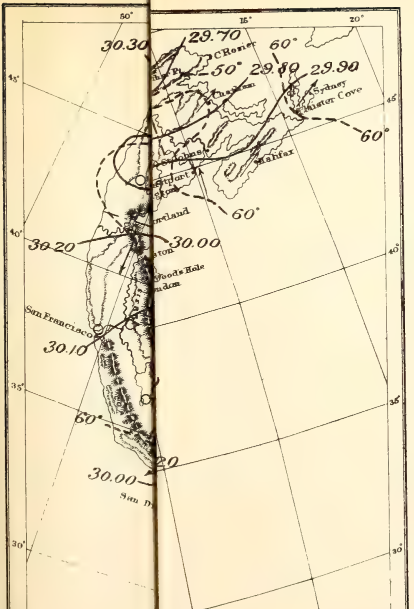

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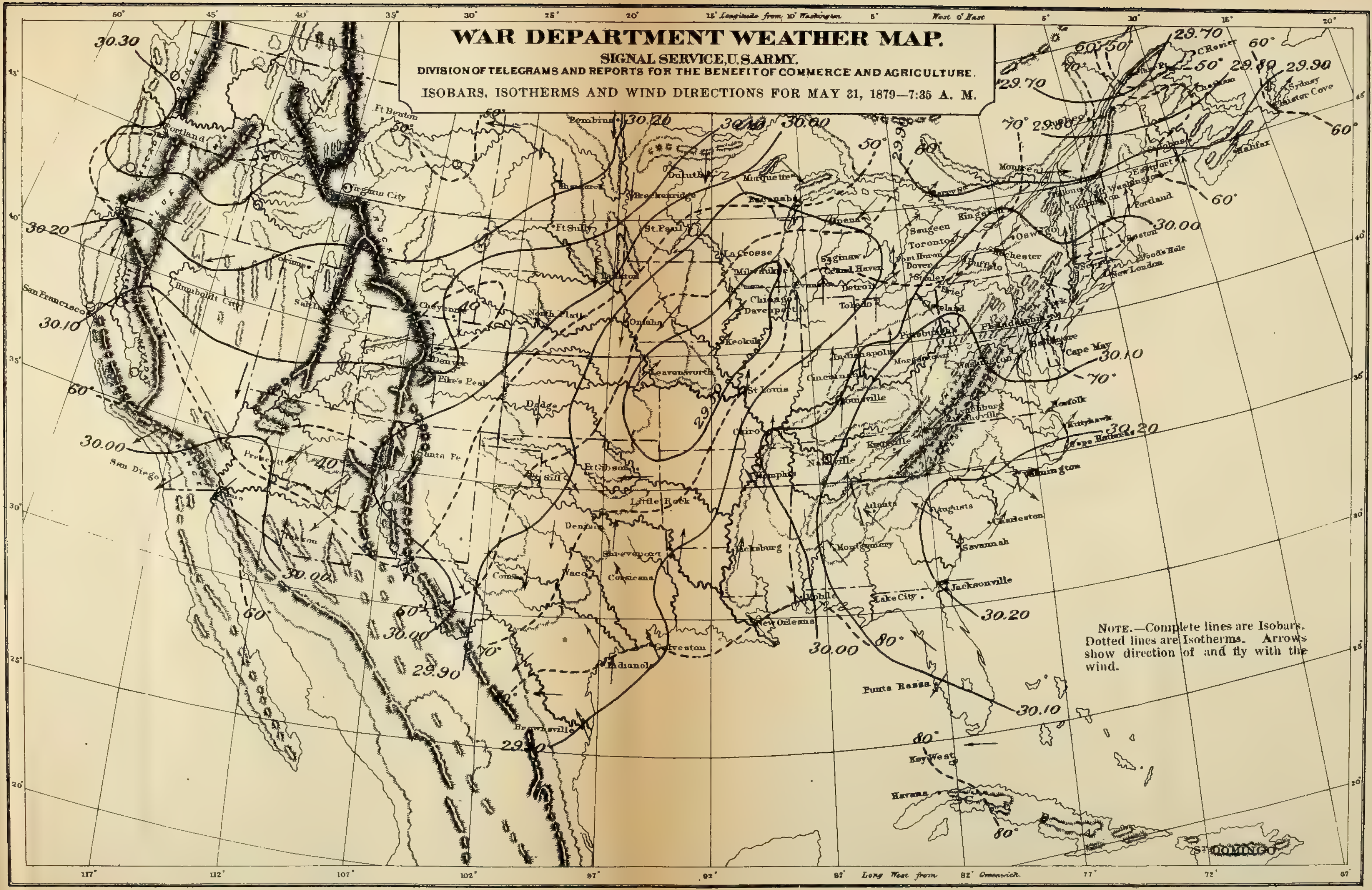


WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

ISOBARS, ISOTHERMS AND WIND DIRECTIONS FOR MAY 31, 1879—7:35 A. M.

NOTE.—Complete lines are Isobars. Dotted lines are Isotherms. Arrows show direction of and fly with the wind.

or fair weather, with southerly winds, prevailed southward to the Gulf and eastward to the Mississippi, and the isotherm of 70° traversed the central portions of Texas, Indian Territory, and Kansas. Over the Territories of Wyoming and Montana the winds veered to light westerly, with a slight fall in temperature, foretelling the decided change which the morrow would inaugurate.

On the morning of the 29th the area of lowest pressure extended from southern Manitoba to Northern Iowa, with southerly, backing to easterly, winds and light rain. Throughout the extreme Northwest and the Northern Rocky Mountain slope the winds had shifted to brisk northwest, and the temperature fell from 8° to 10° at all stations. At 4.35 p. m. (Washington mean time, and this time is indicated whenever the figures 7.35 a. m., 4.35 p. m., and 11 p. m, are used, other figures show local time) the low area was still occupying very nearly the same position, but the winds to the north of its center had changed from northeast to northwest, and occasional thunder-storms were reported.

To the west of its center the northwest winds had increased in force from 4 to 20 miles per hour at different stations, so affecting the temperature that the instruments barely indicated the accustomed daily range. At Fort Keogh, Montana, a temperature of 53° was reported at 7.35 a. m., and 52° at 4.35 p. m., with a precipitation of 0.01 inch. The highest temperature north of the 40th parallel and between the 102d and 112th meridians was 60° and the lowest 52°. Pike's Peak reported a northwest wind of 20 miles per hour, exposed thermometer 31°; upper clouds hidden and lower clouds (stratus) moving from the southwest.

South of parallel 40° and between the 92d and 102d meridians every station reported a south or southeast wind, and the temperatures ranged from 81° to 100°, the majority being above 92°. Those stations farthest north reported the highest temperatures. Here is presented a contrast in temperature of from 30° to 45°, and in the case of Pike's Peak (31°, wind northwest) as compared with Fort Griffin, Tex. (100°, wind south), a difference of 69°.

At this hour (4.35 p. m.), and while the contest of opposing warm and cold currents was vigorously proceeding, occurred two of the destructive tornadoes of northwestern Missouri. By midnight the temperatures throughout the Northern and Middle Eastern Rocky Mountain slopes had fallen from 4° to 18°, and snow was reported on the summit of Pike's Peak, with a brisk northwest wind and a temperature of 21°. The contrast of temperature north and south of parallel 37° still remained about the same. Throughout the eastern and western portions of Missouri and Kansas the temperature had fallen about 20°, with the winds shifting to westerly.

On the morning of the 30th the lowest pressure was central over the western portion of Lake Superior, accompanied with light rains as far south as Missouri and Kansas, and westward to Colorado and Wyoming. Throughout the Northern and Middle Eastern Rocky Mountain slopes the winds were north to west and the temperature ranged from 40° at Virginia City, Montana, to 55° at North Platte, Nebraska, and 13° on summit of Pike's Peak.

South of parallel 37° the temperatures ranged from 75° to 82°, with southerly winds. The cold westerly winds passing down in rear of the low area, which was moving to the northeast, now embraced a larger territory, and swept forward with more freedom to engage in conflict with the warm currents from the Gulf as they passed northward over Texas, presenting the first indications of the development of a second low area. By 4.35 p. m. this area extended from northwestern Texas northeastward to central Iowa, attended with very light precipitation over its northern half, and brisk winds to gales to the west and south. Fort Sill, S. 28 miles; Fort Gibson, SE. 24; Denison, Tex., SE. 20; Cheyenne, N. 22; Dodge City, NW. 44, and North Platte, N. 28. The first low area was now central over the Upper Lake region and but slightly affecting the atmospheric conditions over the Lower Missouri valley. Over the Northern and Middle Eastern Rocky Mountain slopes cold northwest winds still prevailed with hardly a perceptible change since morning, although it was but little past the hottest part of the day. The temperature at Cheyenne still remained at 43°, and Denver rose but 1°. Pike's Peak was now 15° with a northeast wind and light snow.

To the southward of parallel 37° the temperatures were nearly all above 90°, and Fort Griffin reported 101°, with a south wind. From this hour (4.35 p. m.) up to 7 p. m. occurred the violent tornadoes in Kansas, Nebraska, and Missouri. By 8 p. m. the winds throughout the Lower Missouri valley had changed to north and west, and the temperature fell from 10° to 14°. In central and eastern Kansas and western Missouri frost was reported during the night in many places. To the north and west of this district the temperatures remained low, with brisk north to west winds. At 11 p. m. Cheyenne reported wind N., temperature 43°; Denver, NW., [illegible]8°; Pike's Peak, NE., 15°, with light snow; Santa Fé, NW., 48°; Fort Keogh, NE., 45°; Fort Benton, NE., 48°; Fort Stevenson, N., 45°; Bismarck, N., 46°; Fort Garry, N., 38°; Pembina, NW., 40°, and Breckinridge, N., 47°.

During the 31st the barometer rose rapidly over the Northern and Middle Eastern Rocky Mountain slopes, with still lower temperatures, particularly over central and western Kansas, where high winds to gales prevailed from the northwest. At 7.35 a. m. Pike's Peak reported a temperature of 10° with fair weather. To the southward, over Indian Territory and Texas, the winds by afternoon had changed to north and northwest, with a decided fall in temperature. Low area No. I had now reached the Gulf of Saint Lawrence, while No. II had formed an irregular elongated "barometric trough," extending from southern Michigan southwestward to Arkansas, accompanied with moderately heavy rains and brisk to high winds from the Mississippi valley eastward to the Middle Atlantic states.

It will be of interest to note the fact that, throughout the Lower Missouri valley, the region of the violent storms, there occurred no unusual fall in the barometer during the entire passage of the general storm area. Compared with the means for May of previous years the mean pressure for the present month agrees with the average or is slightly above, as indicated by the following table; which, in addition, shows the lowest pressure at the several stations on the days upon which the tornadoes occurred, exemplifying the extremely local influence of their devastating energy:

Stations.	Monthly mean.	Lowest reading on 29th and 30th.	Mean for many years.
	°	°	°
North Platte	29.47	29.16	29.454
Leavenworth	29.86	29.50	29.858
Dodge City	29.49	29.10	29.479
Omaha	29.81	29.32	29.823
Fort Gibson	29.91	29.50	29.878
Saint Louis	29.97	29 74	29.956
Keokuk	29.90	29.58	29.874

The remarkable and important feature of the general storm area from which the tornadoes developed was not a decided barometric depression, but a marked contrast of temperature. Their approach was not indicated by the rise and fall of the mercury in the barometer tube, but by the change in temperature and the direction and continuance over a considerable area of the prevailing northerly and southerly winds. Even within a few miles of the tornado's track, and from one to two hours before the storm appeared, no decided change in the barometer was noticed. This fact was reported to me by several persons who had simply consulted their instruments without making a record of the observation, but the incident seemed such a strange anomaly that the impression was not easily forgotten.

As shown by the Signal Service weather maps, there had been, since the morning of May 19th, a continued movement of warm, moist air from the Gulf, northward over the prairies of the Lower Missouri valley, which fact corresponded very closely with the statements of many observers, who remarked that they had had a strong and humid south wind for from ten days to two weeks previous to the tornado's appearance. This current was not only experienced on the surface, but it prevailed in the upper regions of the atmosphere, as will be seen by the records of the Signal Service observer on the summit of Pike's Peak, who reported a continued southwest wind from the morning of the 5th to noon of the 11th, and from 4.35 p. m. of the 14th to 7.35 a. m. of the 29th. During this time the highest temperature of the month, 40°, was recorded at 2 and 4.35 p. m. of the 27th, and the lowest, 10°, at 7.35 a. m. of the 31st. Throughout the entire month in the Lower Missouri valley there were only three or four intermissions of from twenty-four to thirty-six hours when the wind changed to another quarter. The prevailing direction for the month at all of the Signal Service stations (50) between the 87th and 107th meridians was southerly, with the exception of eight, and the entire region was from 1°.5 to 4°.5 above the mean of May for several years.

All of the heavy storms of the month of May had passed across the country north of parallel 40°, becoming thereby the principal factor in the work of inducing this unusual movement of air to the north. Such a continued movement of the atmosphere in one direction had the effect of producing over the regions which it passed very marked changes in temperature and humidity. These warm southerly winds laden with moisture, crossed the land from the heated region of the Gulf and, passing northward, constantly increased the temperature and humidity of the surrounding air, until, with the approach of cold northwest winds, the atmosphere over the Lower Missouri valley was prepared not only to form unusually high contrasts of temperature but to present the prerequisites of excessive precipitation.

This comprehensible result is abundantly verified by the facts set forth in the accompanying weather maps and the following descriptions of the several tornadoes.

In order to avoid any confusion with reference to the location, which might result from so large a number of storms occurring on the same day, I have considered it advisable to designate each storm by some name that shall in a measure define its geographical position. The term so used does not in all cases mean that the storm actually passed over the spot from which the name is derived, but it is chosen with reference to its importance in defining the position of the storm's path.

THE LEE SUMMIT TORNADO.

On the afternoon of May 30th, the first developments of this storm were observed near the headwaters of Grand river, Missouri, a region of country lying between West Line, Cass County, Missouri, to the east, and Louisburg, Miami County, Kansas, to the west.

At Paola, about 12 miles southwest of Louisburg, no storm of any importance had occurred during the spring, or up to the 16th of June (the day of my visit there), except a very light thunder shower unattended by hail or strong wind about 3 p. m. of May 29th. This storm of the 29th was much more severe further westward, as will be seen from the weather reported at Osawatomie, about 7 miles southwest of Paola, where a heavy rain and hail storm came up from the southwest about 6 p. m. Before the storm the wind was very hot from the south and southwest, the prevailing directions for a week or two past; this storm was also felt at Somerset and Wichita, still further west. The Louisburg Herald of June 5th mentioned no storm on the afternoon of May 30th, but referred to the light shower of the 29th. Several persons residing near Louisburg stated that there were threatening clouds to the east and south during the afternoon and evening, but culminating in no storm.

These facts relating to the atmospheric conditions west of Louisburg, and also to the south and east, show that in all probability the tornado cloud formed to the eastward over the section of country previously designated. Its topography, as far as the eye could reach, was an alternation of high prairie and heavily wooded ravines, the latter generally trending east and west. The timber appeared to be more dense and heavy and the ravines wider than in any other portion of the storm's track. The ravines were not bounded by precipitous banks, but gradually rose to the upland over bottoms varying from one-fourth of a mile to two and a half miles in width. The intervening hills, forming the rich prairie of the farmer and herder, ranged in height from 75 to 150 feet. Here was what might be called an excellent opportunity to study any connection that could exist between the origin of the funnel cloud and the formation of the earth's surface. If the irregularities here observed entered as an important factor into the disturbance necessary to destroy the equilibrum of the opposing warm and cold currents, and thereby form the funnel cloud, then at this point if at any in the storm's path, should the cloud have descended and commenced its destruction. But the facts indicate no such operation, for the cloud was first seen at a considerable height above the earth, well defined against an almost clear sky (that is, for a short distance about it), apparently having formed and descended as the result of some violent commotion in the upper regions of the atmosphere. Maintaining this height of several hundred feet it moved at times slowly and then again more rapidly, in a northeast direction over Dolan, Union, and West Peculiar townships, Cass County, Missouri, a distance of nearly 22 miles.

Mr. R. H. Abell, who lives 3¾ miles directly south of West Line, stated, that on the afternoon of May 30th (could not give the exact time, but thought about 6 p. m.), he saw two ominous looking clouds in the northwest and southwest; the former appeared to be rising and moving forward but very slowly, while the latter moved much more rapidly toward it. Did not see the funnel cloud form, but noticed great commotion in the clouds near where the two currents appeared to have met, and judged that it must have originated there. He further stated that on the evening of the 29th it rained considerably, with a light fall of hail, wind NNW. quite strong. On the following morning the sky was partially clear until near noon, when it began to be overcast with dense haze, during the prevalence of a light southerly wind. About 3 p. m. heavy clouds commenced to bank up in the west, with a moderate wind from the SW.

Mr. J. W. Emerson, at Brosley, 7 miles due south of West Line, stated that about 9 p. m. of the 29th it rained very hard with a violent wind from the NW. During the day the wind had been mostly from the SE.

Mr. Emerson was at West Line on the 30th during the passage of the tornado, and stated that between 5 and 6 p. m. it commenced clouding up in the northwest with a brisk wind from the SW. There was a slight sprinkle, wind still in the SW. as the storm passed by. Nothing of importance was noticed, except that it was very sultry.

Dr. E. L. Sands, druggist at West Line, 2½ miles east and 2¾ miles south of the storm track, furnished me with the following data: During the afternoon of the 30th the air was very hot, thermometer suspended in the store back of the show case and against the shelves registered 96° wind south; but as the clouds from the NW. and SW. approached each other the wind "whipped around" quickly to the SW. At about 6 p. m. saw dark clouds in the southwest and northwest, with great commotion between them, and the funnel cloud, apparently resulting therefrom, moved from between the two to the northeast. After it had passed, the wind changed through the west to the north, and the thermometer fell 20°.

During the cloud's progress over this portion of its path (above the ground), occasionally a tree was blown over, and now and then a few rods of rail fence, but no significance could be attached to the direction in which the objects were blown, or the amount of force represented in their destruction. The tornado had not yet commenced its characteristic work, although it was plainly seen by many parties situated several miles to the north and south of its path.

Mr. O. A. Hoag, jr., of West Union, Cass County, one mile east and three-fourths of a mile south of the storm's course, stated that between 5 and 6 p. m. he saw a funnel-shaped cloud to the northwest of him, and at a considerable height from the ground; did not notice any gyration or movement in the cloud, as his observation was made very quickly. Considerable rain and but very little hail fell immediately preceding its approach.

Mr. A. W. Hoag, sr., stated that about 6 p. m. he saw clouds coming from the NW. and SW., the latter moving the most rapidly. In a few moments thereafter, and while watching the sky, clouds began to rush together from the S., SW., NW., and N. with almost lightning rapidity. The lower current seemed to come from the S. and the upper current from the SW., the latter being the stronger. The heavy black cloud in the W. and NW. was the largest and blackest, and "sort of held back" or appeared to remain stationary until struck by the strong SW. current, when there resulted a terrible commotion in the surrounding clouds and great roaring like an approaching train of cars.

In a moment or so the funnel cloud made its appearance, looking like a large elephant's trunk with the small end pointing downward. Rain and hail fell in small quantities a few minutes before the funnel was formed, and appeared to be brought by the cloud from the SW. Neither Mr. Hoag nor his son saw the funnel cloud reach the ground, and are confident that it did not anywhere in their vicinity, as no destruction had been reported. This statement verified the results of my own observations, for in traveling down to West Line and beyond, on one side of the storm's course, and back on the other, I had failed to find or hear of any evidence of the existence of the tornado upon the earth's surface. Mr. Hoag, sr., further stated that before any distinctive features of the storm had appeared, the wind blew quite strong from due south, prostrating a small hickory tree near his house, and remained in that direction until the cloud from the SW. came up, when rain and hail followed, the wind veering to the SW., coming with a warm, quick rush like a puff of steam. It was soon over, and the wind blew from the north much cooler. On the approach of the storm the thermometer stood 98°, but did not observe the fall when the wind changed to the N.

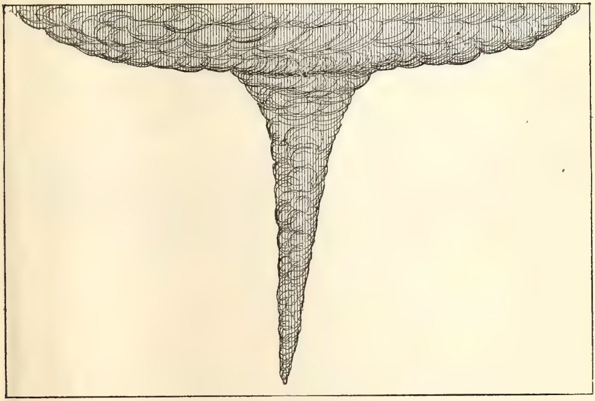
After leaving the vicinity of West Union the storm crossed Grand river in section 13, Union Township, and the northwest corner of West Peculiar Township, Cass County, first reaching the ground in the southeast corner of section 34, Raymore Township, Cass County, destroying the smoke house of Mr. L. Shackelford, carrying the *débris* to the northeast. This building stood a little west of the storm's center, on an elevated strip of prairie called a "divide," running between Grand river and Major's creek to the west, and another creek (name unknown) to the east.

Mrs. Irwin, who lives 3½ miles south of Raymore, half a mile west of Mr. Shackelford's, and three-quarters of a mile north of the storm's track, stated that about 6 p. m. she saw a funnel-shaped cloud approaching from the southwest, above the ground, but moving up and down with a "boiling motion." Could not see anything entering the cloud or flying about in it. The lower current was from the northwest and the upper current from the south. Hail like large "chunks of ice," with very little rain, fell just after the storm cloud passed. Saw the cloud when it dipped down at Mr. Shackelford's, rolling up cornstalks and dirt in a frightful manner.

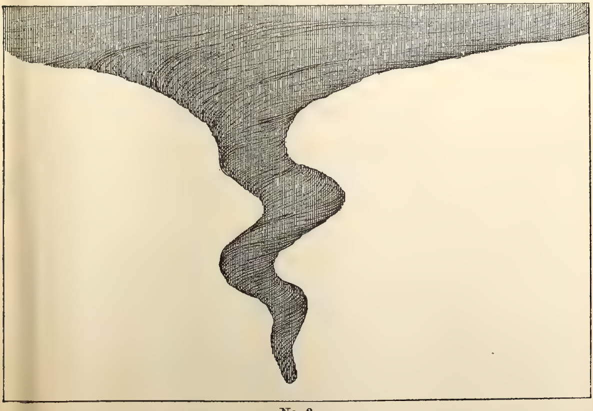
Before advancing further with the course of the storm, I will give the reports of several persons who witnessed the cloud in this vicinity from Belton and Raymore, Cass County, the former 6½ miles and the latter 4 miles north of the track. Both of these towns are on "high divides," from which the storm could be easily seen.

Rev. S. R. Reese, whose place of observation was 1 mile west of Raymore and 4½ miles north of the storm's track, reports as follows:

"For several hours before the storm the wind blew hard from the southeast as the lower current, and carried no clouds. The upper current was from the southwest, brisk, and carrying a thin sheet of clouds. At about 6 p. m. saw two rain clouds in the south and west, the former traveling with the under current, and the latter with the upper current in an easterly direction. In about half an hour these two clouds met at a point judged to be about 1½ miles northeast of Raymore. At their meeting the west cloud became violently agitated at its western extremity (several parties stating that they saw a 'white cloud column' form at the agitated point and pass eastward); soon thereafter the tornado cloud was observed (diagram No. 1) passing a point two miles southeast of Raymore, its course being about north, 20° east. Its form was that of a funnel, at times elongated into a serpentine-like form of heavy mold, hung up by the head and writhing in agony, its tail curling and lashing as if actuated by the impulses of a living body. (Diagram No. 2.) It was above the ground and doing no damage, though at times, in its violent contortions and struggles, it would descend very near to the ground. Its circular motion seemed to be from right to left. When last seen it rose high in the air and swept swiftly, in a northerly di-



No. 1.



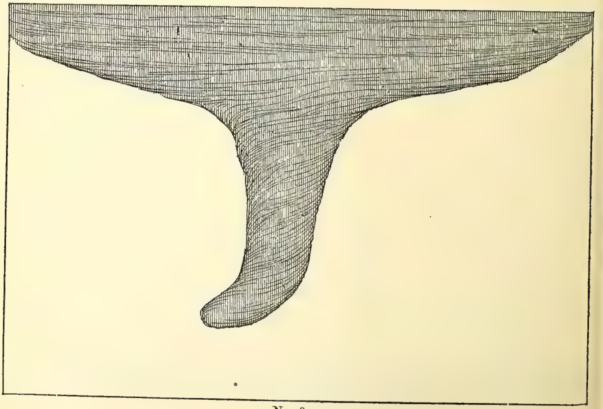
No. 2.

rection, into the apex of the two adjoining rain clouds which had preceded its appearance, and then disappeared."

Mr. W. E. Wannamaker, stock and grain dealer at Raymore, was on the day of the storm 6 miles due east of there, which locality placed him a little west of the storm's track; stated that between 5 and 6 p. m. he experienced a heavy wind from the SE., with rain and hail.

Mr. James W. Harrison lives 4½ miles SE. of Belton and about 2½ miles north of the storm's path; at about 5 p. m., as he was proceeding homeward, felt a strong SW. wind, with rain and hail.

Mr. P. B. Hanna, postmaster at Raymore, stated that at about 6 p. m. the storm cloud, funnel-shaped in form, made its appearance to the SW. of the town, forming an angle of about 45° with the horizon; the lower portion seemed to be changed from a right line so that its position was inclined, the base being thrown forward in the direction in which the storm was moving. (Diagram No. 3.) During the afternoon and before the storm, it had been exceedingly hot, with a slight breeze from the SE. When the funnel cloud had approached a point nearly opposite him to the SE., and at a distance of about 2½ miles, he felt a momentary calm, followed by a strong blast from the SW. When the funnel was first noticed clouds were seen rushing from the NW. and SW. toward its base, moving inward and upward from right to left. The violence of the boiling motion in the vortex increased greatly as the blast from the SW struck, causing the elastic column to sway off to the north, returning gradually again to its former course. A southwest wind was felt until the funnel had passed out of sight, when it changed to west and northwest.



No. 3.

Mr. W. S. Swisher lives 4½ miles SE. of Raymore and about 2 miles north of the storm's path. At about 6 p. m. felt a strong wind from the SW., accompanied by heavy rain, but no hail. Mr. J. O. Cheney, of Belton, stated that about 6 p. m., and before the tornado approached, it rained and hailed, with very little wind, as the raindrops and hailstones seemed to come straight down. After the rain and hail stopped, wind came very strong from the SW., but no damage resulted. Noticed very dark-green-colored clouds gathering in the SE., but did not see any funnel-shaped cloud.

Mr. John Ingram lives 4¾ miles south of Belton and about 2¾ miles north of the storm's path. Was coming home from town, and had reached a point about 3 miles due south (time about 5 p. m.), when a severe storm of rain and hail, wind south, was experienced, lasting but a few minutes. After partially ceasing, several puffs of very hot wind struck his face, coming from the WSW.

At Mr. Shaw's, 6½ miles SW. of Belton and 5¼ miles north of the storm's path, considerable rain and hail fell, while the funnel-shaped cloud could be distinctly seen to the southward. It did not come down to the ground while passing. The elevation of

Mr. Shaw's house is considerably above the surrounding country, as the funnel cloud could be seen at Blue Springs, a distance of 14 miles due northeast.

Mr. John Bales, living in township 46 N., range 33 W., 4 miles south of Belton, and about the same distance north of the storm's path, stated that at about 5.30 p. m. he saw clouds, having the appearance of smoke from a burning straw stack, moving from the SW. and SE., and boiling up in great commotion. They were moving very rapidly towards the NW., where a dense black cloud was rising, much heavier in form and indicative of rain, while the other clouds presented the characteristics of a heavy wind storm.

This noticeable difference in the character of the two clouds was quite well exemplified in what followed, as the hail and rain was considerably heavier between Mr. Bales's residence and the town of Belton to the north and west. About ten minutes before the commotion in the clouds was witnessed, rain and hail fell with a moderate north wind. It was exceedingly sultry before the storm. Mr. Bales did not see the funnel, but his brother-in-law, Mr. R. M. Johnson, living 1 mile SE. of him, saw it plainly. The air immediately surrounding Mr. Bales's house did not seem to be influenced by the passage of the storm cloud. It was much cooler after the storm; yet the wind continued from the SW. During the passage a strong current of wind rushed down a little ravine running from west to east about one-quarter of a mile south of the house. It was very violent, short and quick, tearing down several quite large trees.

Dr. R. M. Slaughter, of Belton, stated that at about 6 p. m. he saw clouds in the SE. and SW. moving toward each other, the former more rapidly. They formed a junction to the E. of Belton, when the funnel was seen to dart downward, reaching, as he thought, to the ground, and this, in all probability, was the case, for it was at a point a little SE. of Belton where Mr. Henderson's orchard was nearly destroyed. The funnel cloud about its edges possessed an indigo color, but in its center a greenish hue prevailed. It rose and fell and had a gyratory motion in a direction contrary to the hands of a watch. For the past five or six days the wind had been blowing from the south at from 25 to 30 miles per hour (estimated). About ten or fifteen minutes before the tornado approached, rain and hail fell, the former quite heavily and the latter scattering, but large, rough and sharp cornered. This precipitation did not change the temperature perceptibly. Just afterwards, and before the appearance of the tornado, a cool blast of air came from the NW., and in about three minutes from that time the funnel was observed to the eastward.

Mr. C. M. Williams, of Belton, stated that at about 6 p. m., when first watching the storm, he saw dark clouds approaching from the SE. and SW.; and when again making an observation, in the course of ten or fifteen minutes, saw that the two clouds had united near Dr. Dunnington's, about 15 miles NE. of Belton. The funnel cloud seemed to extend downward from the point where the two clouds joined, and to reach the ground. Before it did so, a great commotion was observed in the clouds and in the vortex, like the ebullitions of hot water. It would rise, fall and careen from side to side like a balloon. The roaring was intense and could be heard a distance of about 17 miles. About fifteen minutes before the tornado was observed, rain and hail came from the SW. The latter was very large and peculiar in form, being covered with corn-shaped crystals on all sides. During the passage of the tornado no unusual wind was felt. On Thursday, the 29th, the wind blew very strong from the SW. all day and part of the night, but no rain fell, although thunder showers were witnessed in almost every direction.

Mr. T. J. Parris, hardware merchant at Belton, had a thermometer and barometer combined, forming what is called the "patent chemical barometer." On the approach of a storm the chemical precipitation in the bottom rises and permeates the clear liquid above, to a considerable height; but during the passage of the tornado it remained undisturbed at the bottom, showing how narrow were the well defined limits of the storm, and particularly the peculiar character of the disturbing forces. It seemed very strange and quite inexplicable to Mr. Parris, not understanding the peculiar nature of this class of storms.

Mr. J. B. Breckenridge, who lives upon about the highest point of land in Cass County, 2 miles SE. of Raymore, 1 mile N. and 2¼ miles W. of the storm's track, stated that between 5 and 6 p. m. he noticed to the E. of his house, and at a considerable height above the ground, a dark funnel-shaped cloud like a balloon, moving slowly to the NE., and completely isolated from all surrounding masses of clouds. Did not watch it carefully, but noticed its queer shape, and particularly the fact that it seemed to be entirely by itself. During the time of its passage the wind was from the NW., and gentle. Did not experience anything oppressive in the atmosphere or consider it an unusual day in any respect, although it was quite warm. Previous to the 30th the wind had been southerly for several days, but changed to the NW. during the storm, and remained so for two or three days, the weather in consequence becoming so cool that fires were required in the house, a remarkable occurrence for that time of the year. Mr. Breckenridge kindly furnished me with a series of thermometric observations taken before, during, and after the storm, at 3 p. m. of each day, from

May 23d to June 4th, inclusive. His instrument hung in the library, near the north window.

Date.	Hour.	Themometer.	Wind.
		°	
May 23	3 p. m	75	SE.
May 24	do	90	S.
May 25	do	88	S.
May 26	do	84	SW.
May 27	do	81	SW.
May 28	do	86	S.
May 29	do	88	SE.
May 30	do	78	NW.
May 31	do	76	WNW.
June 1	do	68	W.
June 2	do	71	NW.
June 3	do	84	WSW.
June 4	do	90	SW.

It is very interesting to note the marked change in the temperature on the afternoon of the 30th, about two hours before the tornado was seen to the eastward, when the thermometer read 10° lower than on the previous day. But taking into consideration the direction of the wind at the time, as well as the position of the house regarding elevation and the storm track, the explanation is not difficult.

Returning to the storm's track where we left it at Mr. Shackelford's, we find that the funnel cloud remained but a few moments upon the surface of the ground. Rising about as quickly as it descended, it passed a distance of 3¼ miles at a height of several hundred feet, descending for the second time on the farm of Mr. Hamilton, where it struck a shed covered with flax straw, which it scattered all over a ten-acre field. It rose but a short distance above the ground after leaving this point, for it again descended about half a mile to the northeast at the house and orchard of Mr. Henderson. Mrs. Henderson kindly furnished me with the following information:

At about 6.30 p. m. the tornado struck the middle of the orchard at a distance of 145 feet west of the house. Mr. Henderson, who stood out near the southwest corner of the house, saw the funnel-shaped cloud about 80 rods distant, coming up from the southwest. It was boiling and twisting, and presented a frightful appearance. Watching it but for a moment he turned about and walked into the house, going a distance of 35 feet, and had hardly made his entrance ere the cloud struck the orchard, and almost as quickly left it. I examined the ground and found that twelve trees were blown down, part were torn up by the roots, and others simply bent to the ground. Not one of them was twisted, but all lay straight to the northeast with hardly a twig broken, showing that in all probability the base of the funnel did not really reach the ground, for, if it had, the circular action of the vortex would certainly have left some evidence of its force. The orchard had lately been trimmed, and small limbs lying upon the ground under the trees, were, during the passage of the storm, picked up and violently forced into the south side of a hedge fence just across the road from the orchard The rail fence on the south side of the road next to the orchard was blown over (not twisted) for a distance of 20 rods. The width of the damage in the orchard and of the rubbish in the hedge was exactly 100 feet in each case. The corn and oats to the south and west of the orchard were whipped to pieces and looked as if dipped in muddy water. The width of the track where even the slightest damage was committed was 515 feet. The house stood 175 feet east of the center of the storm's path, but was not injured, although the sensations of the inmates at the time of the storm, were, as if the building had been grasped by a monster hand and shaken severely. The ground about was swept as clean as if with a broom. Two hundred and seventy feet east of the house, the western half of a hay-covered stable was partly destroyed and the *débris* carried to the northeast. The eastern half was still standing, and about as secure upon its foundation as before the storm. Thirty-three feet SE. of the stable lay a straw stack lightly thrown together, which did not appear as if touched by the wind. One hundred and twenty-nine feet east of the house, the hay roof of a hen-house was blown off and carried to the northeast. No part of the destruction in this vicinity indicated the influence of any gyratory force.

Mrs. Henderson further stated that, as well as she could remember, the first blast upon the approach of the storm, came from the southwest, but not as severe as a similar current from the southwest when the funnel cloud passed through the orchard. It had been very sultry throughout the day, with a strong southerly wind, which had continued for nearly a week, accompanied by very little cloudiness until a few hours before the storm. Did not notice anything unusual in the atmosphere, or receive any premonition of the terrible storm, but it broke upon them in all its fury like a lightning's flash. From the time the cloud struck the orchard until it was seen passing over the fields some distance to the northeast, did not consume thirty seconds. The family had hardly time to realize their situation when all was over and the air very quiet.

Mrs. Henderson was quite positive that she could distinguish a gyratory movement in the cloud contrary to the hands of a watch. It was boiling, twisting, and drawing itself up and down like a snake hung by its head and writhing in agony. The lower part of the funnel appeared to be about the size of a water bucket and the upper portion as large as the largest size wagon wheel. The outer portion was very black and looked like smoke issuing from a locomotive, while the inner part had a light milky appearance. It might be of importance to state that Mr. Hamilton's shed and Mr. Henderson's orchard stood upon slight eminences about one mile apart, with quite a well defined valley between them, and the cloud in passing from one place to the other skipped the depression entirely.

The storm cloud next encountered some hay stacks (situated on high ground) on the property of Mr. John Robinson, one-fourth of a mile NNE. from Mr. Henderson's. They were scattered a distance of about 80 rods along the storm's path, in a narrow strip averaging about 100 feet wide, but not thrown about promiscuously as if whirled. The stacks stood about 30 rods southeast of the house, which was not injured in the least. Ten rods NE. of the stacks several rods of fence were thrown over to the east, but not scattered.

From this point the funnel raised again, committing no damage for a distance of 9¾ miles over an alternation of hill and dale, when it struck a large elm tree situated in a broad valley with gently sloping sides. The top of the tree was whipped into strings, but the base or trunk left uninjured. For a distance of 160 rods the storm passed up a gradual ascent to the northeast, reaching the house of Dr. Dunnington's, situated 1¾ miles SSE. of Lee's Summit. It was at this point that all reports from whatever source and of whatever character concerning the storm, began their narrative and located the incipient stages of the tornado. It was about the nearest locality to the railroad of any manifestation of the storm's destructive force, and consequently the easiest attainable. The people in this vicinity were persistent in the belief that this was the starting point of the storm, until I assured them to the contrary after my explorations to the westward.

Dr. Dunnington stated, that about 6 p. m. (and in recalling the time said, that a moment or two before the storm, while reading at his desk, he had looked up at the clock and saw that it was exactly six) a severe rain and hail storm came upon them with a northwest wind which blew "desperately," smashing in the windows on the north and west sides and demolishing his office room, bottles, &c. As soon as possible after this occurred, the doctor with his family, consisting of wife and grandchild, descended into the cellar. After the blast from the northwest a dark cloud was seen in the southwest moving up rapidly, and "it seemed as if the house was to be ground to pieces between the two clouds approaching each other." This supposition proved a reality, for the family had hardly reached the cellar ere the building was struck from the southwest, throwing the north end to the west about two feet. The next instant the body of the house was lifted, pulling the studding out of the sills, and leaving the floor upon the foundation, which protected the family in the cellar. It was now completely twisted around from right to left and broken into kindling wood, the *débris* being scattered to the north, northwest, and west, at distances ranging from 15 to 30 rods. The north gable end was carried to the northeast 300 feet and apparently torn to pieces after striking the earth. The bed clothing and clothes of the family were torn into shreds and looked, said the doctor, "as if some person, out of pure mischief, had carefully torn them into small strips." The house was one story and a half high and 16 by 30 feet, with studding 12 feet and 2 inches long and 6 inches square. One hundred and eighty feet NNW. of the house stood a stable and corn crib, which were swept from the ground, torn into pieces, and carried along the storm track to the northeast. A hen-house weighing hardly two hundred pounds and standing 126 feet west of the house and 90 feet south of the corn crib, was not moved from its foundation or injured in the least. Some 25 or 30 trees were blown down about the residence, none of them twisted however, but all lay out straight from the stump, pointing to the north and northeast. The width of the path of destruction was 180 yards. Seventy-five yards northeast of the house passes the track of the Missouri Pacific Railroad, on both sides of which, and for a distance of 180 rods, the board fence was blown down to the north. Twelve telegraph poles in the center of the storm's path were thrown in the same direction.

The roaring of the storm was so great that the family, while in the cellar, did not hear or know of the destruction that was going on above them, not realizing that the house had gone until they had emerged from their place of safety. The doctor was quite confident that he experienced a very strong smell of sulphur while in the cellar, yet those who were witnessing the passage of the tornado cloud were positive that no lightning issued from it. During the rain and hail from the northwest, there were alternations of hot and cold puffs of air from the NW. and SW., the former at times almost suffocating; but after the cloud had passed a cold brisk wind set in from the west, veering to the northwest, causing the family to shiver, the change in temperature being painfully evident. There was but a slight interval between the rain and hail, and the striking of the tornado cloud, say about five minutes, when precipitation entirely ceased. About half an hour before the storm passed, very dark clouds were noticed in the west and a low rumbling noise heard, but up to 5.30 p. m. there was no rain. The darkness grew so rapidly after 5 p. m. that it became necessary to light a lamp, at least an hour before the usual time. During the morning there was an alternation of cloud and clear sky up to 10 a. m., when it commenced to grow threatening in the west, which condition continued very irregularly up to the culmination of the storm.

Several papers from Dr. Dunnington's were found at long distances from the house. A receipt for lumber, received from the firm of Childs & McClannahan, of Lee's Summit, was discovered at Knoxville, Ray County, across the Missouri, 40 miles to the northeast. This paper was no doubt carried upward through the funnel cloud, and shot outward into a strong upper current from the SW.

The place of Daniel Cline, a tenant of Dr. Dunnington, and 40 rods northeast of the latter's house, was next visited. He stated that the tornado reached him about 6 p. m. The roaring was so loud and powerful that his wife felt certain that the eastward-bound mail train was approaching, and could not be convinced to the contrary until a careful observation was made revealing the truth. The house stood 25 rods west of the storm's center, and was moved bodily about 6 inches to the north, but not otherwise damaged. A stable containing five horses and a colt, and standing 50 feet northwest of the house, was turned over on its side to the northeast, then torn to pieces and the *debris* scattered along the storm's track. The roof had not been found, nor any portion of it recognized although search had been made along the track for several miles.

Before proceeding further with a detail of the destruction along the storm's track, it will be of importance to consider the testimony of several persons who witnessed the storm in this locality, from the town of Lee's Summit, 1½ miles west of the storm center.

Mr. James A. Shaw, attorney at law, stated that at about 5.30 p. m., and before the funnel-shaped cloud made its appearance, rain and hail fell with a northwest wind. Shortly after, dark clouds commenced to bank up in the SW. and NW., and almost immediately thereafter a gust of warm air came from the SW. which appeared to encounter the clouds approaching from the NW., rolling them up and over each other in a very portentous manner, after which they seemed to move south again, and at that moment the funnel was seen working down in a twisting manner from the overhanging clouds. At the moment the NW. clouds were driven backwards, the rain and hail, which was coming violently from the west, was also diverted so that it came from a southerly direction.

At this juncture Mr. J. B. Campbell, who was walking along the main street to the north, stated that his umbrella was converted into a parachute instanter, whereas just a moment before, the wind and rain had been beating against it, making it difficult to control.

Mr. O. H. Lewis, of Lee's Summit, whose house stands one mile west of the storm's track, experienced the rain and hail as first coming from a southwesterly direction against his house, changing in about five minutes to the NW. almost instantly, when the hail commenced to strike the north side of his house.

No damage of any kind was committed in the town during the passage of the storm. In fact, the air was quite still while the dark cloud was opposite to the SE. and E. The strongest wind experienced came with the hail from the northwest.

It will be remembered that preceding the destruction at Dr. Dunnington's, a large elm tree was partially demolished in a valley SW. of the house. From this point it becomes necessary to follow the course of a second and much smaller funnel-shaped cloud that appears to have separated itself from the main cloud, and traveled along the valley which runs a little south of east towards Greenwood, a small town on the west fork of Big Creek, 4 miles south and 2 miles east of Lee's Summit. Mr. William Thompson, whose new house stands 160 rods east of the large elm tree, and 80 rods north of the track of the small funnel, stated that he was watching the approach of the strange looking cloud for some time before it reached the valley. It did not divide until it struck the elm tree, when a smaller funnel was discerned forming on the east side of the large one, finally separating itself entirely, as the latter darted forward to the northeast. The former then started down the valley back of his orchard, taking an ESE. course. Ten trees were blown over, and two chimneys were carried off from the house, all to the east.

Mr. Thompson's old house stands east of the new one about 350 yards, and a half mile north of the storm's track; it was not injured, except that a heavy platform lying on the ground west of the kitchen was picked up and dashed through one of the windows in the east front. A large granary, 12 by 32 feet, standing a few rods north of the house but on not as secure a foundation, was turned over to the east, not otherwise injuring it. About half way between the two houses (old and new) stood a large railroad-crossing sign. The posts were 18 feet high, 12 inches square, and placed 3 feet in the ground, each post being supported by four braces, each 6 inches square, one end mortised into the post and the other placed in the ground. A heavy pine plank, 33 feet long, 2 inches thick, and 18 inches wide, connected the two posts at the top. The south post was pulled out of the ground and away from the braces, leaving the other still upright and firm. The pine plank was split in two from end to end, and both it and the post were carried across the railroad track, a distance of 50 feet to the east.

Mr. Albert C. Millen, a carpenter who was working on Mr. Thompson's new house at the time of the storm, stated that at 6.05 p. m., by his watch, there was a strong wind from the northwest, accompanied by rain and hail. By the time he had stepped out of the house to watch the storm the wind had changed to the southwest, and felt very hot against his face. At the same time he noticed to the south of west a strange-looking cloud moving rapidly to the northeast, having also a very violent motion, apparently from right to left upon its own axis. But one of these clouds was at first seen, and soon after another, similar in form but smaller, shot out from its side and passed eastward. In anticipation of a very hard wind storm, Mr. Miller ran southeast of the house several rods and grasped a small elm tree. He had hardly made himself secure ere he was enveloped in a thick, dark smoke, and whipped about the tree two or three times from right to left.

After leaving Mr. Thompson's, the small funnel passed down a short branch of the west fork of Big Creek to the ESE., a distance of 1½ miles, without doing any damage, although a heavy wind was felt on both sides of its path. When it reached within about 300 feet of Greenwood cemetery, it left the creek (and, as some say, divided into two smaller funnels) and turned up a small ravine running to the northeast, changing the course of the cloud about 80°. There was nothing of an abrupt nature in the configuration of the earth's surface at this point to influence the cloud in taking the new direction. It could have pursued the valley of the west fork of Big Creek, down as far as Greenwood and beyond, without any apparent obstruction, so far at least, as topography was concerned. The banks on the west and south of the creek were quite high, and covered with a considerable growth of timber, but to the east and in the course of the storm there were broad flats stretching out a distance of 80 rods or more.

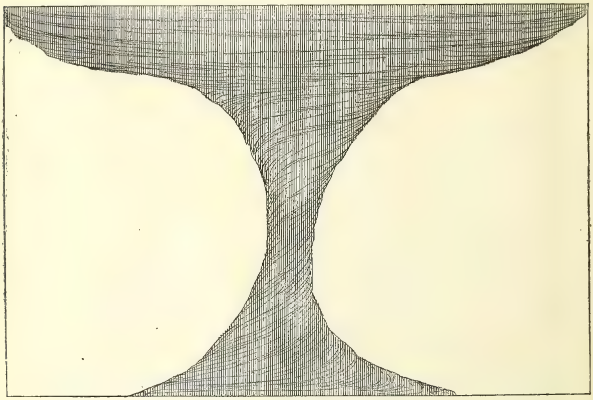
Where the funnel turned to the northeast it passed around the base of a hill rising about 60 feet in a gentle slope to the northward. The cemetery to the southeast and on the opposite side of the storm's track was also on a slight rise of ground.

From all appearances the funnel seemed to be controlled by powerful forces in the atmosphere, emanating, perhaps, from the main funnel, only a short distance to the westward, or indirectly the effect of its disturbing influences, and not by any irregularities in the surface of the ground. The two traveled along side by side, the smaller one constantly approaching the larger, until it joined with it on the farm of John O. Howard, a distance of about 4 miles from the point where it turned to the northeast. At no time was it distant from the main funnel more than two miles, and parties standing on the "divide" between them could see both distinctly.

Dr. J. L. Remsburg, who witnessed the storm from Greenwood, stated that at about 6 p. m. it rained and hailed with a southeast wind. After the rain and hail the wind veered to the southwest quite strong, and the small funnel cloud was seen reaching part way to the ground; at the same time an inverted funnel of dust and light materials formed over the earth beneath and reached up to it. (Diagram No. 4.) Both funnels had a gyratory motion from right to left, and were accompanied by a roaring noise like the rumbling of many trains of cars. No lightning was seen in either funnel cloud, yet during the rain and hail it was frequently observed.

About 30 rods north of the cemetery, stood the house of Mrs. Kerr. She stated that a little after 6 p. m. saw two small funnels (Diagram No. 5) side by side, connected at the top, but separated at the bottom, passing up the ravine, the center of which lies 65 feet north of the house. Northwest of the house 12 rods, where the ravine crosses the north and south road, and on the west side of the road, nine panels of board fence which connected a small portion of hedge on either side, were taken out without injuring the hedge. Across the road to the east, a distance of 40 feet, two panels were lifted above the rail fence, without throwing it down. Mrs. Kerr's house stood upon a rise of ground about 30 feet above the ravine, but escaped all injury save a violent shaking which broke some of the windows. One hundred and fifty rods northeast of the house, and in the line of the storm, twelve panels of fence were destroyed, the posts being jerked out of the ground and several of them thrown to the north on the east side of the storm's track, but the majority back to the south on the west side of the track.

Mrs. L. Jones, who lives half a mile north of Mrs. Kerr's, upon higher ground, and about 80 rods west of the storm's track, and three-quarters of a mile east of the track of the larger funnel, stated that she could see quite distinctly the latter while it was still southwest of Dr. Dunnington's; did not see it divide, as she was too much frightened to remain outside of the house and watch its progress. The house was shaken very violently, but could not tell positively the direction of the wind at the time. Thought that it must have come from the west, as everything lying loose about the building, such as chairs, boxes, barrels, &c., was carried out of the yard and across the road to the east. In the orchard to the south of the house five trees were blown down to the east and two to the west. Thirteen rods of fence west of the house was all blown over to the east.



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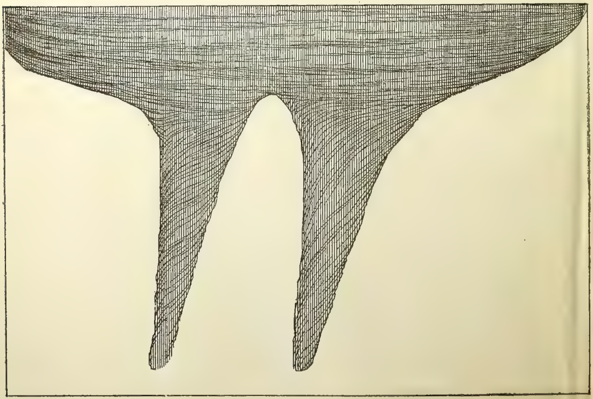
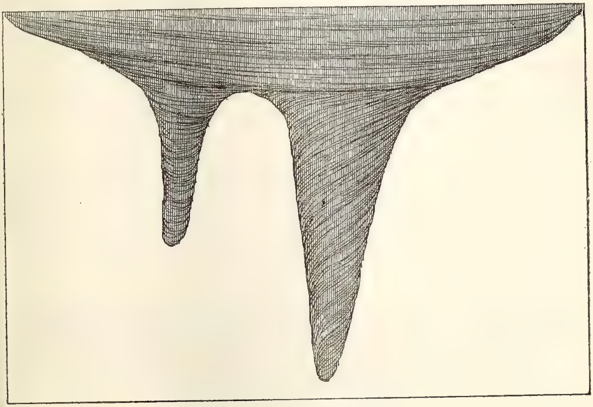


No. 5.

Mr. O. G. Bartley, who resides at Mr. J. C. Ransom's, nearly 1 mile northeast of Mrs. Kerr's, stated that about 6 p. m. saw two funnel-shaped clouds near Mrs. Kerr's house; they were passing up the ravine, and one of them seemed to be a little behind the other, and smaller than its companion. (Diagram No. 6.) Saw them enter the wheatfield northeast of the house, twisting and whipping the grain about, and filling it with black mud in places, from 6 to 20 feet wide. After leaving the wheat, the two clouds reunited into one, entering a cornfield and then a flaxfield half a mile east of Mr. Ransom's house. Passing up a gentle ascent until it reached high ground, the cloud rose from the surface and bore away to the NNW. for one-fourth of a mile, when it again descended (still upon the high ground) in a small piece of flax, passing within 50 feet of a small shanty without harming it.



No. 6.

Mrs. B. H. Strother, who lives three-quarters of a mile NNW. of Mr. Ransom's, and one mile W. of the storm's track, stated that she saw the dark funnel-shaped cloud come to the ground east of the shanty, and then draw itself up into the clouds above. Mr. Stephen A. Lea, a neighbor, corroborated this statement.

Three-fourths of a mile north of Mrs. Strother's, 1 mile west of the course of the small funnel, and about the same distance east of the larger one, stood the house of Mr. J. B. Fields. Considerable fencing to the east of the house was thrown down, some of it to the south and north, but the largest portion to the east. One chimney was blown off to the east, but the house was not shaken much; the wind seemed to strike it only on the west side.

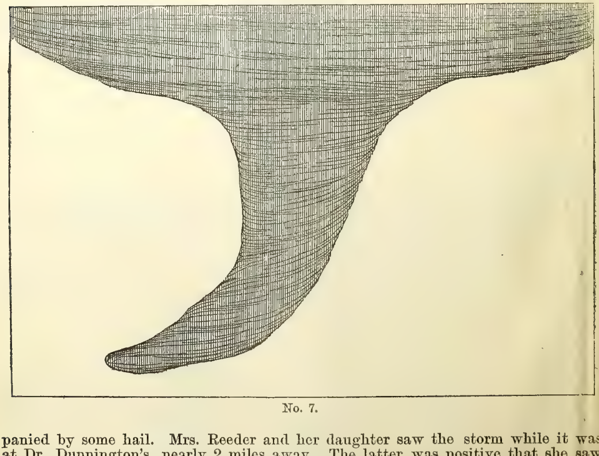
Mr. Robert Daniel, a hired man of Mr. Fields's, stated that about 6 p. m. saw the small funnel-shaped cloud about half a mile east of the house passing in a northwesterly direction towards the larger funnel. It was at a considerable height from the ground, and seemed to be fast losing its identity in the surrounding clouds. Mr. Daniel did not see the junction of the two storm clouds, but had heard several persons mention the fact. I was not successful in finding any one who actually witnessed the contact, although I have no reason to doubt its occurrence.

Returning to the track of the larger funnel, where it had damaged the property of Mr. Cline, the tenant of Dr. Dunnington, we trace the storm to the house of Mr. John L. Van Meter, standing 75 rods east of the storm's track. As the heavy wind struck the house, the clock stopped at 6.30 precisely. The building was one story and a half high, and 16 by 24 feet. On the approach of the storm the first heavy blast smashed in the south door, and moved the whole house to the northwest a distance of 12 inches. Mr. Van Meter stated that he saw the dark cloud pass to the NE. west of his place of observation, and that afterwards the wind blew furiously from the SW. Did not see any lightning in the cloud, which was intensely black and seemed to fill the surrounding air with smoke. In the orchard to the southwest of the house (rows of trees running N. and S.), 15 or 20 trees were blown down to the NW., NNE., E., and NE. One hundred feet east of the house stood the barn, 22 by 40, and 12 feet high, which was moved along on its foundation to the north, 4 feet.

About fifteen minutes before the funnel cloud appeared, rain and hail fell with a north wind, which, after the precipitation had ceased, changed almost instantly to the south and blew violently, followed by the passage of the dark cloud.

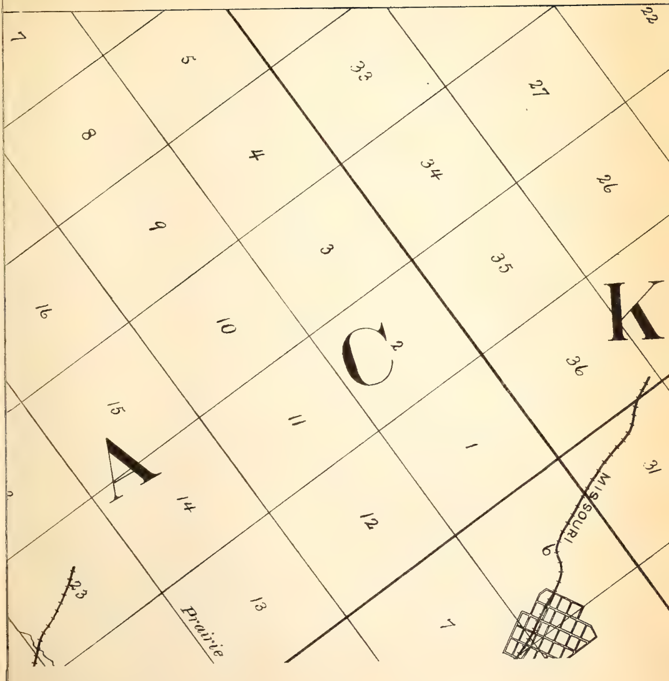
At Mr. Jonas Houghton's, one-fourth mile north of Mr. Van Meter's, and 40 rods east of the storm's track, a kitchen 10 by 12 feet attached to the east end of the house was entirely demolished and the *débris* carried away to the north. In the front yard, west of the house, several cottonwood trees were broken off at the height of 12 feet and the tops carried to the northeast. In the orchard, 50 feet east of the house, 45 trees were blown down with their tops pointing to the northeast; none of them were torn out by the roots. A grapery NW. of the orchard was badly damaged, the vines being torn from the trellises and both carried to the north. Mrs. Houghton stated that the funnel-shaped cloud as it passed, was intensely black and greatly agitated. It moved with its lower portion or tail thrown forward, causing the cloud to appear inclined. (Diagram 7.) A young orchard 20 rods southeast of the old one was not harmed.

The house of Mr. Daniel Reeder, next in the course of the storm, stood west of the track 40 rods. Upon examination I found that the building, 26 by 27 and 12 feet high, had been carried over the foundation to the SE. 14 feet 7 inches, and the southeast corner driven into the ground 2½ feet. Upon questioning Mrs. Reeder as to the effects of the storm at her house, she stated that the wind first struck the building from the NW., coming with the violence and quickness of a cannon-shot. It seemed as if something solid had been thrown against it. The northwest corner of the house was lifted from the ground and every particle of plastering knocked from the walls of the two west rooms. About ten minutes before this strong blast it rained quite hard, accompanied by some hail. Mrs. Reeder and her daughter saw the storm while it was at Dr. Dunnington's, nearly 2 miles away. The latter was positive that she saw two funnels, the large one, and a smaller companion, a considerable distance to the E.; both were very dark on the outside, but lighter within. They were whirling continually, but could not tell the direction. Across the road from the house, to the west 50 feet, not the least damage was done to anything. The house seemed to stand on the extreme western edge of the storm's path.



No. 7.

Among several of the peculiar manifestations of the wind's force at this place I relate the following: One hundred and fifty feet northeast of the house and 10 feet west of the stable, a large gate was carried 200 feet to the southeast and torn to pieces without injuring the stable. A heavy lumber wagon standing behind the corn crib and at a distance of 155 feet east of the house, was lifted up bodily and carried to the southeast over a cornfield a distance of 100 feet without injury. Two window panes were blown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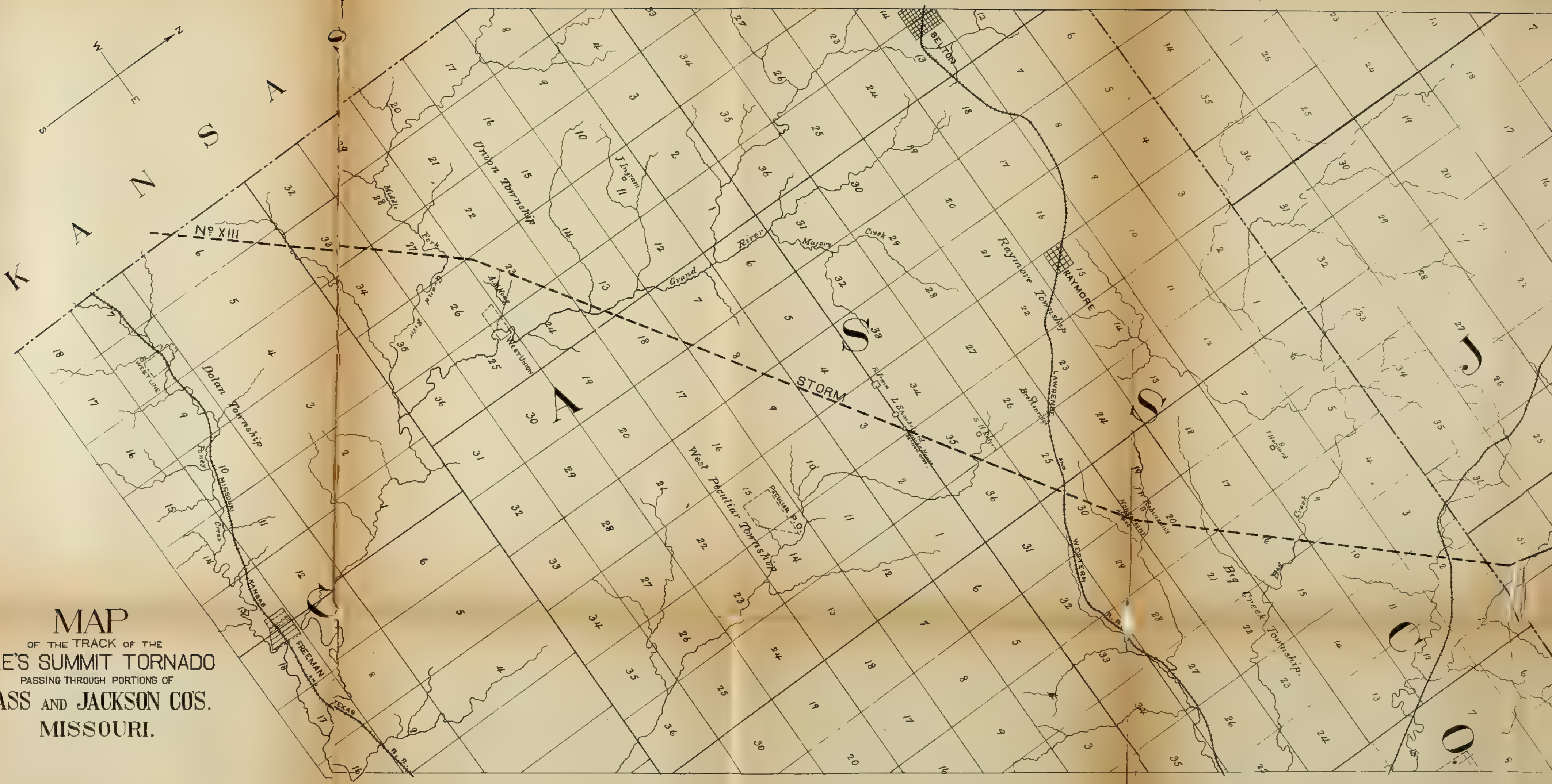


MAP

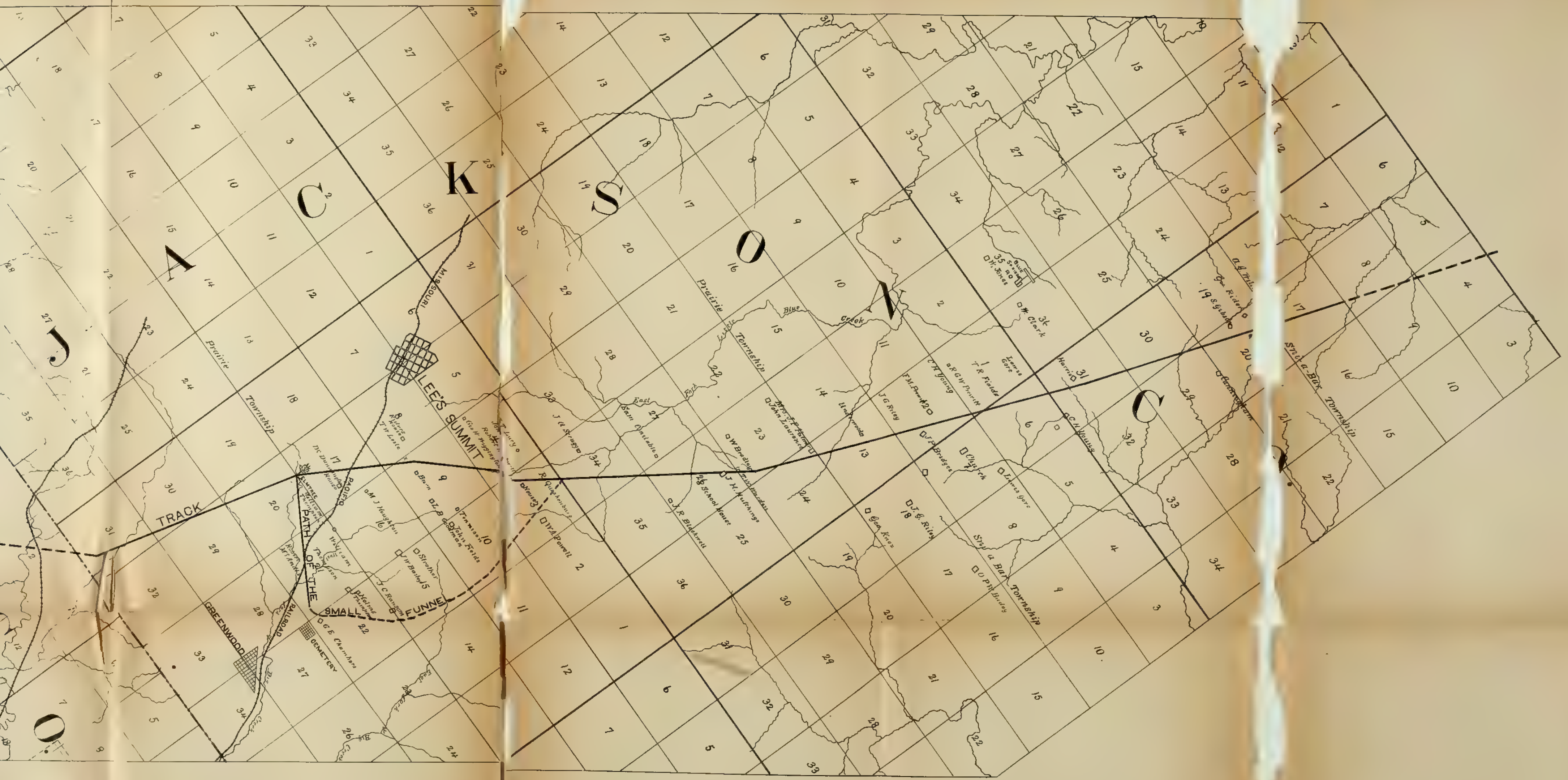
OF THE TRACK OF THE

LEE'S SUMMIT TORNADO

PASSING THROUGH PORTIONS OF

CASS AND JACKSON CO'S.

MISSOURI.


J A C K S O N C O.
Prairie Township
Prairie Township
LEE'S SUMMIT
MISSOURI PACIFIC RAILROAD TRACK
GREENWOOD
CEMETERY
PATH OF THE SMALL FUNNEL
Little Blue Creek
East Fork
Sni-a-Bar Township
Sni-a-Bar Township
Elmtree
School house
W. A. Powell
J. R. Blackwell
J. H. Hutchings
Sam Constable
C. H. Young
T. R. Fields
J. G. Riley
Geo. Knox
M. J. Houghton
G. E. Chambers
J. C. Ramsey
O. P. Hickey
Clark
Harris
Jones gore
Church

from a sash on the west side of the house and carried inside without breaking them, while two out of the north window were found broken. A large well curb lying east of the house 15 feet was carried one-fourth mile to the southeast and lodged in a wheatfield. A heavy sulky cultivator, weighing about 600 pounds, was carried free from the ground a distance of 86 yards to the SSE. and broken by the fall. Another one standing near the corn crib was partly carried and partly rolled, along a distance of about 60 rods to the SE., and then literally twisted to pieces and the *débris* scattered about over a field of 12 acres, apparently in circles. Mrs. Reeder and her daughter both stated positively that the time consumed in the destruction at their house did not exceed a half minute.

One-half of a mile south of Mr. Reeder's, and west of the storm's track 250 yards, stood a corn house, 16 by 24 feet and 12 feet high, nearly filled with corn. The building was torn to pieces and the grain scattered to the east, south, and northeast for distances varying from 75 to 100 feet. A large cooking stove was carried out of the building 15 rods to the east and badly broken. Surrounding the corn house to the east and south was a large cornfield of 15 acres which was beaten flat to the ground, the stalks pointing in a northeast direction and covered with black mud. A fence made of oak posts and pine boards, running east and west, to the north and east of the corn house, was stripped of its boards, the nails remaining in the posts. Several of the latter were broken off at the ground. In this vicinity hedge fences running east and west were filled with *débris* only on the south side, while north and south fences were filled on both sides.

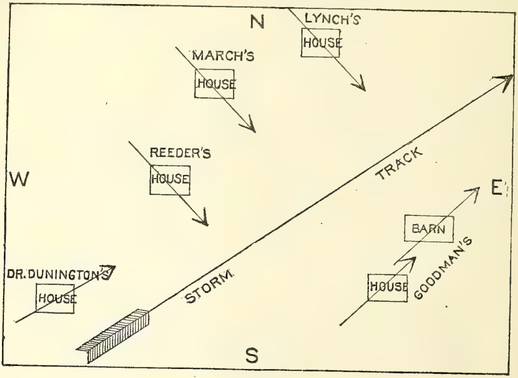
Mr. J. F. Goodman lives on the opposite side of the storm's track from Mr. Reeder's and 300 yards east of its center. At about 5 o'clock p. m., as he states, a dark cloud was seen to rise in the northwest, previous to which during the day, the weather was fair and pleasant. As the cloud approached, a light rain set in with a gentle southwest wind, when it began to grow darker, and in a few minutes hail came very fast and of large size. Just as the rain cloud had arrived nearly over the house, a dark smoky-looking cloud was seen extending around the horizon from southeast to southwest, and moving rapidly towards the northwest cloud. Before they met the hail and rain stopped, followed in a moment or two by a hard, misty rain with a cold brisk wind from the north. It then grew darker than ever, rained very hard for a moment or two, let up quickly, and as the mist cleared away, disclosed to the southwest about 2 miles, the two clouds in conjunction. By this time could not tell which way the wind was blowing, as everything in the atmosphere seemed to be converging to the point of meeting. Very soon after the clouds met, a dark funnel-shaped mass of vapor was seen depending from them near their point of meeting. The darkness was intense, and the roaring unlike anything ever before heard. Although the cloud was nearly a mile away, members of the family could not hear each other speak, as they rushed to and fro about the house, shutting and barring doors and windows. They had hardly finished when the storm was upon them, and almost as quick as thought the shock was over. The house was struck by the wind at the southwest corner, the current seeming to divide, a portion passing on either side and then coming together, giving the house a severe shock from the northeast. The south side of the house was bent inward considerably, and a window sash blown in, plastering was knocked off in many places, and the studding on the west end was loosened from the sills. A smoke-house 20 feet east of the house, size 12 by 14 feet, containing 1,000 pounds of bacon and about 400 pounds of lard, salt, &c., was all blown away to the northeast, except the floor and a portion of the bacon, which seemed to hold it down. A large barn 50 yards northeast of the house, size 30 by 36 feet, 16 feet high, with sheds on the north and south sides, was moved on the foundation to the north, the west end 12 inches and the east end 7 inches. The northwest corner of the barn was entirely carried away. Several trees in the orchard were carried to the east and northeast.

Upon examining the center of the storm's track in the fields to the west of the house shortly after the passage of the tornado, Mr. Goodman stated that it looked as if a violently rushing stream of water had passed over the surface having a width of from 50 to 100 feet. He also observed that the center of the storm could be easily distinguished wherever there was destruction, as all *débris* on the west side was carried inwards toward the track, on the east side parallel with it, and in the center in every direction.

Mr. W. E. Thorpe, about 50 rods southeast of Mr. Goodman's, and east of the storm's track, first felt the wind from the north, as the storm approached, and in a few moments it shifted instantly to the southwest, shaking the house severely, and prostrating 40 trees in the orchard, laying them to the northeast without a single exception.

Mr. Bartly Jones, one-fourth of a mile east of Mr. Thorpe's, and nearly 1 mile east of the storm's center, did not experience as strong a wind from the southwest. One tree was blown down, and a barn 60 feet southeast of the house was first moved to the south 4 feet, and then back again to the north; all done very quickly.

Mr. J. L. March, west of the storm's center about 40 rods, and a little north of Mr. Reeder's, had 15 or 20 trees blown down in his orchard to the southeast. As the storm passed the wind changed to the north and grew colder.' Mr. Thomas J. Lynch, adjoining Mr. March, but a little nearer the storm's center, had trees and fences blown to the southeast. (Diagram No. 8.)



No. 8.

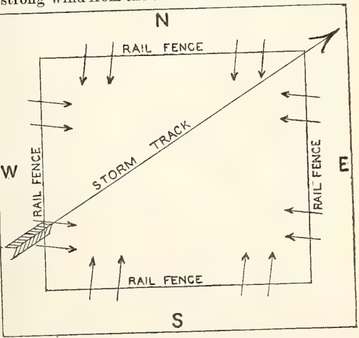
Mr. Theo. Tennison, due east of Mr. Goodman's one-fourth of a mile, half a mile east of the larger storm cloud, and 1¼ miles west of the smaller, had 20 trees blown down in his orchard to the east, an l half a mile of rail fence carried in the same direction. During the first part of the day the weather had been very pleasant, but inclined to be sultry, wind principally from the southeast, which had been the prevailing direction for several days. No clouds were to be seen up to 3 p. m., but an hour later a few began to appear along the western horizon. At 4.30 p. m. two very dark clouds rose quickly above the horizon, one in the northwest and the other in the southwest, followed in a few moments by rain and hail with a cold northwest wind. Did not see the small funnel cloud to the east, but could distinctly discern the large one, and after it passed a current of air came from the southwest, not as strong as the one that did the destruction, but so hot as to almost prevent respiration.

Mr. C. D. Martin lives northwest of Mr. Tennison and 150 yards east of the storm's center. He stated that about 6 p. m. saw a dark funnel-shaped cloud coming up from the southwest. By the time it had reached a point nearly opposite his house the darkness became so intense that he could not see ten feet away from him, and the roaring was so great that, standing with his wife in the kitchen holding the door, they could not hear the screaming of their daughter for assistance in an adjoining room, even though the door between the two rooms was open. The strongest wind was felt from the southwest, and during the passage of the tornado no other current was experienced, although previously the rain and hail came with a northwest wind. While the tornado was passing, the house seemed to rise and fall very gently five or six times. Mr. Martin had hardly reached the doors and windows to hold them before the storm was over. Although the house was not moved from its foundation, a larger and stronger building standing 8 feet to the northeast, consisting of a smoke-house and granary 12 by 21 and 12 feet high, was lifted from its foundation and carried, the SE. corner 8 feet to the NE. and 4 feet east, and the NW. corner 9 feet to the NE. and 20 feet east. Thirteen trees in the orchard north of the house were blown down to the east and northeast. Northwest of the house about 140 rods the funnel-cloud struck the ground in a cornfield, scooping out a hole 3 feet deep and 5½ feet long. I did not see the excavation, as the field had been recultivated, but Mr. Martin and his son positively affirmed its existence and the cause as assigned. The cloud was very dark on the outside but lighter through its center. As it drew nearer *débris* of all kinds was seen flying about in the central portions of the cloud, and many light objects were drawn into the vortex from all sides and then upward through it, being shot out from the top in many directions. Several persons in this vicinity stated to me that at points outside of the path of destructive winds, and at distances varying from 1 to 2½ miles, leaves, papers, and pieces of timber fell straight to the ground, and was in some cases the first intimation to them that any severe storm was in progress.

Moving onward in the course of the storm, we next visit Mr. Alva A. Drake, tenant upon the farm of Mr. McMillan. House stood 60 rods west of the storm's center. The wind struck it square from the southwest shaking it severely but causing no particular damage. The current of air then whirled around the building to the west and south, carrying small apple trees and loose articles in a circle to the south and east. An outhouse was turned over to the south, and a lumber wagon backed in the same direction a distance of 40 feet.

Mr. George Wigington, who lives WSW. of Mr. Drake's half a mile, did not know that any unusual storm had passed, until the next morning when he was notified by Mr. Drake. Mr. E. Smart, one-fourth mile WNW. of Mr. Drake's, did not feel the storm; the atmosphere was very quiet about his house. Mr. John Litzsinger lived due east of Mr. Drake's 40 rods and within about 20 rods of the storm's center; his house, 14 by 24 feet and 7 feet posts, had the north end carried to the west 12 feet, while the south end was moved only 15 inches.

Mr. John T. Lacy lived north of Mr. Drake's, and 80 rods west of the storm's center, house was not damaged; first felt a strong wind from the southwest and then from the north during the passage of the cloud. Southeast of the house, and in the center of the track, a rail fence surrounding a piece of land 40 rods square, was thrown down inward toward the center on all sides. (Diagram No. 9.) The fence was put up when I arrived upon the ground, but Mr. Lacy, and also one of his neighbors, assured me that the facts were just as stated. A tenant house belonging to Mr. Robert Watson, and situated one-fourth mile SE. of Mr. Lacy's, and west of the storm's center 50 yards, was damaged severely. The building stood north and south, was 20 by 30 feet long and 8 feet high. It was first moved to the west 30 feet, then turned around by the north, so that the length of the building stood east and west, and then moved 70 feet to the east, where it was left standing right side up, but badly twisted. In these movements it must have been above the ground nearly all the time, as where it touched it only scratched the surface slightly. Two stacks of rye straw (in bundles), standing side by side 40 feet north of the house, were mingled together in the most indiscriminate manner; even the bundles were in some instances found twisted into each other. They were carried to the NW., W., SW. and by the S. to the NE. A barn, 16 by 20 feet and 10 feet posts, standing 20 feet east of the stacks, was completely demolished, and the *débris* carried to the NW., W., SW., and NE. In an orchard of small trees, 40 feet north of the stacks, only two of them were broken off, and lay pointing to the east.



No. 9.

Mr. John C. Howard's residence, east of the storm's center about one-quarter of a mile, and standing upon a considerable rise of ground directly east of Mr. Watson's tenant house, was damaged but slightly. It is one of the largest houses in the vicinity, and very strongly built. Three chimneys were blown off, and during the prevalence of the violent southwest current it was shaken so severely that the inmates expected it to be torn to pieces. In the orchard just north of the house, 110 trees were blown to the NE. A large straw stack, 200 yards NW. of the house, was scattered along the track for a mile or more. Sixty rods of east and west fence, 250 yards west of the house, was blown down to the east.

Mr. John Espy, three-quarters of a mile SE. of Mr. Howard's, and over a mile east of the storm's center, felt a very strong wind from the southwest during the storm, which shook his house quite severely, and blew down several trees in his yard.

One of the most completely demolished houses throughout the entire path of the storm was that of Mr. R. Quissenberry. It stood a little east of the storm's center, perhaps 30 feet, upon quite high ground, and just across the road north of Mr. Howard's. Unfortunately I failed to see Mr. Quissenberry to question him concerning the storm, but instead obtained a very fair statement from his nephew, Mr. T. O. Evans, who occupied a portion of the house when it was destroyed. During the afternoon Mr. Evans was cultivating corn east of the house (the cornfield surrounded the dwelling), and at 6 p.

m. was called to stop and come in. On going "a round or two more" he did as requested, and "put out" his horses. It was then 6.30 p. m. and rain was falling gently; had not rained before during the day. Went inside the house, sat down near a window in the south end and began reading, but was almost immediately interrupted by a strange and unusually loud roaring noise outside, as if a train of cars was coming very near and at a terrible rate of speed. In about five minutes, and while considering from what source the noise could arise, a violent gust of wind, coming like a cannon shot, struck the southwest corner of the house, moving it to the west a little, and then in an instant everything went to pieces, but could not tell how. Mr. Evans was thrown to the southwest about 30 yards. After striking the ground he was lifted up and down, nearly in the same locality, two or three times, but each time very gently. After the storm passed, which was not more than fifteen or twenty seconds, he found, upon examination, that his hair was completely matted, and his eyes and ears filled with with black mud. There were five children and three grown persons in the house at the time of its destruction. One boy was thrown to the NW. 90 feet and cut severely upon the head and nose. His clothing was filled with black mud, it being fairly driven into the texture, and his eyes, ears, and hair suffered a similar fate. Another child was carried to the northeast 20 yards and completely bedaubed with mud, which latter condition was the case with the entire family. Three of the children who were in the same room with Mr. Evans and his uncle were covered up in the rubbish near the foundation; the latter being carried 65 feet to the NW. and considerably bruised. Mrs. Quissenberry was knocked senseless at the commencement of the storm by the east kitchen door blowing open against her. She was cut badly in several places and found lying in the field 20 feet north of the house. The dimensions of the building were as follows: 20 by 36 feet, one and one-half stories high, standing north and south, with a kitchen on the north end 18 by 20 feet and one story high. The west side of the house was thrown outward and remained upon the ground near the foundation, its south end whirled around to the northwest in a half circle, a distance of 66 feet. The remainder of the house was scattered over 15 or 20 acres and in a general direction to the northeast.

In the edge of the corn-field, just west of the house, and for a width of 20 to 30 feet, the loose earth had been beaten down by the violence of the wind so hard that it could not be easily worked up with a gardening tool. To the distance of 180 feet west of the house, the corn was beaten into the ground in such a manner as to convey the impression that this portion of the field had been mowed, while 25 feet to the east of the house the stalks were hardly bent over. The barn standing north of the house, 30 feet, was torn to pieces and scattered to the NE. Three horses were in the stable at the time, but all escaped without much injury except one, which, from all appearances, ran directly into the storm's path, where it was picked up and carried or rather shoved along for a distance of 80 feet. The course taken and the length of the path was indicated by the holes cut into the ground where the animal tried to brace itself with its fore feet. A sulky cultivator, standing 10 feet north of the barn and 30 feet west of the storm's center was not moved or injured. A lumber wagon standing a few feet SE. of the cultivator was broken in two, the forward part carried 50 feet to the NE. and stopped by the tongue running into the ground. The hinder part was wheeled along by the force of the wind, which fact was shown by the tracks through a hollow, up and over a ridge to the NE., and through a board fence, a distance of 90 rods. On this ridge, over which the center of the storm passed, the board fence was torn down for a width of 50 rods. Attached to loose boards, naked posts, limbs of trees, and lying upon the ground were fragments of clothing, bed-quilts, sheets, and mattresses scattered along for a distance of 1¼ miles NE. of the house. Every article was filled with mud, which, to all appearances, must have been blown into them with great violence. A dog was carried NE. of the house 200 yards and killed, his head and shoulders being driven into the ground. A large sheet-iron stove standing about the center of the house was carried 25 yards to the N., and completely torn to pieces. A small board step, weighing hardly 10 pounds, and lying 3 feet west of the southeast corner of the house, was not moved from its position during the storm. A large wooden beam plow, with whippletrees attached, and standing near the barn, was carried 30 feet to the NE., and the handles broken off. A sewing machine standing in the south end of the house before the storm, was found scattered in small pieces about the ruins, the largest portion being found 30 yards to the N. in the corn-field.

At the house of Mr. James Duckworth, 30 rods E. of Mr. Quissenberry's, the north gable end was shattered and the portico blown away. A barn, 30 by 40 feet, standing northeast of the house, 20 rods, was entirely swept away, even to the foundation. An out-house, NW. of the house, 40 feet, was carried away, but a corn-crib N. of the house, 30 feet, and a hen-house, ENE., 12 feet, had only their roofs slightly injured.

The next house visited by the storm was that of Mr. J. A. Scruggs, about 1¼ miles northeast of Mr. Quissenberry's, and standing 60 rods east of the central portion of the storm's path, on a side hill near the bottom of a ravine. About ten minutes before the tornado passed it rained and hailed considerably, ceasing very suddenly as the storm cloud came up. The family were seated at supper—about 7 p. m. Mrs. Scruggs stepped out while it was still raining, to protect some of her young chickens, and had barely succeeded in securing them, as best she could, when the storm cloud reached her, the wind blowing so furiously that she could not get back to the house, although only 15 feet distant. In this condition she caught hold of a small tree near by, around which she was blown several times in quick succession, breaking her collar bone and otherwise injuring her. The south half of the roof was torn off without moving the house on its foundation, and the *débris* carried to the northeast. Twenty-five feet northeast of the house a granary was demolished and the *débris* carried to the northeast. A hen house 35 feet east-northeast of the house was destroyed and carried to the east. In the orchard, to the southeast of the house, 18 trees were blown down with their tops pointing, some to the east and others to the northeast. Several other out-buildings, consisting of barns and sheds, were unroofed or torn down to the foundation, and the *debris* carried to the east and northeast. A heavy lumber-wagon box was carried across the ravine east of the house and landed upon a high piece of ground, a distance of 100 rods. Two of the wagon wheels were carried into the ravine, a distance of 30 rods, and the remainder of the wagon was distributed along the track in small pieces. There were two colts and two horses pasturing in the ravine about where the center of the storm passed. After the storm they were not found until the next morning, when it was discovered, in following their trail, that at times they had been lifted from the ground and then dashed down again, their feet plowing up the surface every few rods. They were driven over several rail fences and straight through one thick hedge. In their course they had passed out of the open ravine, through a corn-field, over a ridge, and into a wooded ravine beyond. The colts were badly crippled, the horses receiving but a few scratches.

Mr. Thomas Winburn, one-fourth mile north of Mr. Scruggs's, but further west of the storm's center, had a few small trees blown down near his house, but no further injury was committed.

Mr. John Jones, one-fourth mile west of Scruggs's, and 130 rods west of the storm's center, did not feel the effects of the storm or know of its destruction until the next morning. It rained quite hard, but without a strong wind; heard roaring, but thought it was the water running into the cistern.

Mr. George Bennett and Mr. James W. Dunn, near neighbors of Mr. Jones, did not experience any strong wind during the passage of the storm.

Again, evidence is presented of the relative width of the east and west sides of the storm track. On the east side, at this point, fences and scattering trees were blown down for a width of 1½ miles, while on the west side such destruction did not extend 80 rods. In fact, at many places on the west side not even a brisk wind was felt at that distance, while on the east side strong winds were experienced at a distance of from 2 to 3 miles.

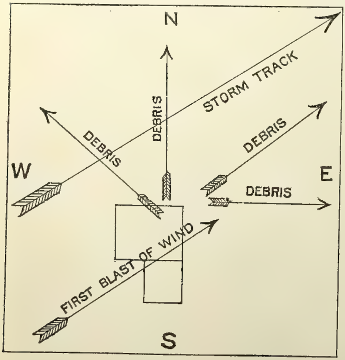
Since leaving Dr. Dunnington's, which was upon a slight rise of ground sloping to the north and south, the storm has pursued a course nearly due northeast and confined its destruction within the bounds of a considerable depression (not quite a ravine) in the rolling surface of the prairie. It did not follow all of its windings, but crossed alternately, projecting points of high land and intervening dales; in other words, the storm kept to its characteristic NE. course, whatever the surface. After leaving Mr. Scruggs's it bore a little more to the east, apparently purposing to avoid the ravine, which, from this locality, grew deeper, with precipitous sides, as it advanced to the northward. Here was encountered the deepest ravine in the course of the storm, its sides and bottom lined with heavy timber, offering no obstruction at its entrance and right in the line of the storm, had the funnel bore to the north instead of to the NNE. In bearing to the east the funnel passed over a projecting point of high land and then down into a short branch of the large ravine, which ran 550 yards to the ENE. This branch was at least 400 feet wide, and its eastern bank presented an almost perpendicular height of between 70 and 80 feet. The cloud, instead of dipping down into this cañon, as it were, seemed to passed over it, almost above the highest tree tops, as they were found broken off through the bottom and along the eastern bank at heights ranging from 15 to 50 feet. Many of the trees had just the upper limbs twisted off, and in this respect the circular action of the cloud was most graphically displayed. Small limbs of the oak and hickory were in many cases twisted several times about adjoining limbs or the body of the tree and invariably in a direction from right to left. Along the upper edge of the eastern bank green hickories, of from 1 to 2 feet in diameter, were twisted off near the base. Along the eastern side of the storm's path, on the high ground above the ravine, narrow paths or swathes were cut into the timber from the southwest, viz, a group of trees twisted or broken off, alternating with a strip of ground several rods wide (sometimes a quarter of a mile), apparently unharmed. This peculiar effect of the SW. air current could be observed wherever the timber was wide enough, and also, I was told, in the fences after the same manner. The cloud did not follow the course of the short ravine at all, but cut across it in the direct line of its course, rising over a ridge about 100 feet high, and passing through an open field to the house of Mr. Samuel Constable, tenant on the farm of Mr. Blackwell. It was a log house standing upon a ridge of land one-fourth of a mile northeast of the ravine and about 60 feet west of the storm's center. Where the tornado crossed the road below the house, the rail fence on both sides, for a distance of 30 rods, was completely bedaubed with mud and weeds, each rail looking as if taken from the bottom of a muddy stream. The width of the path of greatest destruction at this place was 580 feet, it widening out in every instance as it entered the timber. The house was thrown in to a mass of ruins, logs scattered about promiscuously, and portions of the roof lodged in the woods 25 rods northeast of the house. Clothing and bedding, torn into strips, were found hanging in the tops of the trees. A log barn, 18 rods west of the house, was torn down, but not as badly as the latter.

In the timber to the north and west of Mr. Constable's, for a distance of 60 to 80 rods, large oak trees, 2 and 3 feet in diameter, were broken square off near the ground, or terribly shattered by a violent twisting force. Their tops lay pointing to the NW., W., E., and S. A very tough green white-oak tree, 18 inches in diameter, standing near the storm's center, was bent over to the northwest about 2½ feet above the ground, and twisted once around from right to left, but the fibers of the wood were so tough and flexible that they still held the trunk to the stump.

Mr. Constable, who sat upon the fence just south of the house watching the approach of the ominous looking cloud, did not move from his place of observation, thinking that the cloud would certainly pass him without injury it being so narrow; but before being at all aware of his perilous position, he was caught up by the whirling current of air and carried across the road into a pasture, a distance of about 80 feet, where he afterwards found himself covered with mud from head to foot, clothes torn, and badly frightened, but a wiser man.

From this locality, for a distance of 1¼ miles to the northeast, the track of the storm lay through a belt of heavy timber, bordering upon and thickly lining a large ravine to the west of the storm's path. The path of greatest destruction widened out here to its utmost, varying from 800 to 1,200 feet, and at Mr. Hutchins's, the next place visited, its width was about 90 rods. This place and vicinity, was the scene of the greatest manifestation of the tornado's power, throughout its course. In its path through the timber, trees on the west side were thrown to the N., NW., W., SW., and S., while on the east side they were thrown to the E., NE., and N. At the center they lay parallel with the storm's course, and also across it, with their tops sometimes to the east and quite as often to the west. I examined 21 cases where trees had been twisted and found without an exception that the direction was from right to left. Before reaching Mr. Hutchins's, the tornado demolished a school house, situated at the edge of the timber, about 20 rods east of the storm's center, and on a considerable elevation, the ground sloping to the SE., S., and SW.

The storm at this point bore considerably to the north, and just as it changed its course the school house was taken, in all probability, by an inrushing current from the southwest. Its size was 18 by 33 feet and one story high. The building was first lifted bodily, moved 16 feet due north, and then all above the floor was carried away to the northeast, the south side dropping to the ground after passing 2½ feet beyond the foundation. There were two rows of desks running east and west, six in each row. In the south row two were left on the west end, and in the north row five were left, showing that the greatest force of the impinging current struck the southwest corner of the house and lifted the body of the building clear from the desks on the west end, but on the opposite end the desks were entirely carried away. The north side, together with both ends and the roof, were literally torn to pieces, and portions carried to the E., NE., and NW. The stove remained in the center of the floor, but the drum and pipe were carried away.

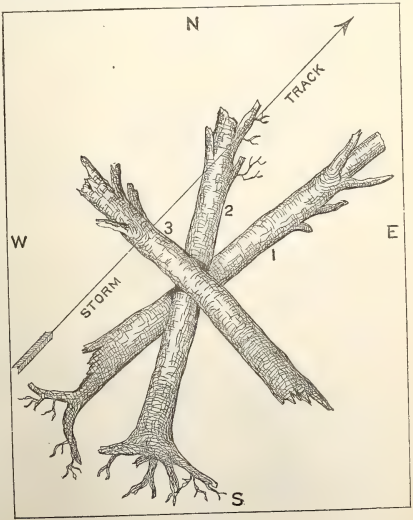


No. 10.

The storm from this point made frightful havoc in the heavy oak and hickory timber, as it moved up the hill towards

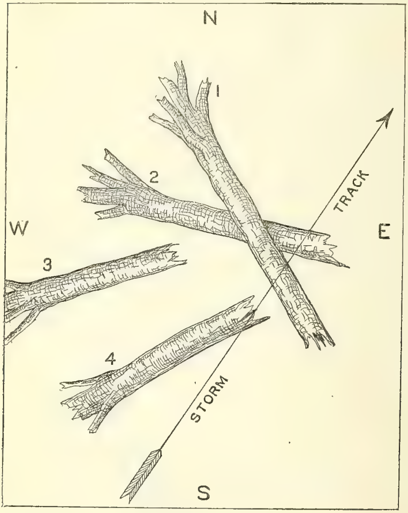
Mr. Hutchins's, one-fourth of a mile to the NNE. Here, as I said before, the storm was remarkably severe. The house stood upon a considerable elevation, about 200 feet east of the storm's center, with the ground sloping to the S., W., and NW. into a heavily wooded ravine, a continuation of the one commencing near Mr. Scruggs's. To the NE., E., and SE. lay a broad stretch of highly cultivated prairie with a gently rolling surface. The house was a new building and very firmly constructed; size, 18 by 36 feet and two stories high, with an L to the north, 24 feet square, and of the same height. The storm came upon them, as Mr. Hutchins stated, about 7 p. m.; only one strong blast was experienced, and that came from the southwest, striking the building in the open corner between the L and the main part, as shown in the accompanying diagram. (Diagram 10.) The whole building was first moved off the foundation to the northeast, when it broke to pieces, the floor of the main part going around to the northwest and the top to the northeast. The L was carried to the north, 60 yards, and then around to the NW. about the same distance, going to pieces in making the circuit. There were seven persons in the house at the time of the storm but none were seriously injured. A hired man, who was trying to get into the house on the west side, was picked up and thrown to the NW. 30 yards. A log cabin standing northeast of the house 35 feet, was demolished by a portion of the main building striking it. Two others, northwest of the house 50 feet, had their roofs taken off and were otherwise injured. Large pieces of tin piping, guttering, and weather-boarding were found 6 miles northeast of the house. Many pieces of lumber were found at distances of from 2 to 3 miles to the northeast, being easily identified by the color of the paint upon them, which no other house had for miles about. A seed drill and drag, northeast of the house 35 yards, were not injured or moved from their positions, yet there was nothing surrounding them to offer protection as far as could be seen. A heavy stalk cutter, made largely of iron, and a hen house by which it was standing, were both demolished, though situated but 28 feet east of the former implements. Two lumber wagons standing 40 rods NW. of the house and filled with shelled corn, were broken to pieces and the grain scattered in every direction in such a manner as to prohibit the possibility of its being gathered up. In an apple orchard of 60 trees, south of the house, 57 were pulled up by their roots and carried to the northeast, and one, 18 inches in diameter and 25 feet across the top, was carried 5 miles in a northeast course. The tree was positively identified as belonging to Mr. Hutchins's place, because it was the last orchard through which the storm passed.

About 15 rods west of the house was the heavily wooded ravine previously spoken of. It was through the eastern portion of this timber belt that I traced the storm's center, from the manner in which the prostrated trees were lying. This course, as indicated, was also corroborated by statements of members of the family, who saw the funnel-shaped cloud pass west of the house. Sketches of destruction in the timber, made upon the spot, illustrate very clearly the circular movement of the winds. (Diagrams 11 and 12.) As a general thing oak trees, however large, were broken off near the base, stripped of their limbs, or shattered, while hickories, and those trees with a tough elastic fiber, were twisted into splinters. Two



No. 11.

hundred and fifty feet southwest of the house stood a group of oaks and hickories, the former from 14 inches to 2 feet in diameter and the latter 6 to 10 inches. The oak trees were broken off at a height of from 10 to 25 feet; some of the hickories were bent over and twisted (Diagram 13), and others were so severely whipped about, as to be shivered and stripped of their bark. But the most interesting and peculiar feature in connection with the destruction of this group, was the fact that the southwest sides (only) of the high stumps were covered with a mixture of fine leaves and mud, extending up to the point where the top was broken off, the severed portions furnishing no evidence of a like condition. The greatest thickness of the covering was near the base, gradually thinning out towards the top. The dirt and small grains of sand were fairly driven into the tough bark, and through it in many places. Fifteen days after the tornado, and although subjected to several very severe rain and hail storms, the dirt was over 3 inches thick near the base of the tree, and over 1 inch at the height of 10 feet.



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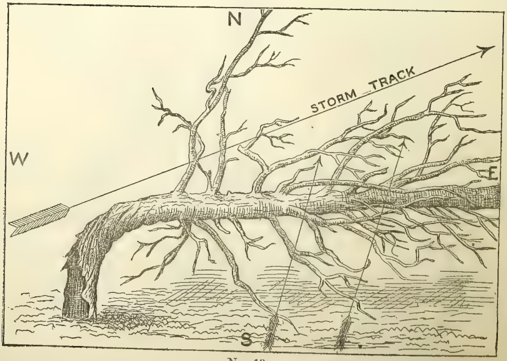
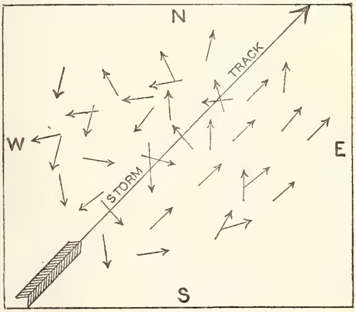


No. 13.

To show the position of the fallen trees, where the center of the storm passed, I append the following diagram, the arrows indicating the trees: (Diagram 14.)

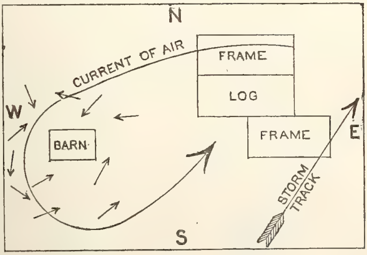
Mr. Hutchins stated that his loss would easily reach $5,000, and that it all happened before he had time to realize what was the matter. On his farm of 320 acres, lying mostly east of the house, not a single rod of fence was left standing. The width of the path of greatest destruction at Mr. Hutchins's house was nearly 1,500 feet—the widest point in the storm's course—and the only house except Mr. Constable's (another wide portion of the track), where heavy timber lay close to it. In every case where the tornado passed through woods the track widened out to an unusual extent.



No. 14.

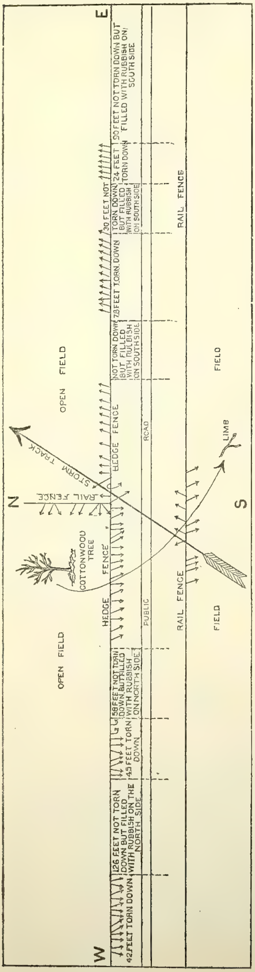
The next house visited by the storm was that of Mr. Thaddeus W. Warden, tenant on Mr. Cowherd's property, one-fourth of a mile NNE. of Mr. Hutchins's. The positions of the house and barn, regarding the storm's center, are given in the accompanying diagram (Diagram 15). The north frame part was 12 by 30 feet, the log part 18 by 30 feet, and the south frame part 18 by 25 feet, all very strongly constructed. In respect to the approach and destructive effects of the storm Mr. J. H. Warden, jr., stated as follows:

"At a little past 7 p. m. I saw the dark funnel-shaped cloud whirling terribly and approaching from Mr. Hutchins's. Was standing near the center of the south frame part and rushed to the south door to hold it, but before I could pull a chest to the door from a distance of 10 feet, the storm cloud was upon us. The wind struck the south end of the house first, raising it from the foundation; then the log and frame parts to the north, were struck upon the east side, also raising them from the foundation, when the top of the entire house fell in, and the whole confused mass was turned over twice to the northwest. It was left there but for a moment, apparently to give the whirling current time to pass around the barn to the west and south, which it did without injuring it, but throwing down the surrounding trees, as indicated by the small arrows in the diagram. Returning to the house, which it did almost instantly, the violent SW. current carried all but the west side back to the north, a distance of several hundred yards, smashing everything into kindling wood." No part of the roof and upper floor had been found, up to the date of my arrival at the scene of destruction.



No. 15.

Mr. Warden, jr., was carried with the house to the northwest, and while the current passed to the barn, was held between two of the floors and badly bruised, and on the return of the current was carried to the north 200 yards. His father and younger brother pursued about the same course, except that the former was blown to the northwest and there remained with the west side of the house, while the latter was carried to a point within a few feet of his older brother. All of the parties were covered with mud from head to foot; eyes, mouths, and ears filled, and clothing torn into shreds. The oldest son had his head and face cut and shoes torn from his feet, one of them being left at the house and the other carried one-fourth of a mile to the northeast. His pants and shirt were torn into strips, hair matted with black mud, and his face skinned and dirt driven into the flesh. The mother and two children were left in the rubbish, the former having her head crushed, and her long hair which reached below her waist, was partly cut and partly pulled from her head, twisted into a rope, and found several feet from her body. That portion of hair left upon her head was twisted into little wisps and mixed with mud. The baby was thrown to the southeast about 20 yards, and another child was carried to the west 112 feet, and two large splinters driven through its thigh, one of which came from Mr. Hutchins's house, it being identified by the peculiar color of the paint upon it. A little girl was thrown 6 rods to the northwest, and uninjured. In all cases, cuts were made upon the head and bruises upon the body. Every member of the family had their hair matted with mud, and their clothing so filled with it that it was impossible, even after a number of washings, to render the garments fit for use. The bodies of most of the children, after having been washed daily for four days, were still covered with specks of fine dirt and leaves which seemed to be driven into the flesh.


E
90 FEET NOT TORN DOWN BUT FILLED WITH RUBBISH ON SOUTH SIDE
24 FEET TORN DOWN
30 FEET NOT TORN DOWN BUT FILLED WITH RUBBISH ON SOUTH SIDE
78 FEET TORN DOWN
NOT TORN DOWN BUT FILLED WITH RUBBISH ON SOUTH SIDE
OPEN FIELD
HEDGE FENCE
ROAD
RAIL FENCE
FIELD
LIMB
STORM TRACK
RAIL FENCE
N
S
COTTONWOOD TREE
HEDGE FENCE
PUBLIC
RAIL FENCE
FIELD
OPEN FIELD
58 FEET NOT TORN DOWN BUT FILLED WITH RUBBISH ON NORTH SIDE
45 FEET TORN DOWN
126 FEET NOT TORN DOWN BUT FILLED WITH RUBBISH ON THE NORTH SIDE
42 FEET TORN DOWN
W

No. 16.

The following will indicate some of the peculiar freaks of the storm: A carpet upon the floor of the log part of the house and securely tacked about the edges, was taken up and carried out of the house without being torn. A new sewing-machine was broken into forty or fifty pieces. Fine feather beds were torn into strips and the feathers scattered broadcast over the country. Several garments were carried four or five miles to the northeast. An iron kettle holding 15 gallons was found broken into six pieces and scattered about in several directions. A 10-gallon keg filled with vinegar was carried to the northeast 40 rods. A large iron-bound trunk, fitted with an extra heavy lock, was torn to pieces, and the lock found a half mile to the northeast sticking into a rail. Several photographs, which were known to have been securely placed in an album in the trunk, were found over four miles to the northeast. A watch, in the vest of Mr. J. H. Warden, was blown 50 yards to the northeast and found covered with mud, but the vest was carried to the east 20 yards. Several chickens were carried to the northeast, from one-fourth to one-half mile and entirely stripped of their feathers. Two stoves were broken into small pieces, and one standing near the middle of the house was uninjured. Heavy bed-quilts were so filled with mud that when dry they were as stiff and hard as boards. A lumber wagon was carried to the NW., 10 rods, the box torn to pieces, and nearly all of the spokes taken out of the wheels. An iron-beam plow, 25 feet west of the house, was not moved or injured, and a seed-drill and harrow near the barn were also untouched.

The *débris* of the house was scattered over an extent of country 1 mile wide by 5 miles long. The path of greatest destruction was 80 rods wide, but fences were torn down to the eastward for nearly 2 miles. Mr. C. W. Bradley, living one-fourth mile WNW. of Mr. Warden's, experienced only a gentle wind from the SW. His house stood upon a high rise of ground, from which point the storm could be seen in all its fury, and as the dark, funnel-shaped cloud passed over Messrs. Hutchins's and Warden's he could see the *débris* being carried up the center of the funnel and thrown outward in every direction from the top. Heard the roaring for a distance of 6 miles. The cloud from which the funnel depended seemed to be about a mile in width and hung quite low down, with comparatively clear sky all about it. The funnel cloud, while on the ground at its work of destruction, appeared to be from 150 to 200 feet wide, but it was continually contracting and enlarging except when above the ground, it then maintaining about the same diameter but much smaller than before.

Mr. Bradley and his son, who had been engaged for several days in putting up fences over the path of the storm, were struck with the marked contrast in the comparative width of the east and west sides of the storm's track. For a distance of nearly four miles they had found that the west side averaged about 40 rods in width, the maximum being 80 and the minimum 25 rods. On the east side, over the same distance, the average width was over a mile, the maximum being 2 miles and the minimum three-fourths of a mile.

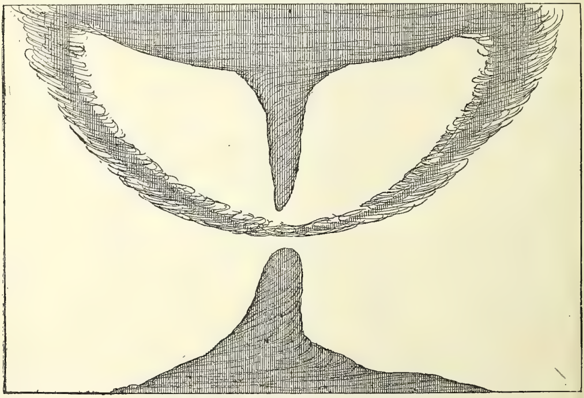
According to Mr. Bradley's description, narrow paths of destruction seemed to be cut in towards the storm's center on the east side, from the SW. and SE., making a jagged appearance, while the west side was comparatively straight. Where fences were thrown down on the west side, the last panel left standing, would, in nearly all cases, be erect and quite firm, but this was rarely the case on the east side, where the work of destruction was very irregularly committed.

After leaving Mr. Warden's the cloud partially rose from the surface as it passed up a rise of ground to the northward, causing no destruction until it reached the top of the ridge, half a mile distant. Here it encountered the oldest and largest hedge fence in the surrounding country displaying wonderful power in its destruction. That portion torn from the ground by the roots was 6 to 10 inches in diameter, and of fifteen years' growth. It was considered by all who knew of the destruction, that it required more force to pull one of these small trees from the ground, than to overturn the largest oak in the forest. The people for several miles around, were apparently more amazed at the power displayed here, than at the houses previously destroyed. The width of the track, as indicated in the hedge, was nearly 500 feet, but it was not all torn down for that distance, only here and there portions, as will be seen in the annexed diagram. (Diagram 16.)

Mr. W. H. Richardson, who lives half a mile north of the hedge fence, on the property of Mrs. Palmer, gave me a very interesting account of the approach and passage of the storm cloud. The funnel came in at the southwest corner of the farm and passed out at the northeast. House stood about 30 rods west of the storm's center, and escaped uninjured, although the wind blew very violently from the northwest and west, and after the tornado passed was followed by a slight fall of rain. At about 6 p. m. heavy rain, mingled with scattering hail, fell from dark clouds hastily gathered in the west and northwest. This continued for about thirty minutes when the tornado cloud appeared in sight at Mr. Hutchins's, where trees and broken timber could be seen jerked up into the vortex, whirled about with terrible fury, and then thrown outward at the top. The rain cloud had gone beyond Mr. Richardson's a considerable distance, and the rain ceased when the funnel cloud arrived at the hedge, where it drew down again to the ground, and spread out along the fence to the east and west. It seemed to stand for a minute or two whirling with terrible velocity from right to left, and this was, in all probability, the time when the trees were torn out by the roots. Mr. Richardson could distinctly hear, as the funnel passed and while it was at the hedge, a loud sucking noise as if water was rushing into a partial vacuum. Where the center of the funnel passed over the fence, a very large and heavy farm gate was lifted from its hinges, and let down unharmed within 3 feet of the posts.

In questioning Mr. Richardson about the dimensions of the funnel, and the action of the surrounding clouds and currents of air, I received information which led to the preparation of the accompanying sketch. (Diagram No. 17.) The funnel is represented as reaching the ground, which under such circumstances, causes the narrowest part to be some distance above the surface, but when it rises the lower portion tapers down to a very small diameter. Dark masses of clouds shot downward on either side of the funnel, entering it just above the ground, apparently thereafter rushing upward through the center, for immediately following this action, black smoke rolled and rushed out of the top in a frightful manner. During the day, as Mr. Richardson stated, the weather was not hot enough to stop work in the field, but it had been unusually warm for several days previous, with a brisk and continuous southerly wind. The temperature did not change much until Sunday night, forty-eight hours after the storm, but on Monday, the 2d of June, it was cool enough for frost, which some persons reported as occurring in low places. On Thursday, the day before the storm, it rained a little in the afternoon with a south wind. At the house of Mr. John Goodnight, three miles west of the storm's center in this vicinity, very large hailstones like ragged chunks of ice fell, about twenty minutes before the tornado passed, wind from the northwest at the time. The wind was so strong at the house of Mr. Snodgrass, half a mile east of the storm's center, that persons could not stand up outside of the house. At Mr. Daniel White's, three fourths of a mile east of the storm's center, the wind blew very strong from the SW., and fences were blown down. At the house of Mr. Knox, 1½ miles east of the storm's center, very little wind was perceptible, but during the passage of the storm, leaves, limbs, pieces of boards, and shingles fell straight down in his yard.

On leaving the hedge fence at the ridge, the funnel diminished in size and force and again rose from the earth, but only a short distance, now and then dragging its tail over the surface for several rods, without causing any particular damage, until it arrived at the house of Mr. James Black, distant about 2 miles. The building stood upon an elevation of 40 feet, sloping to the south and east, which the cloud, in order to reach, had to cross, a deep ravine running east and west; this was done without disturbing the fences and small trees therein. This ravine, at a short distance west of the house, turned to the NW. and grew deeper, its sides being lined with heavy timber. There was nothing on the surface to prevent the passage of the funnel cloud up this ravine, had its course been so determined, but the latter led to the northwest, while over the high ridge, which offered the only obstruction, if any could be presented, the storm pursued its characteristic course to the northeast. The house was part log and part frame, the main part 20 feet square, and an addition to the north, 15 by 30 feet, both one and a half stories high. As near as could be ascertained the center of the storm passed over the house, the *debris* appearing to be carried in circles about the foundation, and in a direction from right to left. The floors were not carried away, being held down by the crumbled mass of the heavy stone chimneys. A wood-house, 44 feet northeast of the house, and the barn and stables, 90 feet to the NW., were entirely demolished and the *debris* scattered about in circles. A lumber wagon was found broken to pieces, hardly a spoke left in the hubs and the tires badly twisted. Two stoves were likewise broken so as to be completely unserviceable.



No. 17.

Mr. John Riley, half a mile east of the storm's center, had fences blown down to the east, but his house was uninjured. Mr. John D. Selvy's house, three-fourths of a mile E. of the storm's center, and south of Mr. Riley's, was shaken very severely by a southwest wind. The course of the storm from Mr. Black's for a distance of nearly three miles, lay over the high prairie with a gently undulating surface. The next building damaged was Gore's Chapel, half a mile southeast of Mr. George Prewitt's, 1¼ miles NW. of Mr. Riley's and about 75 rods east of the storm's center. The building, 30 by 40 feet, and standing north and south, had both ends moved to the west four inches, and the middle 1½ inches. The plastering was entirely taken off from both ends, but only cracked on the sides.

Mr. John C. Bridges, on the opposite side of the track and to the west of the center about 250 feet, had his barn, 32 by 42 feet, torn to pieces and the *débris* carried to the north and east. The entire building was first moved on its foundation to the southeast, the south end 3 feet and the east side 1½ feet, when it was then destroyed. One of the heavy oak plates, 8 inches square and 16 feet long, was carried two miles to the northeast. There were two tons of hay in the barn, but only 150 pounds could be gathered up after the storm. The house, 100 yards NNE. of the barn, entirely escaped injury. A lumber wagon, 75 yards southwest of the barn, was moved to the east 8 feet.

Twisted stove-pipes, lightning-rods, pieces of farming implements and kitchen ware, were found about the premises and recognized as coming from Messrs. Hutchins's and Warden's, over 4 miles to the SW. A horse weighing 1,000 pounds, and standing in a field southeast of the barn, was partly carried and partly driven by the force of the wind, eastward through a heavy hedge fence into an adjoining field, a distance of 120 yards, where he was found severely scratched and covered with mud. Where the animal passed through the hedge it was bent over, and small furrows cut in the ground by his feet on either side, indicating that he had tried to resist the force of the wind. At intervals of about 40 feet there were indications, by depressions in the ground, that the horse had been thrown down and rolled.

The house of Mr. Geo. W. Prewitt is situated about three-quarters of a mile north of Mr. Bridges's and 250 yards west of the storm's center. It stands north and south. While the dark cloud was passing the north end and east side only were completely covered with black mud. So forcibly was it driven against the building that the heavy rains for the past fifteen days had failed to remove it, and it was possible to distinguish this part of the house at a considerable distance. Mr. Prewitt was standing with a child in his arms, in the yard three rods southeast of the house, as the funnel passed. Both were covered with black mud, whirled around and nearly thrown to the ground, some trees near by offering a partial protection against a more violent accident.

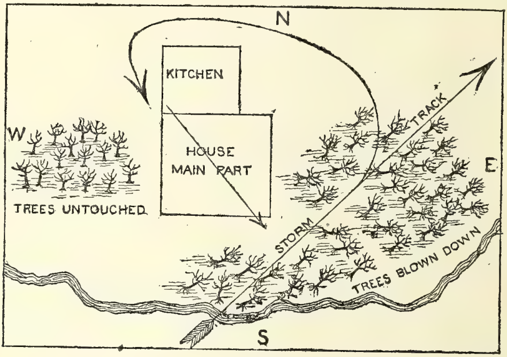
Mr. Prewitt positively affirmed that the current of air which swept by the house did not move in a straight line, but that its course was circular and from right to left, as he could distinguish by the sensations of his body. Fencing, over some 15 or 20 acres southeast of the house, was all thrown to the southeast. During the passage of the storm the roaring was terrible and the darkness intense.

About one-half mile northeast of Mr. Prewitt's, the storm passed over a stone wall running north and south, tumbling it down for a distance of 300 yards. The whirl here could be easily distinguished in the small trees and brush growing along the fence. On the south end all prostrations pointed to the E. and NE., while on the north end they pointed to the W., SW., and S. Mr. William Gore, who lives north of Mr. Prewitt's three-fourths of a mile and 120 rods west of the storm's center, stated that the tornado passed him shortly after 7 p. m. House was not shaken by the storm although standing loosely upon a high foundation. Forty rods west of the storm's center, about 100 rods of staked rail fence was blown down to the west, south, and north. About twenty minutes before the tornado passed, there was the heaviest fall of rain experienced for several years. It was mingled with scattering hail and came with a northwest wind. On Thursday night it rained a little with a south wind, but was fair during the day. During Friday it was fair up to about 4 p. m., when dark clouds gathered in the SW. and NW. Mr. F. R. Field, west of Mr. Gore's, a distance of 80 rods and 200 west of the storm's center, did not experience any strong wind, but it rained and hailed before the tornado passed.

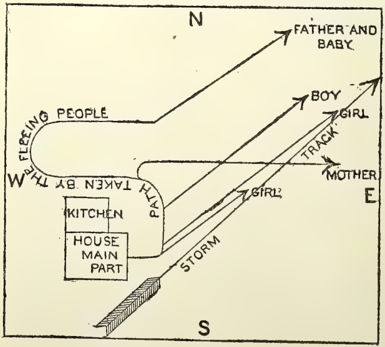
The width of the path of greatest destruction, opposite Mr. Gore's, was about 40 rods, although some fences were thrown down over a path three-fourths of a mile in width.

The next disaster we chronicle, in the course of the storm, is the house of the ill-fated Harris family, situated in a little ravine near one of the branches of Sni-a-bar Creek, one-half mile east of Blue Springs and 60 feet west of the storm's center. The funnel in approaching the house, passed down the south bank of the ravine across the creek, and through the eastern portion of a grove of small persimmon trees that surrounded it to the SW., S., and SE. The dimensions of the house were as follows: main part 16 feet square and one and a half stories high, with kitchen attached to the north side, 12 by 15 feet, and one story high. The building was first struck by the wind at the northwest corner, and moved entirely from its foundation to the southeast; then broken to pieces and scattered along the track to the northeast for over a mile. The group of persimmon trees, SW. of the house, were uninjured, although standing but 65 feet distant, while those to the east and south were partially bent to the ground, stripped of their bark and foliage, and the southwest side of the trees were blackened as if burnt (Diagram No. 18). This last effect was, in the opinion of many, due to the discoloration of the sap by exposure to the sun, though there were not a few who considered it the effect of electricity; however, no one with whom I spoke concerning the matter, noticed at any time during the progress of the storm the presence of lightning in the funnel cloud. This discoloration was not found in any instance under the bark, except where it was loosened from the tree, but not entirely peeled off. Mr. E. H. Jones, who witnessed the destruction at this place, and from whom I obtained a large share of my information, stated that the trees were bent and stripped of their foliage and limbs, by a large portion of the house being dragged over them, and not directly by the force of the wind, which, from all appearances, seemed a very probable explanation.

The family, consisting of father, mother, and four children, ran out of the house on the approach of the storm, the former and one or two of the children first moving to the NW., but thinking that the cloud was coming directly towards them in that position they turned back to the east, and by the time they had reached a point about on a line with the storm's course they were struck by it. The father and baby were carried into a field northeast of the house, 150 yards, covered with mud and bruises, and found in the agonies of death. The mother, who had not succeeded in getting as far away from the house as the two former, was carried to the east, 75 yards, and lodged against a small tree, around which she was partially twisted. Her skull was crushed, and she died a few minutes after being found. Her clothes were stripped from her body, which was bedaubed with mud from head to foot. A girl, eight years old, was found dead in the center of the storm's path, 50 yards northeast of the house. A boy was blown into a straw-stack, 45 yards northeast of the house, and another little girl was found 80 yards to the northeast, lying in the center of the storm's path. The two latter were not dangerously injured. I was told by several parties, and among them a physician, who had examined the bodies of those killed after they were washed, that the entire surface of the body was ecchymosed; or, in other words, they had been so severely dashed about by the wind, that the flesh was nearly black by the settling of blood in the tissues of the skin. The accompanying diagram will show the relative directions in which the several members of the family were carried (Diagram No. 19). The ground upon which the house stood was swept as clean as if by fire. There was hardly a vestige of clothing any where to be found. Now and then a small rag could be seen fluttering from some tree top, caught upon a rail fence, or wound around some broken piece of timber.



No. 18.



No. 19.

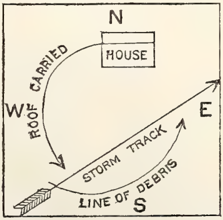
The creek to the southeast of the house was choked up with a mixture of straw, rags, feathers, kitchen utensils, rails, boards and pieces of farming implements. Wagon hubs were to be found with every spoke gone, some broken off and some pulled out. Two heavy ½-inch wagon tires were twisted nearly into knots. The iron mold-board of a plow, one-half inch in thickness, was broken in two and one of the parts driven into the ground a depth of 9½ inches. There was not a single farming implement or article of furniture that was not rendered unserviceable. The width of the path of greatest destruction was 120 yards.

Mr. E. H. Jones, who lives about one-quarter of a mile west of Mr. Harris's, watched the approach of the storm for several miles. Had a very hard rain and considerable hail with a northwest wind, about twenty minutes before the tornado passed. While it was passing a light misty rain fell, but the hail had entirely stopped some minutes before. The tornado struck Mr. Harris's house a few minutes after 7 p. m., say about 7.15 or 7.20 p. m. Immediately after the destruction a hot moist current, like steam, appeared to rush back from the departing cloud. Several other persons experienced a similar current of air. Mr. Jones particularly called my attention to the fact that the funnel-shaped cloud did not move forward in a straight line while above the ground, but swung from side to side, rising and falling like a huge column of some elastic material. While the funnel was upon the ground this motion from side to side was not observed, but instead there was an upward motion through the center, which could be easily distinguished by the *débris* carried upward, and also a circular motion from right to left, quite as easily discernible by the *débris* and the movement of the dark smoke. There was nothing to indicate on the ground that the general path of the funnel was zigzag. The cloud would shoot to the west at times with considerable velocity, causing great alarm among the inhabitants in that direction, and then gradually swing back again to its usual course without having produced any injury. The cloud was not seen to make this movement eastward from the center, but always from the center westward, which peculiar feature may receive some explanation from another important fact noticed in connection with the movement, viz: that coincident with it, there was a violent rush of air from a southerly point towards the funnel, which generally threw down fences or overturned trees in a narrow path, though sometimes it was not sufficiently strong to cause any damage.

At Blue Springs, one-half mile west of the storm's center, no damage was done. The wind blew harder with the hail and rain that came from the northwest before the tornado, than during its passage or afterwards.

Mr. W. H. Jones, one and a half miles west of the storm's center, heard loud roaring, but did not feel any brisk wind except the hot current which rushed back from the cloud after its passage eastward. Persons who lived five miles west of the storm's center told him that they also felt this hot wind. Saw the cloud when it disappeared from the earth near Judge Williams's, several miles to the northeast. It appeared to divide about 80 feet from the ground, the lower portion, about 30 feet in length, coming to the earth, not instantly, but in the course of 30 seconds, while the upper portion slowly drew itself up into the overhanging clouds. It was about five minutes after this occurred, that the hot current was experienced from the northeast, while at Lee's Summit and vicinity a similar current was felt from the southwest, but the latter was at the commencement of the storm's destructive effects and the former at the finishing touch.

The next work of destruction, after leaving Mr. Harris's, was at the house of Mr. Oliver Underwood, on the property of Charles Young, three-quarters of a mile to the northeast. The building stood 100 yards west of the storm's center, size 20 by 36 feet, and one story high. It was completely demolished, the roof being carried almost entire, first to the northwest about 150 yards, and then in a half circle by the west to the south, and deposited within 25 yards of the storm's center, crushing it by the fall, from which point the pieces were then scattered to the north and northeast along the storm's path. (Diagram 20.) The stable, which was very near the center of the storm, was blown to pieces and the *débris* carried to the northeast and northwest. The family ran out of the house on the approach of the storm, and moved near the eastern edge of its path, throwing themselves flat upon the ground and grasping the trees near by. They were whipped about them several times and lifted up and down, the father making quite distinct impressions in the soft ground where his knees repeatedly struck.



No. 20.

The storm next encountered the house of Mr. Martin Gore, 1¼ miles northeast of Underwood's, and 60 feet east of the center of the track. It was completely enveloped in dark smoke, whirling rapidly, and so intense that Mrs. Gore could not see her children who were within almost arm's-reach. The house was severely shaken but not torn down. A log stable, 120 feet west of the house and 20 feet west of the storm's center, was torn down, the roof carried 30 yards to the north, and the remainder of the building to the west and south. A smoke-house, 30 feet west of the house, had its roof blown 50 yards to the south. A well-house, half way between the two former, was carried 300 yards to the north. The entire width of the storm track at this place was about 250 feet, while a mile to the southwest it was one-quarter of a mile. The buildings stood upon higher ground than at the previous place of destruction, as the cloud was gradually ascending a high "divide" to the north. The intensity of the tornado was considerably diminished, for had Mr. Gore's house stood the same distance from the storm-center, one mile to the southwest, it would have been torn into splinters and the surrounding buildings more completely destroyed. People in the vicinity noticed also a marked change in the intensity of the roar of the storm, it dying out gradually until it almost disappeared, as the funnel drew up into the clouds above.

At Mr. George Smith's, only 300 yards east of the storm's center, in this vicinity, no damage was committed except that a few small trees were blown over. At Mr. C. H. Young's, 600 yards east of the storm's center but further south than the former place, no damage of any kind was committed, but a brisk southwest wind prevailed.

Mr. J. K. Reed, one-half mile east of the storm's center and one mile southeast of the spot where the funnel disappeared, stated that the air was nearly calm, and drops of mud fell like rain about the house for a few seconds, daubing the face and clothes of those outside watching the storm. After the cloud "bursted" a hot, moist current of air was felt for about ten seconds coming from the northwest, not as a direct current but in a whirling manner. It was quite clear in the west just after this occurred, but still threatening in the northeast.

Mr. Thomas M. Cunningham, one-quarter of a mile east of the storm's center, and three-quarters of a mile southeast from the spot where the funnel disappeared, did not feel any strong wind while the cloud was passing. Watched the funnel-shaped cloud for some time before and also when it vanished. Mr. Cunningham considered the time of disappearance as very near 7.30 p. m. or just as the sun was setting. After leaving Mr. Gore's the tornado cloud moved forward to the dividing ridge between Blue and Sni-a-bar Creeks, about three-fourths of a mile distant, and when it had reached the summit (from which point any part of the country could be seen within a radius of five miles) the funnel bursted as previously described. This operation occurred over a corn-field on the farm of Mrs. Rider, in section 19, township 49 north, range 30 west. The corn was covered with mud and severely whipped and the ground apparently deluged with barrels of water for a width of 30 yards. The rail fence just beyond this spot to the north, was blown down for a space of 50 yards. This constituted the entire damage at this point and was the last I examined or heard of in connection with the storm. There were some uncertain reports current, that the tornado had crossed the Missouri river at Wellington, La Fayette County, drawing up large quantities of water. I did not visit the place to verify the statements, as I was positively assured by men who had been there, and also by those who lived near the town, that no such thing had occurred. Heavy rain and considerable hail fell shortly after sundown but no damage resulted. With respect to this question and concerning the disappearance of the funnel cloud, Judge A. G. Williams, living a short distance north of Mrs. Rider's, sent me the following communication:

"I have no knowledge of the tornado doing any damage beyond Mrs. Rider's farm. If it reached Wellington I have no knowledge of it, either public or private. When I first saw the tornado my attention was directed to the breaking of the rain-cloud, and I noticed what I supposed to be a water-spout such as Professor Maury describes in his geography as occurring on the Indian Ocean. It seemed to be about the size of a man's body where it touched the clouds above, and then tapered down to the size of a mere rod. It appeared to create quite a whirl among the clouds which it came in contact with, and to worm itself up into the cloud above like a large auger entering a hole. The funnel commenced to break up and scatter after it had reached the high ground at Mrs. Rider's, but I was prevented from tracing the shape of the cloud from top to bottom because of the shade trees in front of me. I did not lose sight of some slight recognition of its form (the upper portion of it) until it had reached a point not exceeding one mile northeast of my place."

Dr. Fred. A. Ballard, of Independence, Mo., and correspondent of the Kansas City Journal, who was employed by that paper to write up a report of the Lee's Summit storm, sent me a communication, date of July 7th, stating that since his last conversation with me he had received additional information concerning the course of the storm after leaving Blue Springs; that instead of passing over Wellington, as reported, it had crossed the Missouri river at Sibley, a point considerably west and north of the former, and almost due NNE. of Blue Springs, thus approaching more nearly the course the storm had previously pursued. At Sibley, during the prevalence of a rain and hailstorm in the early part of the evening, a loud roaring noise and rushing of the air was distinctly heard overhead, but no funnel cloud descended. From thence the storm passed over Knoxville, Ray County, Missouri, where, later in the evening, similar atmospheric disturbances were experienced and *débris* was deposited. A summons, taken from the office of a justice of the peace, located southeast of Lee's Summit, fell at this point, where it was discovered shortly after the storm and identified.

The whole distance traversed by the storm, supposing it to have reached Knoxville, was not less than 86 miles. The distance over which I traced the effects of a well-developed tornado from near the Kansas State line to where it rose from the earth beyond Blue Springs, was 52 miles. That portion of the track which proved to be the most destructive was from Lee's Summit northeastward, a distance of 20 miles, following, very closely, the line of greatest elevation between Little Blue River and Sni-a-bar Creek, crossing it twice in that distance. As to the time occupied by the storm in passing over the track of 52 miles, no data that could be considered accurate, except, perhaps, that given by Mr. Van Meter, living near Lee's Summit, whose clock stopped by the shaking of the house at 6.30 p. m., could be obtained. This hour coincides very closely with the time given by Daniel Cline, and also Dr. Dunnington, whose houses stood a short distance to the southwest. The time given for the disappearance of the funnel cloud beyond Blue Springs was about 7.30 p. m.; this would make the progressive velocity of the storm between Lee's Summit and Mrs. Rider's about 22 miles per hour. From the place of its first appearance to the town of Lee's Summit, covering the longest portion of the track, or about 30 miles, and while the cloud was above the ground, the time occupied was 1 hour, or from 5.30 to 6.30 p. m. This last calculation is simply a rough estimate, as it was impossible to obtain anything but a probable guess as to the minute of time at West Line or in the vicinity. Every one questioned, gave the time as between 5.30 and 6 p. m., and I have called it 5.30 p. m., as it seemed the most consistent conclusion, considering the hour at, and the distance to, Mr. Van Meter's, whose time I use as a sort of datum point, being from all appearances the most reliable. Upon this basis of calculation the progressive velocity over the first portion of the track was 30 miles per hour, an excess of 8 miles per hour as compared with the velocity over the second portion, or an average of 26 miles per hour for the whole distance.

The difference in the velocity between the northern and southern portions of the track may not appear strange, when it is considered that over the latter the funnel cloud was above the ground, not meeting with anything to call for a development of its force or retard its progress, while the contrary was the fact over the former portion. It was the testimony of several persons along the northern portion, that the tornado at times appeared to be moving slow enough for them to have walked briskly before it and kept out of its way. Again, at several points it appeared to stop for a moment or two, and again to move over short distances of from one-fourth to one-half mile at a velocity of about 60 miles per hour. The course of the storm over the southern portion of the track was more duly northeast than over the northern portion, where the cloud bore more to the north after leaving Lee's Summit, taking a NNE. direction.

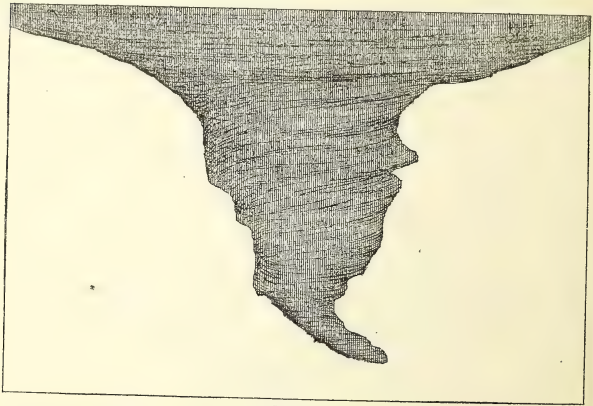
THE CLARINDA TORNADO.

I heard of this storm while in Missouri, not as a tornado, which it proved to be, but as a heavy northwest storm. Many of the facts were kindly reported to me by Dr. Kridlebaugh, of Clarinda. This town is situated upon the Nodaway river, in the eastern portion of Page County, Iowa, within 40 miles of the Missouri river, and 14 miles north of the Missouri State line. The morning was fair and suggestive of pleasant weather, but at about 2 p. m. an occasional rumble of thunder was heard in the northwest, when soon after a much disturbed and heavy cloud appeared in that direction, and one of like character in the southwest. The former was in terrible commotion, and the whirling, shooting clouds seemed to predict a storm of unusual fury. Says the Doctor:

"I watched both clouds from their first appearance; the one from the southwest especially alarmed me, as it looked green and dirty, boiling up dreadfully in the center, and presented an unusual appearance, the lower portion being prolonged into a cone-shaped mass, and apparently dragging the smaller end upon the earth." (Diagram No. 1.)

The heaviest portion of the storm passed south of the town, as within its precincts but little wind was felt, and the hail-stones together with leaves and *débris* fell straight to the earth. The large covered bridge (Howe truss) across the Nodaway beyond the city was badly damaged. It was first struck on the south side, and despite the heavy iron rods which held together the braces, the structure was torn apart, the side braces between the sills and plates carried into the river, and the upper stringers with portions of the roof fell to the floor. Large trees were twisted off near the bridge, giving evidence of a whirl or auger-like motion to the current of air, from right to left. The course of the storm was from southwest to northeast. Rain commenced at 2 p. m. and hail five minutes after, lasting until 2.15 p. m., with a precipitation of 0.55 inch of rain and melted ice. The mercury in Fahrenheit's thermometer stood at 80° at 2.05 p. m., and 70° at 2.15 p. m. The following is taken from the Clarinda Herald of June 5th:

"About two o'clock in the afternoon, on Friday last, a terrific and destructive hail-storm, accompanied with heavy rain, passed over our city in rather a northeast direction, lasting about ten minutes. The hail stones were quite large, measuring 3 inches in circumference. The ground was soon thickly covered with them. As there was at this point but little wind, they descended perpendicularly to the earth, but were precipitated with such force that the sky-lights, wherever found, were broken out completely. The green leaves fell as rapidly as the leaves of autumn. All kinds of fruits and garden products were injured. The cherries were literally picked from their stems. The belt or track of this storm was quite narrow, perhaps not more than a mile in width. While in town we had scarcely any wind, about half a mile east of us it was so heavy that some of the railroad bridges, and the covered bridge across the Nodaway, were badly damaged. Mr. M. G. Blair, east of town, had a large barn completely demolished and several pigs killed. There were eight horses in the barn, which, for a wonder, were not hurt. The house of a Mr. Hodgkens was lifted around, and shingles were ripped from the residence of Mr. Frank McMahan. It was one of the worst storms ever known in this vicinity."



No. 1.

The northwest storm spoken of in the Irving tornado passed this place about 8 p. m., as will be seen from Dr. Kridlebaugh's statement:

"At 8 p. m., a nimbus (rain) cloud appeared in the northwest, accompanied with high wind, loud thunder, sharp electrical discharges, and a gale of about 40 miles per hour. Heavy precipitation, with a violent wind, lasted fifteen minutes, and was followed by a slow drizzling rain all night. The amount of water in the gauge at daylight on the morning of the 31st was 1.2 inches. This storm did much damage in town, lifting the house of Mr. Simms off of its foundation, and breaking large limbs off of the shade trees in the park and elsewhere about the suburbs. A school-house one mile north of town, district No. 12, was considerably wrecked by being thrown off its foundation on the southeast corner, and doubtless would have been torn to pieces, had it not been a ceiled house instead of a plastered one."

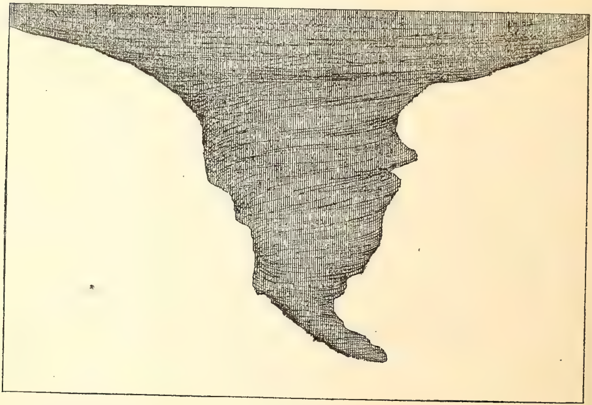
Many old citizens say they never saw a more terrific hail-storm in Iowa. The storm after passing this point, struck Bedford, Taylor County, where it also did much damage

THE IRVING TORNADO.

The present storm, which proved to be the longest of any examined and also the most destructive, especially to life, first appeared over the heavy rolling prairie of Bala Township, Riley County, Kansas, near the source of no less than five creeks, which flow to the SE., ESE., E., NE., and NNE.

Over a series of ridges alternating with heavily wooded bottoms from 60 rods to a mile in width developed the first stages of the storm. From the house of Mr. T. Naninaga, near Walnut Creek, where the first destruction occurred, there was observed forming in the southwest and northwest about 4 p. m. dark heavy clouds. Their appearance was considered nothing unusual except that they came up very suddenly, first from the NW. and then the SW. In fact, a storm was rather expected, because of the sultry and close condition of the atmosphere, which had continued most of the

were precipitated with such force that the sky-lights, wherever found, were broken out completely. The green leaves fell as rapidly as the leaves of autumn. All kinds of fruits and garden products were injured. The cherries were literally picked from their stems. The belt or track of this storm was quite narrow, perhaps not more than a mile in width. While in town we had scarcely any wind, about half a mile east of us it was so heavy that some of the railroad bridges, and the covered bridge across the Nodaway, were badly damaged. Mr. M. G. Blair, east of town, had a large barn completely demolished and several pigs killed. There were eight horses in the barn, which, for a wonder, were not hurt. The house of a Mr. Hodgkens was lifted around, and shingles were ripped from the residence of Mr. Frank McMahan. It was one of the worst storms ever known in this vicinity."



No. 1.

The northwest storm spoken of in the Irving tornado passed this place about 8 p. m., as will be seen from Dr. Kridlebaugh's statement:

"At 8 p. m., a nimbus (rain) cloud appeared in the northwest, accompanied with high wind, loud thunder, sharp electrical discharges, and a gale of about 40 miles per hour. Heavy precipitation, with a violent wind, lasted fifteen minutes, and was followed by a slow drizzling rain all night. The amount of water in the gauge at daylight on the morning of the 31st was 1.2 inches. This storm did much damage in town, lifting the house of Mr. Simms off of its foundation, and breaking large limbs off of the shade trees in the park and elsewhere about the suburbs. A school-house one mile north of town, district No. 12, was considerably wrecked by being thrown off its foundation on the southeast corner, and doubtless would have been torn to pieces, had it not been a ceiled house instead of a plastered one."

Many old citizens say they never saw a more terrific hail-storm in Iowa. The storm after passing this point, struck Bedford, Taylor County, where it also did much damage

THE IRVING TORNADO.

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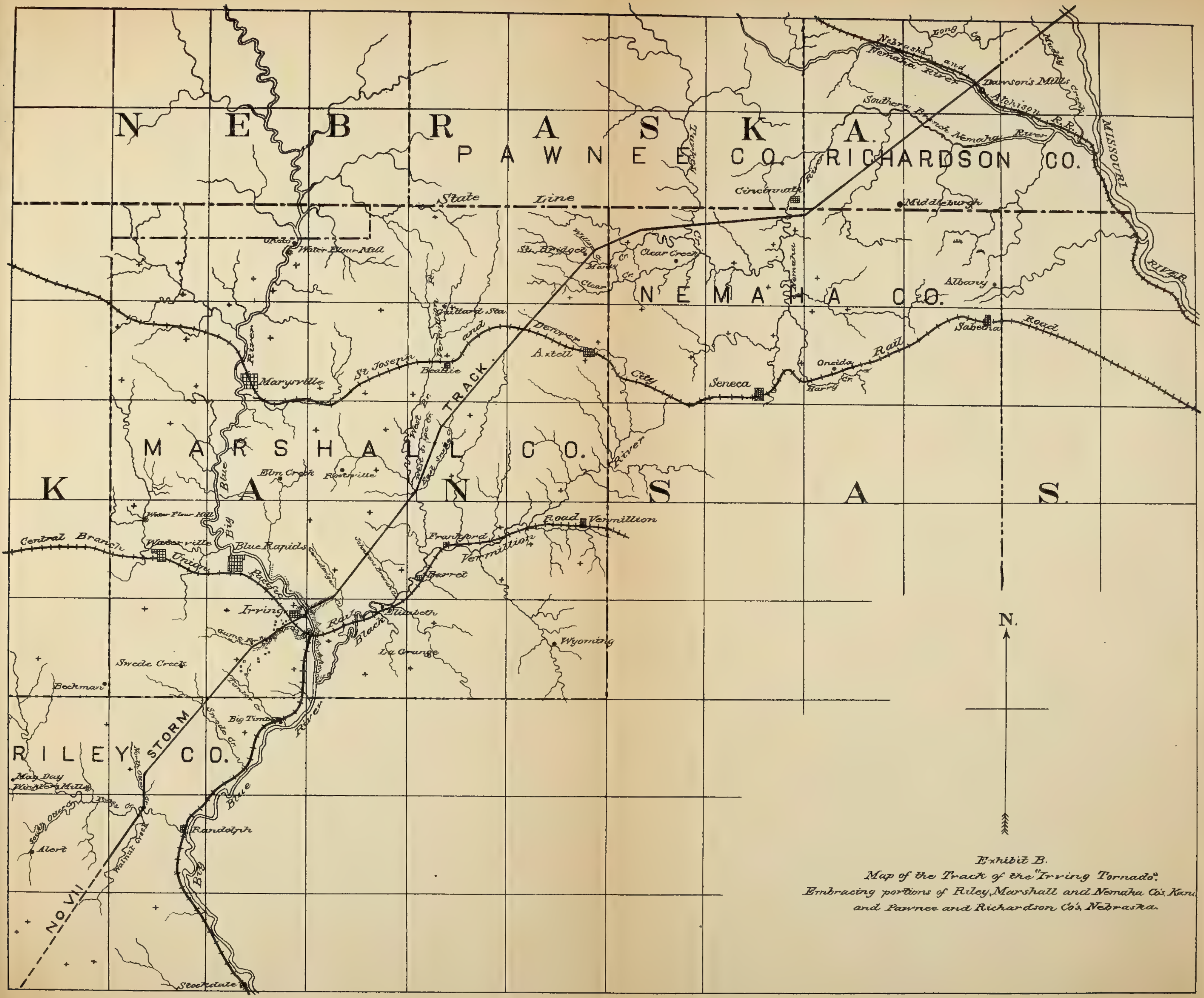


Exhibit B.

Map of the Track of the "Irving Tornado".

Embracing portions of Riley, Marshall and Nemaha Co's Kan

and Pawnee and Richardson Co's, Nebraska.

day, with a southerly wind. In a short time the clouds which had come up so quickly and quietly were thrown into the most terrible commotion; huge black masses mingled with lighter clouds, would roll upward in front of and between the opposing currents, the latter sometimes shooting upward with lightning velocity. Rain and large hail had already commenced to fall, and in about fifteen minutes the whirlwind of destruction formed, having the shape of huge elephant's trunk, and gradually lowered itself towards the ground. As it passed (yet above the surface) to the west of Mr. Naninaga's his corn cribs and stables were destroyed, and about 150 bushels of corn strewn along the prairie. The *débris* was all carried to the northeast, north, and northwest. The house was severely racked by a southwest wind, but not destroyed. The storm next unroofed the house and stables of Mr. Peter Nelson, half a mile to the northeast, carrying the *débris* along the track to the northeast for several hundred yards. Mr. C. A. Gouranson, the last resident on the high prairie before reaching what is called "Hanson's Ravine," which cuts off from the "divide" running ENE. towards Walnut Creek, was next reached, and his house unroofed. The smaller and weaker out-buildings were entirely demolished. The storm, from its inception, had followed the "divide," running from southwest to northeast, between Walnut Creek to the east and South Otter Creek to the west, a distance of about seven miles. It then descended the "Ravine" and northern slope of the "divide" to Fancy Creek, a large stream running from NW. to SE. and emptying into the Big Blue River at Randolph. At this point a smaller funnel cloud shot off from the main one and passed down the "Ravine" to the northeast, while the latter continued down the slope of the "divide" to the north.

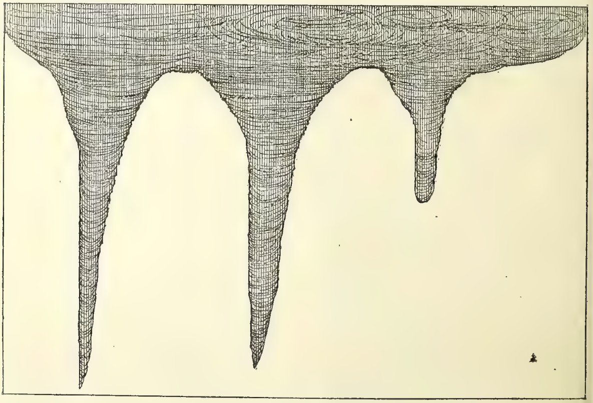
In the bottom of the "Ravine," the house of Mr. Thumbloum was simply turned over to the northwest, and the roof blown off from the house of Mr. Lewis Peterson; both buildings stood east of the storm's center about 20 rods. The house of Mr. Lewis Hanson standing west of the storm's center 35 rods, was deprived of the kitchen, which was attached to the south end of the building, the largest portion of it being taken up into the air and scattered, no one knew where. The small funnel cloud now reached the timber on Fancy Creek, 2½ miles northwest of Randolph, which it destroyed, with terrible fury, embracing all of the irregularities of the creek's course for a width of half a mile. As the tornado first crossed the creek the large stone barn of Mr. E. Secrest was unroofed and the south gable-end blown in. This building stood on the southern side of the wide bottom lands which spread out to the north and east for nearly a mile and a half. Northeast of the barn and nearly across the valley, a new and large church building was completely wrecked, and the *débris* carried forward in the track of the storm for one fourth of a mile.

This, to all appearances, was the last destruction committed by the *small* funnel cloud. The *large* one, before crossing Fancy Creek, struck the large two-story house of Mr. Weisdanger, entirely destroying the second story and roof, except a portion of the east wall. The building was situated 25 rods west of the storm's center and first struck by the wind from the north, the *débris* being carried to the W., SW., and S. Large stones weighing from 150 to 200 pounds were carried about 300 feet. Out-buildings standing east of the house and nearer the storm's center were more completely demolished. The house of Mr. Charles Peters, still further west of the storm's center, was considerably racked, but not otherwise damaged. In crossing through the heavy timber on Fancy Creek, the destruction was even more fearful than that produced by the smaller tornado. Large oaks 3 feet in diameter were broken off like pipe-stems, and tough elms nearly as thick, were twisted into ropes.

The two clouds were now on the northern side of Fancy Creek close to the mouth of the North Otter. Here the two tracks, which had previously been separated about 1½ miles, merged into one. In this separation, I refer to the distance apart of the centers of the paths of greatest destruction, which corresponds very closely with the immediate diameter of the dark mass of clouds which formed the funnel. A strong wind prevailed between the two clouds of sufficient force to destroy small trees and overturn fences. It was quite a difficult matter to trace the respective courses of the two storm clouds, which were reported to have passed over this section, because their supposed points of meeting and separation were located among the ridges and heavily wooded ravines of several creeks, where the timber was more or less destroyed for a width of 2½ miles. The storm certainly spread out here to an unusual width, but it was the case in all of the tornadoes where timber was encountered, caused in all probability by the opportunity offered to the revolving current of air to reach out and constantly find well suited material for its fury to feed upon, and also the fact that in a heavy forest the resistance offered to the developing energy of the storm cloud, as the inrushing currents of air attempt to reach the vortex of the whirl, is increased many fold, thereby concentrating from point to point the extreme limit of the tornado's power.

While the storm was raging with demoniac fury in the timber, the people of Randolph were looking on with fear and trembling. Mr. Alfred A. Parkerson, one among many who watched the formation of the tornado at its inception southwest of Fancy

Creek, stated that during the day the wind had been from the south most of the time, and the weather unusually sultry. About 4 p. m. clouds began to gather in the west (wind still south), with every appearance of a very hard storm. Shortly before 5 p. m. a light breeze came from the north, which kept increasing in force and finally blew very hard, when new and strange looking clouds seemed to dart up along the horizon, from the south around to the northwest with amazing rapidity, and rush towards a very black spot, apparently about an acre in size, directly in the west. In about five minutes a whirling motion was discernible in the black center, resulting in the gradual development of a small funnel-shaped cloud, which wound itself downwards toward the ground, where its tail, at the distance of between 3 and 4 miles, did not appear larger than a man's leg. In about three minutes another funnel formed on the right of the former, extending part way down to the ground, and still another formed on the left, reaching entirely down to the ground. (Diagram No. 1.) The main funnel appeared to be stationary, until these smaller ones formed, when it moved with its companions towards Fancy Creek, causing the people in the town to seek places of safety in cellars, "dug outs," and wherever else they might hope for secure shelter. After passing by the heavy belt of timber along the creeks the two smaller funnels disappeared.



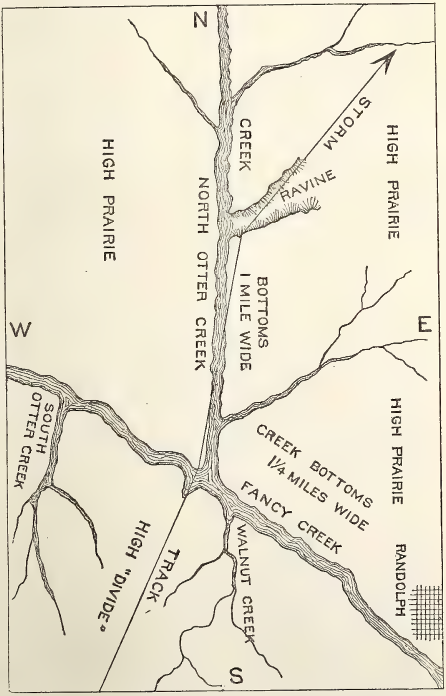
No. 1.

While the tornado was passing the atmosphere surrounding the town of Randolph was nearly calm, and occasionally large hail stones would fall straight to the ground. The roaring of the storm, particularly when in the timber, was like the rumbling of a thousand trains of cars. Mr. Henry Condray, of Randolph, who also witnessed the three separate funnels, stated that during the day the wind was blowing from the southeast stronger than for some weeks past, and at 4 p. m. light rain fell but no hail. Half an hour after the tornado passed, a very heavy rain came from the NW. with a remarkably cold wind.

The three funnels reported by these gentlemen, taken in connection with the supposed division of the storm's track, as before stated, would seem to add largely to its probable occurrence. The division is not at all improbable, although the evidence furnished by the track as I saw it, which was many days after the storm, during which much of importance was obliterated, was not very strong.

The storm left Fancy Creek near the mouth of North Otter, up which it passed for about two miles to the north, first encountering a stone school-house about 70 rods west of the storm's center, which it unroofed, carrying the *débris* to the west and south. A portion of the east wall was thrown inward, crushing the seats. The scholars were dismissed a few minutes before the storm struck, going to neighboring houses for safety. Across the creek bottom, three-fourths of a mile to the northeast, stood the house of Mr. Heller, who saw the two funnels before spoken of unite after passing Fancy Creek, at a point about half-way between the church and school-house, but being terribly frightened from the expectation that his entire property was to be destroyed, he could recall very little concerning the particulars of the junction. His house barely escaped destruction, having a few shingles taken from the roof and a lightning-rod torn down.

One half mile NNW. of the school-house the storm struck the house of Mr. Adam Schwein, which stood 250 feet east of the storm's center, the cloud following the creek quite closely. The building was part stone and part frame; size, 16 by 28 feet, and one and one-half stories high. It was swept from the ground in an instant; no one seemed to know just how. Within were gathered at the time, three of the school-children besides the family, numbering eight in all, who were each and every one buried beneath the ruins. The father was badly bruised about the hips and hurt inwardly. The mother was not dangerously hurt, but an infant held in her arms was instantly killed. Their little daughter had her head crushed to a jelly by falling timbers. The remainder escaped with a few bruises. The clothing and furniture were totally ruined, shreds of the former being found one mile from the house hanging in some tree-tops. Trees in the yard about the house were stripped to bare poles, and about them in several instances were wound the remnants of what were once whole garments. Beds, bedding, stoves, crockeryware, and tinware were strewn along the track in shapeless ruin for hundreds of rods. The once happy home was desolated as if by fire—worse than fire, for it was the work of an instant—dashed into eternity and oblivion without the slightest opportunity for defense or escape.



No. 2.

For the distance of a mile and a half still further north, the funnel cloud followed the stream, not as closely as before, but bearing off gradually more and more to the east over the wide creek-bottoms, approaching the high rolling prairie, which it soon reached by traversing a little wooded ravine that led out of the creek to the northeast. (Diagram 2.) Throughout this ravine nearly every tree, both large and small, was either broken off, uprooted, or divested of every leaf and limb, and the earth fairly shorn of its covering of prairie grass.

Throughout the storm's entire course along North Otter Creek, in the heavy timber, trunks, limbs, and foliage were torn and shattered in the most fearful manner. Often the limbs of one large monster were found completely woven into those of its neighbor, and always in a direction from right to left. Many times the very center of the funnel appeared to have traversed the bed of the stream. The width of the path of greatest destruction averaged 275 feet. In several sections of the track which were closely examined, the trees generally lay pointing to the northeast and north, on the east side of the center, lying across the track from east to west along the center, and on the west side pointing to the WSW. and SE. There was no portion of the track where a well-developed whirl was not evidenced by the destruction. Hardly a tree or limb, unless partially rotten, but what bore some evidence of being twisted.

Upon reaching the high prairie the cloud passed along the undulating surface for a mile and a half until it reached the house of John Daly, standing a considerable distance west of the storm's center, which it unroofed, and, in like manner, the house of Mr. Ericson one-fourth mile to the northeast. Both houses stood upon ground below the general level, yet not really in a ravine. A horse belonging to the last-named farmer and picketed out upon the prairie near the storm's center, was carried up into the air, in all probability a considerable distance, as nearly every bone was broken when it fell.

The tornado now lifted from the ground, which presented nothing in its topography materially differing from that already passed over since leaving the creek, and continued a direct northeast course over a section of the prairie very thinly inhabited. A few inconsiderable out-buildings were overturned, but no damage of importance was committed. Upon reaching the head of Swede Creek, 5 miles northeast of North Otter, the small house of a Bohemian standing upon a slight rise of ground was blown down, but not torn to pieces. Four miles further to the northeast the storm cloud reached the head of Timber Creek, where the stables and out-buildings belonging to Albert Beeckman were demolished, the funnel passing within two or three hundred feet of them to the west, but still above the ground. At both of these creeks the timber, even in the lowest parts of the bottoms, was not destroyed as heretofore; only the tops and an occasional trunk were found twisted or broken off, showing that the funnel had not dipped downward, but remained at the same level as upon the high prairie. The manner in which the buildings were destroyed also indicated the existence of the cloud above the surface. In every instance they were either simply unroofed or toppled over and crushed in falling, and the *débris* without an exception was thrown in the direction in which the storm was moving.

Another important fact was the existence of only one current of air, in these cases of destruction, following in the wake of the cloud from the southwest. The atmosphere was generally very quiet as the cloud came up, followed as it passed, by a loud roar and a swift rush of the air as through a vacuum, not disturbing, however, the lightest article outside of its narrow path of from 60 to 100 feet.

At the distance of 1½ miles to the northeast, the tornado crossed the line of Marshall County, partially destroying the house of Nathan Wentworth, situated 80 rods southwest of the point where the ground began to descend to Game Fork Creek. The cloud commenced to descend again to the surface and widen its path of destruction. Sixty rods east of Mr. Wentworth's a school-house was unroofed and the *débris* carried to the NE. and N.

The storm's path was now one-fourth of a mile wide, but the cloud is still upon the high prairie. The houses of Edward Wentworth, Gavin Reed, Robert Reed, and Wesly Cooper, situated in the bottom of a "draw" leading into Game Fork Creek from Timber Creek, in an ENE. direction, were next reached and fairly ground into pieces. Hardly a board six feet long was left near the foundation of any of the buildings. The funnel as it passed from the high "divide" to the "draw" perceptibly widened at the bottom; but, without bodily swooping downward at once, it drew the buildings up into its vortex and then twisted them to pieces. The house of Robert Reed, 16 by 24 feet and one and a half stories high, was lifted up as easily as a feather, and without at first cracking the timber. So quickly was it done, that before Mr. Reed, who was within, knew of his danger, the building had risen a height of 25 feet or more. The house being then enveloped in darkness and not knowing what had happened, he started for the door, thinking it time to make good his escape, when, instead of stepping out upon the ground, as he expected, he fell the above named distance, injuring himself severely.

In passing down the "draw" the timber was torn in a dreadful manner, but leaving the clearest evidence of the existence of the characteristic whirl. The large frame building of Mrs. Noak, 80 rods west of the storm's center, was torn to pieces and the *debris* carried to the SW. and SE. Mrs. Noak was instantly killed by a falling timber.

The cloud now rose out of the "draw," and passed over a ridge about 75 feet high to the NNE., overturning the house of Mr. Moses, but not otherwise injuring it. For the distance of 120 rods it continued its course upon the high ground, when it reached another little "draw," running from SE. to NW., down which it passsd for about 60 rods to Game Fork Creek, making a descent of 175 feet, destroying the house of Mrs. Miller, at the foot of the bluff. Hardly a vestige of the building remained. The tornado now encountered the timber again, making its usual havoc and widening out a distance of three-fourths of a mile. As it reached the southern bank of Game Fork Creek, a cluster of small houses, occupied, respectively, by Mrs. Brown, Henry Wilson, John Casey, and George Martin, were completely leveled to the ground. Mrs. Martin was killed by the falling timbers. Martin's house stood on the extreme eastern edge of the storm's center and Casey's on the extreme western edge, one-half mile apart. The *débris* from the former was carried to the NE., N., and NW., and of the latter to the W., SW., and SE. Mrs. Brown's house stood east of the storm's center 45 rods, and the *débris* was carried to the NE. and N.

Mr. Wilson's heavy log house one and a half stories high, and 15 by 30 feet, with a monster stone chimney on the west end, occupied the center of the storm's track. It was partially lifted, then thrown to the ground, and finally carried away, piece by piece. There were thirteen persons in the house at the time, mostly small children, not one of whom received a serious injury. The storm is now in the midst of the heavy timber lining the banks of Game Fork Creek, where it spread out nearly a mile in width, but the path of greatest destruction only averaged about 80 rods. The creek was first encountered where it made an abrupt bend to the northeast. It flows from NW. to SE. up to this point, when it bears 1¼ miles to the north in making one mile to the east. Over this portion of its course the storm followed the stream closely. The eastern bank forms the highest bluffs in the surrounding county, rising abruptly over 200 feet, while the western side spreads out into a very fertile valley, one-fourth to one-half mile in width, and but slightly raised above the bed of the stream. Along the western border of the valley the surface gradually rises 60 to 80 feet to the high rolling prairie beyond. This valley, running to the northeast 1½ miles, opens into the still broader and more beautiful valley of the Big Blue, stretching out from north to south a distance of from 4 to 5 miles. That portion of this rich and fertile valley bounded on the south by Game Fork Creek, on the north and east by the Big Blue River, and ton the west by a high "divide," formed the site of ill-fated Irving, a very pleasant and thriving village of 300 inhabitants. There were only three openings to this natural amphitheatre (3 miles long by 2 wide), one from the southwest by way of Game Fork Creek, and the other two from the northwest and southeast, by way of the Big Blue.

Going back to the funnel cloud where we left it at its entrance upon Game Fork Creek, we find that it followed the bed of the stream very closely, hugging the eastern bluffs with such tenacity that it ripped up nearly every tree along their sides and withered the tough prairie grass. Persons who watched its progress along this portion of its track stated that the demoniac fury of the cloud was appalling; whirling with most frightful rapidity, the intense black column would at times seem to level the whole bluff as it disappeared from view within the huge rolling mass of darkness. The eastern bank, covered with a luxuriant growth of timber, would, as the cloud moved along, successively emerge from its awful baptism swept clean to the soil. While this terrific manifestation of force was going on along the stream, westward over the valley, a distance of 60 rods, only a gentle wind was experienced.

The first house destroyed on the creek bottom was Mrs. Brumbell's, standing on the western bank, not more than 100 feet west of the storm's center. All that was left of the building, 18 by 20 feet, and one and a half stories high, were five or six of the foundation stones and part of an old stove. The remainder of the house might have been found anywhere on the bluffs, valley, or about the village beyond.

At the distance of a quarter of a mile to the northeast, close to the western bank of the creek and in a little depression forming one of the irregularities of the creek's bank, stood the small house of Mr. Buckmaster; not one vestige remained to mark its former resting place. The *débris* was swept into the vortex to the east and carried no one knew where. Of course it required but comparatively a small manifestation of force to destroy the frail building, as it was diminutive and loosely put together. But this condition made it all the worse for the ill-fated family within, consisting of the parents and four children. Mr. Buckmaster was left upon the ground near the foundation, with fragments of his pants and shirt hanging to him, and dangerously wounded. One of the girls was carried 30 rods to the east, another 40 rods to the south, another 25 rods to the northwest, and the last, 35 rods to the northwest. The mother was carried northeast 45 rods. Each one of the last five were found dead and perfectly devoid of clothing.

At this point the creek turns directly to the east, the high bluffs now forming the south bank, and the cloud which had followed its course for 1½ miles while the creek ran to the northeast, now left it at the southwest gateway to the town, and started across the flats for the latter one mile to the northeast. The first house encountered as it left the creek was the stone building of Mr. Ambrose Ship, standing 45 rods southeast of the storm's center. The building was unroofed and the *débris* carried to the northwest. Directly opposite Mr. Ship's, to the west, stood the large stone house of Rev. Mr. Griffiths, Presbyterian minister at Irving. The kitchen on the west side of the house was unroofed; the cupola and part of the roof of the main building were also carried away. The *débris* from the former lay to the southwest and southeast, while that of the latter lay to the northeast. The house stood on the extreme western edge of the storm's path, whose width was now about three-quarters of a mile. These two houses stood at the very entrance to the valley of the Game Fork, southwest of Irving. The funnel-cloud narrowed its path of destruction about one-half after leaving this point. I will now commence to number the houses that were destroyed within the city limits of Irving in the order in which the storm severally met them. These numbers will also appear upon the map of the city accompanying this report. No. I, or that owned by Mr. John Gale, situated 20 rods northeast of Mr. Ship's, and about the same distance southeast of the storm's center, was unroofed and the walls torn down to the first story. The *débris* was carried to the northeast and north. It was a very old building and considerably out of repair. Mrs. Gale's baby was carried out of the house into a wheat-field to the northeast, a distance of 30 rods, and a little girl carried east into a small ravine, distant 28 rods. Four other members of the family, including the father and mother, were carried to the east at distances varying from 10 to 15 rods, and their clothing torn into shreds and partially stripped from their bodies.

No. II, Mr. Gallop's house, stood within the path of the storm's center. Size 16 by 28, and one and a half stories high, with an addition to the south 12 by 14 and one story high. The entire house was lifted up bodily, containing the family of five persons, to a height of about 20 feet above the ground, without so much as removing the chimney. It was then carried 125 feet to the northeast, when it was twisted into pieces and the *débris* scattered to the ENE. and NW. The family came down to the ground upon the lower floor as it fell out, while the upper portion of the house was carried away above their heads. This was evidenced, aside from their own testimony, by the fact that most of their wounds were upon the scalp, or running from the neck over the head. The mother was carried into a corn-field 40 rods to the northeast, two of the children 20 rods to the east, and the father and one child 15 rods to the northeast. All were nearly stripped of their clothing and covered with black mud, but none killed. The cloud was now traversing the southern skirts of the town along the open flats, which course, had it been maintained, would have saved the trembling inhabitants and their valuable property from the terrible destruction soon to follow. Its course was ENE., sweeping along above the ground for a distance of 1½ miles, when the new and costly buildings (No. III) of Captain Armstrong were reached, standing a little west of the storm's center. The house was a large two-story structure with mansard roof, and, with the barn, cost $9,000. The former was first struck by the wind from the northeast and turned completely over to the southwest, when it was torn to pieces and the *débris* carried to the southeast and east from one-fourth to three-fourths of a mile. The barn, 100 feet southwest of the house, was destroyed in a similar manner and in all probability by the same current, which continued its whirl to the left, as the *debris* of the house was carried to the south, southeast, and east. A new and heavy lumber wagon loaded with 1,000 feet of lumber, standing half way between the house and barn, was carried away and no trace found of it. A new top buggy near by was completely wrecked, and portions of it scattered along the track for half a mile. Many were the curious freaks of the storm at this house, which space will not permit me to relate. Letters from Captain Armstrong were found on the farm of Mr. Frank Bard seven miles to the northeast. Lightning rods and wire fencing were wound into balls or twisted into ropes. Tinware, cutlery, stove-pipes, harnesses, and furniture were broken and twisted in every conceivable manner. Not an article of value throughout the entire large house remained in a serviceable condition, or within 150 yards of the foundation. Everything was swept clean to the bare stone walls. Captain Armstrong estimates the time occupied in the destruction at not more than ten seconds; it was the result of years of careful saving and hard labor utterly annihilated in an instant.

The track now widened out to 80 rods, embracing the barn of Mr. W. J. Williams (No. IV), about 600 feet ENE. of Mr. Armstrong's house, escaping the former's residence by about 70 feet. The barn was torn down and the *débris* carried to the southwest and southeast.

The house and barn of Mr. Thompson (No. V) were now reached, standing 35 rods northwest of the storm's center and 40 rods ENE. of the barn just destroyed. The roof and second story only of the house were carried away to the southwest and southeast, leaving the first story upon the foundation, while the barn 65 feet to the south was entirely demolished and the *débris* carried to the southeast and east. This was the last building destroyed in the town by what we will term the *first* Irving storm.

The funnel-cloud now swept on a mile and a half over the valley beyond the town, scattering fences and twisting off small trees until it reached the Big Blue River at a point about 800 feet south of the large iron bridge. In crossing the river the cloud struck the heavily wooded bluffs on the eastern bank, rising from 75 to 150 feet, and turned immediately up the river, striking the bridge squarely from the south, which it lifted bodily from two stone piers and one abutment and dashed into the river. So completely twisted into shapeless ruin was the huge mass of iron rods and stringers that it entirely disappeared from view in a few feet of water, except several ends of some of the long rods that reached out upon the shore. The superstructure rested upon a heavy stone abutment at the east end and upon two stone piers rising 22 feet above

very entrance to the valley of the Game Fork, southwest of Irving. The funnel-cloud narrowed its path of destruction about one-half after leaving this point. I will now commence to number the houses that were destroyed within the city limits of Irving in the order in which the storm severally met them. These numbers will also appear upon the map of the city accompanying this report. No. I, or that owned by Mr. John Gale, situated 20 rods northeast of Mr. Ship's, and about the same distance southeast of the storm's center, was unroofed and the walls torn down to the first story. The *débris* was carried to the northeast and north. It was a very old building and considerably out of repair. Mrs. Gale's baby was carried out of the house into a wheat-field to the northeast, a distance of 30 rods, and a little girl carried east into a small ravine, distant 28 rods. Four other members of the family, including the father and mother, were carried to the east at distances varying from 10 to 15 rods, and their clothing torn into shreds and partially stripped from their bodies.

No. II, Mr. Gallop's house, stood within the path of the storm's center. Size 16 by 28, and one and a half stories high, with an addition to the south 12 by 14 and one story high. The entire house was lifted up bodily, containing the family of five persons, to a height of about 20 feet above the ground, without so much as removing the chimney. It was then carried 125 feet to the northeast, when it was twisted into pieces and the *débris* scattered to the ENE. and NW. The family came down to the ground upon the lower floor as it fell out, while the upper portion of the house was carried away above their heads. This was evidenced, aside from their own testimony, by the fact that most of their wounds were upon the scalp, or running from the neck over the head. The mother was carried into a corn-field 40 rods to the northeast, two of the children 20 rods to the east, and the father and one child 15 rods to the northeast. All were nearly stripped of their clothing and covered with black mud, but none killed. The cloud was now traversing the southern skirts of the town along the open flats, which course, had it been maintained, would have saved the trembling inhabitants and their valuable property from the terrible destruction soon to follow. Its course was ENE., sweeping along above the ground for a distance of 1½ miles, when the new and costly buildings (No. III) of Captain Armstrong were reached, standing a little west of the storm's center. The house was a large two-story structure with mansard roof, and, with the barn, cost $9,000. The former was first struck by the wind from the northeast and turned completely over to the southwest, when it was torn to pieces and the *débris* carried to the southeast and east from one-fourth to three-fourths of a mile. The barn, 100 feet southwest of the house, was destroyed in a similar manner and in all probability by the same current, which continued its whirl to the left, as the *debris* of the house was carried to the south, southeast, and east. A new and heavy lumber wagon loaded with 1,000 feet of lumber, standing half way between the house and barn, was carried away and no trace found of it. A new top buggy near by was completely wrecked, and portions of it scattered along the track for half a mile. Many were the curious freaks of the storm at this house, which space will not permit me to relate. Letters from Captain Armstrong were found on the farm of Mr. Frank Bard seven miles to the northeast. Lightning rods and wire fencing were wound into balls or twisted into ropes. Tinware, cutlery, stove-pipes, harnesses, and furniture were broken and twisted in every conceivable manner. Not an article of value throughout the entire large house remained in a serviceable condition, or within 150 yards of the foundation. Everything was swept clean to the bare stone walls. Captain Armstrong estimates the time occupied in the destruction at not more than ten seconds; it was the result of years of careful saving and hard labor utterly annihilated in an instant.

The track now widened out to 80 rods, embracing the barn of Mr. W. J. Williams (No. IV), about 600 feet ENE. of Mr. Armstrong's house, escaping the former's residence by about 70 feet. The barn was torn down and the *débris* carried to the southwest and southeast.

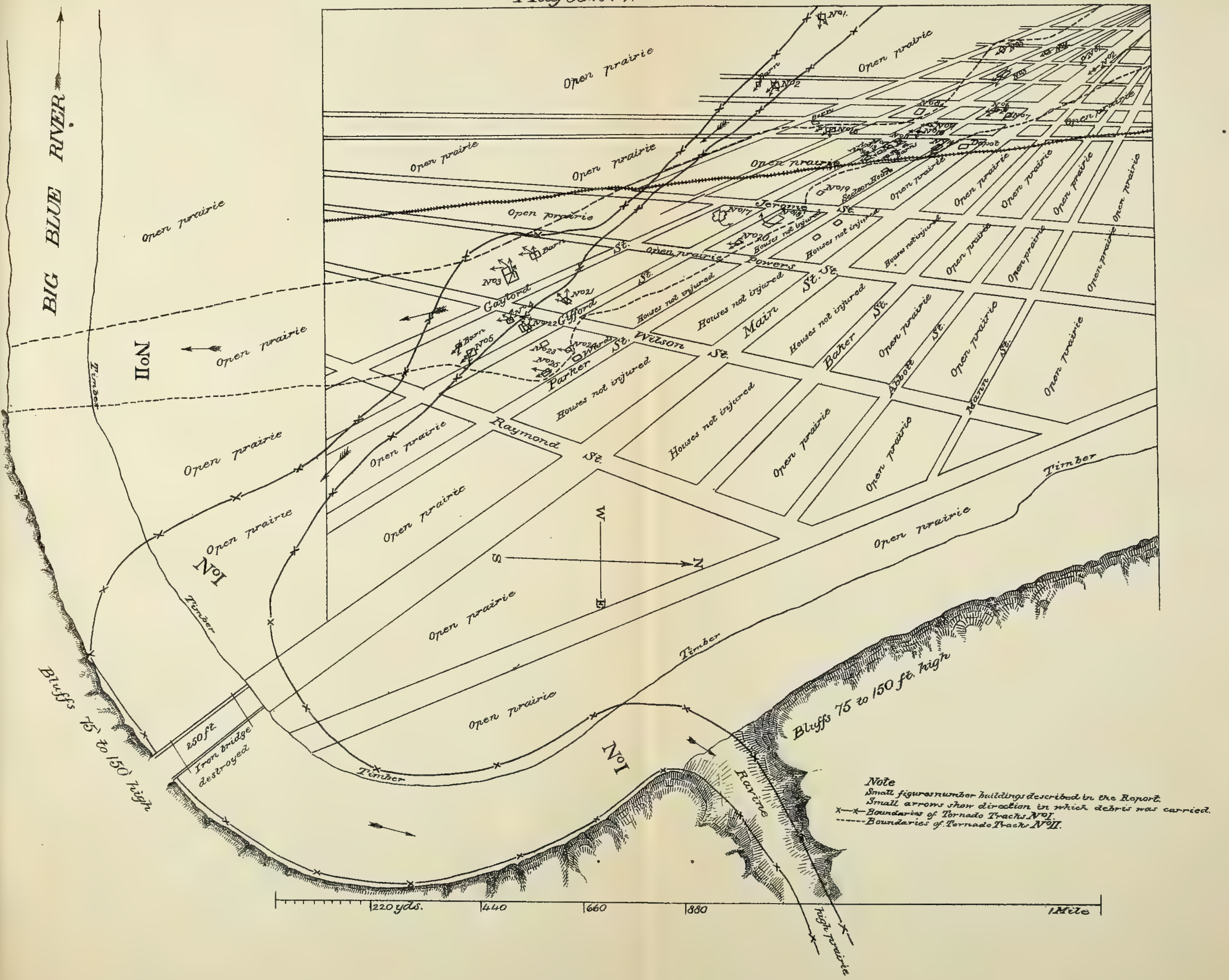
The house and barn of Mr. Thompson (No. V) were now reached, standing 35 rods northwest of the storm's center and 40 rods ENE. of the barn just destroyed. The roof and second story only of the house were carried away to the southwest and southeast, leaving the first story upon the foundation, while the barn 65 feet to the south was entirely demolished and the *débris* carried to the southeast and east. This was the last building destroyed in the town by what we will term the *first* Irving storm.

The funnel-cloud now swept on a mile and a half over the valley beyond the town, scattering fences and twisting off small trees until it reached the Big Blue River at a point about 800 feet south of the large iron bridge. In crossing the river the cloud struck the heavily wooded bluffs on the eastern bank, rising from 75 to 150 feet, and turned immediately up the river, striking the bridge squarely from the south, which it lifted bodily from two stone piers and one abutment and dashed into the river. So completely twisted into shapeless ruin was the huge mass of iron rods and stringers that it entirely disappeared from view in a few feet of water, except several ends of some of the long rods that reached out upon the shore. The superstructure rested upon a heavy stone abutment at the east end and upon two stone piers rising 22 feet above

Exhibit A.

Map of the Tracks of the Tornado's Nos. I. and II. through Irving, Marshall County, Kansas.

May 30th 1879.



Note

Small figures number buildings described in the Report.

Small arrows show direction in which debris was carried.

×—×—Boundaries of Tornado Tracks No I.

-------Boundaries of Tornado Tracks No II.

the water, one in the center and the other at the western extremity of the first iron span. From this pier to the western bank of the river, 140 feet, a wooden trestle work completed the structure. Thirty feet of the eastern end of this trestle was carried away with the iron spans and deposited in the river. Where the wooden portion separated, timbers 10 to 15 inches square, fastened with heavy iron bolts, were broken asunder as if they had been but pipe stems. The iron portion of the bridge consisted of two spans of 125 feet each, and four chords with a rise of 18 feet, weighing 27 tons to the chord. Several of the large iron rods 2½ inches in diameter, sticking out of the water upon the sandy beach, were found broken square in two. Smaller ones, and broad flat strips of iron, were twisted into fantastic shapes. So easily and yet completely was the great structure lifted from its foundation that but two of the top stones were moved from the eastern pier, and none, not even the mortar or cement, from the abutment and other pier. This was perhaps the most terrific manifestation of force recorded in any of the storms. The structure was built a few years since at a cost to the county of $20,000.

The cloud now passed up the river, following the bend to the north and northwest for a distance of about 1,200 feet, when it reached a small "draw" from 250 to 300 feet wide, cutting up through the bluffs to the east and reaching the high prairie beyond. Up this opening the cloud ascended with terrible fury, uprooting and breaking off large oaks and hickories 18 inches to 3 feet in diameter, and plowing up the earth in deep furrows. At the head of the "draw" and 265 feet east from the line of steepest ascent, stood the house of Mr. J. C. Ward, occupied by his daughter and her family. Over this building the cloud raised, shaking it severely, but not overthrowing it. The doors and windows were blown open and out of the house, followed by the furniture and bedding, and the rooms were filled with dense black smoke and flying *debris*. While passing up the river the cloud confined itself almost entirely within the opposite shores (varying in their width apart from 300 to 400 feet), reaching out occasionally into the timber on either side from 30 to 50 feet. As it left the bridge (so related a fisherman living upon the western bank, and in clear view of the whole scene) it backed up the water, exposing to view the bed of the stream in several places. Where the cloud left the river, shells and smoothly washed stones were found high up on the bluffs, which must have been brought from the river bottom. These shells and stones were picked up by Mr. J. C. Ward and other citizens of the town. George Wilson, a very intelligent little fellow of twelve summers, standing near his home in the eastern part of the town, three-fourths of a mile from the river, called to his father to come and see the water, as it was "way above the tree tops." The water must have been raised a considerable height in order to have been seen from the town, as the western bank was lined with a heavy growth of timber.

We have now finished the course of the *first* storm and only *true* tornado that visited Irving. The *second* storm, which came about one hour later, presented peculiarities not common to tornadoes, but a strange commixture of the straight hurricane and the whirlwind. After describing the destruction of the *second* storm, we will proceed to compare relative directions, velocities, appearances, and widths of the two storms.

Storm *No. II* came from the northwest down the valley of the Big Blue, another natural gateway leading into the broad valley surrounding the town. It will be found upon reference to the "Waterville Tornado" that a heavy westerly wind, doing considerable damage, prevailed at Waterville and Blue Springs, eight miles to the northwest, at about 6 p. m., just previous to the formation of the funnel-cloud, several miles west of the former place. This current passed eastward to Irving, reaching the town, after the first storm had disappeared on the high prairie beyond the river. In the wake of the first tornado a warm southerly current passed over the town, accompanied by rain. The sun now partially exposed beneath the heavy clouds lining the western horizon, threw its warm rays upon the terror-stricken inhabitants who, at this welcome invitation, assuring them as they thought, of peace and protection, emerged from their cellars and "dug-outs" to witness the destruction already committed and relieve their suffering neighbors. Hardly had the people recovered from the first shock, when there appeared in the west a cloud of inky blackness and enormous dimensions, presenting a square front of apparently two miles in width and a perpendicular height from earth to sky. It moved along slowly, but with the most inconceivable majesty of force, apparently annihilating everything within its reach. No funnel-shaped cloud was noticed during its passage through the town, and but little commotion or tumbling of the clouds until it commenced its work of destruction, first, upon the farm of Mr. Preston, one mile northwest of the city, which it reached about 6.20 p. m. His buildings were only partially destroyed, as they were situated on the western edge of the storm, on a rise of ground above the valley, yet not upon the high prairie. From this point to the defenseless town there was nothing but a wide sweep of prairie grass. The town is now reached and as the awful cloud starts upon its frightful mission of death and destruction, it strikes into a cluster of eighteen houses and other buildings, within a radius of less than half a mile. Nearly all were swept to the earth in terrible ruin and the *débris* carried in one general direction eastward.

The first houses encountered were those of Mr. George Bowdish and Mr. Johnson, No. I and No. II. The *débris* of the former was carried to the southeast and the latter to the east. The cloud now spread out to the south, embracing the Seminary, No. III, and two small tenement houses, Nos. IV and V still further to the south and west. The latter were simply unroofed, the *débris* being carried to the east. The seminary, owned and conducted by Mr. Charles Preston, was a large stone structure two and a half stories high. It was first struck on the northwest corner, carrying away a portion of the roof and demolishing the south and west walls, the *debris* going to the southeast. Says Mr. Preston, "Our first sensations upon the contact of the storm were as though the building had been picked up, violently shaken, and then set down again. The next instant the doors and windows were broken in, the furniture whirled around the room and broken in pieces, and I, standing in the east room, picked up, whirled around and carried through the folding doors into the main school room to the west, and laid upon the floor uninjured. The same instant the south end of the building was carried away and most of the roof disappeared. Upon rising from the floor I found my clothing torn into shreds, but not a bruise upon my body. While in the act of taking hold of a door-knob to descend into the basement, where I had sent my family, I found both hands benumbed as though asleep, and I was unable to open the door, while my wrists, elbows, and shoulder-blades felt more like the effects from the shock of a galvanic battery, yet no lightning was seen in the cloud or about it during its passage. During the passage of the storm electricity ran over the walls of my house, throwing off sparks like an emery wheel, but of a paler color; yet I would attribute this effect to the particles of sand and plaster blown from the walls by the extreme violence of the wind. While standing in the school room, from the floor of which I had risen, I saw through the open doors and windows to the east the flight of the storm. The cloud was of such intense blackness that I could not see anything of the buildings it would envelop, but as the milky mist passed away, which seemed to linger over the ruins, the terrible work was brought to light."

The frame houses of Messrs. Keeney and Jeffers, Nos. VI and VII, 80 rods northeast of the seminary, stood about in the center of the storm, and were completely destroyed. The former was lifted up, turned over, and torn to pieces, the *débris* being scattered to the east and southeast. The father, mother, and grandfather were carried to the ENE. about 200 yards, lying within a few feet of each other, and found dead. Mrs. Keeney was dashed head foremost into the soft ground up to her shoulders, entirely stripped of her clothing, and covered with black mud. The other two were partially stripped of their garments, and also covered with mud, which was fairly beaten into the clothes. Three little boys of Mr. Keeney's were blown in the same direction, but only about half the distance, partially divested of their clothing, and covered with mud, but not dangerously injured. The barn, west of the house, was also destroyed, and carried along with the other *débris*. Mr. Jeffers' house was carried almost entirely to the east.

The house of Mr. Walker, No. VIII, banker at Irving, 50 rods south of Mr. Keeney's, had the cupola carried away, and also a portion of the tin roof on the north side. Size of the building, 36 by 40, and 2½ stories high, very handsomely and strongly built. Heavy iron rods ran lengthwise of the building, connecting together the heavy oak sills; similar rods also passed through the sills into the heavy stone masonry below them, making the foundation doubly secure. The house, like several others, was built with a view to "weather" the hard "Kansas blows." On the approach of the storm the family descended below into the cellar, there to await the result. It first struck the west end, which was lifted up so that objects outside could easily be seen. Then the whole building was raised up twice, from 12 to 14 inches each time. The building was considerably racked, and the threads torn from the bolts and rods as if they had been made of wood instead of wrought iron. The house was so well constructed, and being on the extreme southern edge of the storm's path, that it did not go to pieces. The barn, northwest of the house a few rods, was entirely demolished, and the *debris* carried to the east.

Northeast of Mr. Walker's, the large stone house of Mr. Buckout, No. IX, was next demolished. The walls were thrown into a shapeless heap, and the roof torn in fragments and carried to the SE. and E. No one occupied the house at the time.

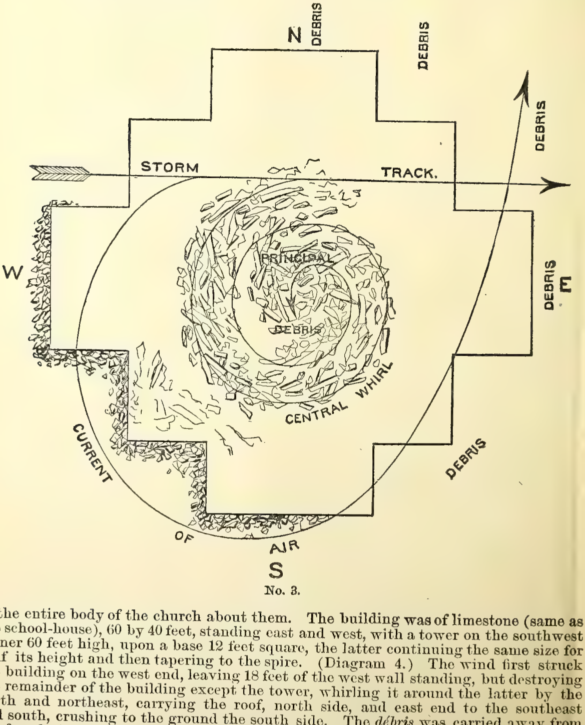
Mr. Bates's house, No. X, a frame structure, was torn to pieces and the fragments scattered in two streaks to the northeast and southeast. The family, consisting of the mother and four children, were thrown out upon the ground severely bruised and lacerated.

In a line east and west with the two previously destroyed, but in the next square, stood the four houses of Messrs. Sabin, Sheldon, McClary, and Leddy, Nos. XI, XII, XIII, and XIV, directly in the storm's center. Here was the most fearful loss of life and limb, and the most complete annihilation of property. All of the buildings were frame, and the *debris* in each case was carried to the ESE. and E. Mr. Sabin's house, with the family in it, was lifted up and whirled around two or three times, which motion the occupants could easily feel, and then torn to pieces, the family being scattered out upon the ground and seriously injured. A hired man was carried from the house several rods, breaking his ribs and right forearm. Mr. Sheldon's house, standing next, was crushed to the earth and afterwards scattered in small fragments upon the prairie. Hardly any material was left to mark its former position. Both Mr. and Mrs. Sheldon were carried a considerable distance east of the house and very seriously injured. The latter was completely divested of clothing and covered with mud. Miss Emma Sheldon, a sister of Mr. Sheldon, and twenty-two years of age, was carried to the southeast about 200 yards, into a low, wet piece of ground. Nearly every bone in her body was broken, and the flesh in many places terribly lacerated by flying *débris*. The body was found perfectly nude and almost unrecognizable from the grass and mire beaten into it. Mr. Leddy's house, the last of the four, was inclosed by a grove of small cottonwoods and a picket fence. The building seems to have been lifted out of its surroundings, carried over the fence to the east, and then destroyed. The fence on the south was not very badly wrecked, but on the east side it was completely carried away. The trees were stripped of every portion of bark and foliage, looking as bare as bean-poles. Wound around their trunks and fluttering from the bare limbs were fragments of garments, strips of long prairie grass, and papers. On the picket fence hung shreds of every article of clothing common to the household, and within a radius of 30 to 40 rods lay portions of chairs, sofas, bedsteads, stoves, tin-ware, and crockery-ware, mingled with shingles, lath, studding, clapboards, sills, &c.

Fifty rods SSW. of these houses stood the house of Mr. Jas. Warden, No. XV, another banker at Irving. It was vacant at the time. Size 30 by 36 feet, and two stories high, with a mansard roof. The kitchen attached to the south end was 22 by 39 feet, and one story high. The main building was carried bodily from the foundation to the NNE. a distance of 15 feet, turned bottom side up and torn to pieces, and the *débris* scattered along the track to the northeast for half a mile. The kitchen was carried bodily from its foundation 30 feet to the ESE. and then dragged about 18 feet farther, the top crushed over to the east, and the east side falling to the ground, where it remained unmoved. The east half of the roof was carried east and northeast, for half a mile. An out-house 12 feet square, and standing south of the kitchen 15 feet, was carried bodily 100 feet to the east without being torn to pieces. An east and west board fence, 45 feet north of the house, was only blown down in portions, and that very irregularly, as if caused by the flying *debris* from the house. Fifty-one feet southwest of the kitchen stood the barn and shed, forming the extreme southern edge of the storm's path. Both buildings were entirely unharmed, except a few shingles taken from the roof of the former. A north and south board fence 100 feet west of the house had but two panels broken down, and the outside cellar door over the west foundation wall was not removed from its position. Small fruit trees south and north of the house, from 30 to 50 feet, were not the least injured. This building was said to be perhaps the strongest in the whole town. It was constructed with great care and at considerable expense, particular attention being paid to the frame and its supports, in view of the heavy winds common to this region of country.

Directly north of the storm's center 35 rods, stood the R. R. Co's elevator, No. XVI, which was the last building destroyed on that side; the depot, 350 feet still farther north, marked the extreme northern edge of the storm's path. The elevator was entirely demolished, and the *débris* carried to the east across the railroad track. The depot was violently shaken, but not torn down. On the side track which ran along in front of the elevator to the east stood several loaded freight cars, one directly in front, two on the south end, and five or six on the north end. The car in front of the elevator was turned over to the east, those on the south end to the west, and two of those on the north end, to the east; the others remained standing. As the storm crossed the railroad track it narrowed down for about 200 feet, just missing the frail section-house, which stood nearly 600 feet due east of the elevator. A scantling 6 feet long and 2 by 4 inches was carried from the lumber yard north of the depot, and sent crashing through the north side of the section-house, falling inside upon the floor.

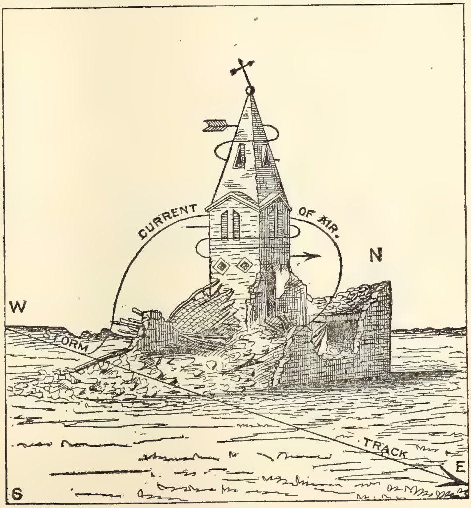
The storm now passed directly east over an open square, for about 400 feet, to the school-house and church, Nos. XVII, XVIII, standing about 275 feet apart, the center passing between them. (Diagram 3.) The former was a very heavy stone structure, 2½ stories high, 50 by 30 feet, with a wing on the north side 22 by 30 feet, and of the same height. It was entirely demolished, the roof and walls being whirled into a cone-shaped mass upon the foundation. The walls were torn down within 2 to 4 feet of the ground. Heavy corner stones 18 by 36 inches were whirled from their base and thrown into the center of the building. The roof and nearly all of the inside timbers lay crushed into splinters in the center. A portion of the latter were tipped over the walls to the NNE., but not thereby indicating any general forward movement of the wind, which throughout bore evidence in the *débris* of circular action. While the destruction was going on portions of the walls on the south, east, and north sides were thrown outward, from 10 to 20 feet, the *debris* going to the S., ENE., and N.; but on the west side, which remained standing 2 feet higher than any other portion, no crumbled remains of the walls were found, the westerly current being of sufficient force to carry inward and over the foundation. Most of the *débris* was carried out to the ENE., in a direction from right to left. The bell, with frame attached (weighing 220 pounds), was carried from the center of the building 200 feet to the northwest. Three ladies, standing in the church-tower while the storm was passing, saw the school-house when it went down, and stated that, as the storm struck it, it was enveloped in darkness and whirled around like a top, carrying the *débris* about with fearful velocity. Nothing was thrown outward from the cloud, and as it cleared away a pyramid of shapeless timbers and stones confirmed their anticipations of the manner of its destruction. The church went down at the same time, yet the roar of the storm was so great that the ladies did not know of the terrible destruction they had miraculously escaped in the demolition of the entire body of the church about them. The building was of limestone (same as the school-house), 60 by 40 feet, standing east and west, with a tower on the southwest corner 60 feet high, upon a base 12 feet square, the latter continuing the same size for half its height and then tapering to the spire. (Diagram 4.) The wind first struck the building on the west end, leaving 18 feet of the west wall standing, but destroying the remainder of the building except the tower, whirling it around the latter by the north and northeast, carrying the roof, north side, and east end to the southeast and south, crushing to the ground the south side. The *débris* was carried away from the foundation to the southwest. The body of the tower was cracked, about in the center, and so wrenched that the doors and windows could not be opened. The spire and weather vane were bent to the southwest, and the shingles on the former were torn off only on the W, N., and E. sides. The body of the spire seemed to be twisted from left to right, corresponding with the manner in which the *débris* of the building was carried. The tower did not form a part of the body of the church, but was built outside of, and attached to, the southwest corner, extending 12 feet south of the south side of the church. The west side of the tower came flush with the west end of the church, both presenting a surface of about 1,500 square feet to the wind. The full force of the current, however, only struck the west end of the church,



No. 3.

presenting a surface of about 1,200 square feet; but as the wall broke at the height of 18 feet above the ground, the impinging area was probably reduced to a surface of about 400 square feet.

Captain Armstrong, who witnessed the approach of the storm at this point, stated that the dark cloud seemed to be formed of two wings, one on the north and the other on the south side, propelling the central body along by an alternate upward and downward movement towards the ground, first one wing descending and then the other in an awkward, flopping manner, whirling all objects in opposite directions inward towards the center. (Diagram 5.) This form and movement of the cloud would certainly seem to make apparent the peculiar destruction at the church and school-house, both buildings being thrown in towards the center from the west, by the north and south points respectively. Not as in the true tornado was the *débris* on the two sides carried inward towards the center by the continuation of one circularly moving current from the east by the north and west to the south, but in this instance two currents were acting upon the material from the same direction and on opposite sides of the storm's track, thus reversing the characteristic action of the tornado. The respective wings of the peculiarly shaped cloud could not have been over 50 feet in diameter, and possibly not that, especially in the case of the church, where the destruction was confined to a width of about 40 feet.



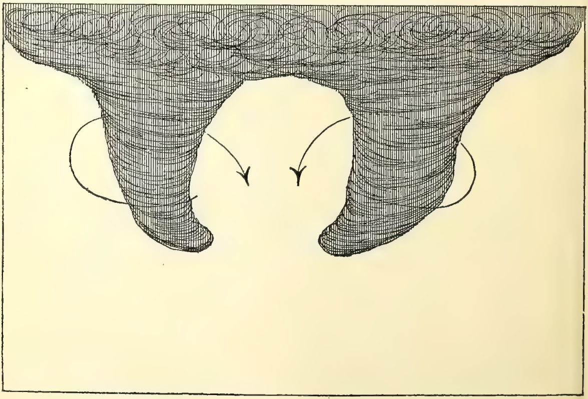
No. 4.

West of the church 160 feet stood a small tenement house, No. XIX, occupied by a family, which escaped injury in a very strange but interesting manner. The building was 12 by 16 feet, 1½ stories high and so loosely constructed that several men could have pushed it over without much difficulty. A portion of the bedding, clothing, and furniture were blown out of the doors and windows and the building violently shaken like a dog would take a rat.

Directly east of the church 280 feet stood the house of Mr. James McCoy, No. XX, 14 by 20 feet, and one story high. It was lifted from the ground and carried 150 feet to the northeast, breaking to pieces, when the *débris* was scattered to the E. and SE. The storm now spread out to the south over the path of that traversed by *No. I*, and followed it for half a mile, but extending its path of destruction several hundred feet further to the north.

After leaving Mr. McCoy's the storm passed over vacant lots for about one-fourth of a mile to the house of Mr. Griffin, No. XXI, which it carried entirely away, throwing the *débris* to the SE., S., and SW. Along a board fence 25 feet north of the house, eight posts were pulled out of the ground from a depth of 2½ feet and the remainder were stripped of the boards. Posts on the east and west side of the house were only divested of boards.

The house of Mr. W. J. Williams, No. XXII, six rods directly east of Mr. Griffin's, was next destroyed. The main part running east and west was of stone, and the kitchen attached to the south side was of wood. The northeast corner of the former was first struck by the wind, crushing in the east end and then whirling the roof and walls around to the southwest and southeast. The kitchen, in which were gathered several families, remained unharmed. Mrs. Williams, who, in search of her child, passed from the kitchen into the main part as the crash came, was found dead with the baby in her arms, the latter still alive and apparently uninjured. The picket fence west of the house remained standing, except about 18 feet opposite the southwest corner of the house, which was partially torn down by the falling timbers. Out of a group of four shade trees standing at the north side of the house only one, and that the smallest, was broken off, its top pointing to the southwest. The others were partially stripped of their foliage, but not broken. On the south side of the house four trees were uprooted, three of them carried several rods to the southeast, and one weighing about 600 pounds, with roots attached, was found three-fourths of a mile east of the house. Trees standing in the corner between the kitchen on the east and the main building on the north were not damaged, except by those portions of the *débris* which fell against their trunks. One of the number rising considerably above its companions had its top badly whipped and broken. The destructive current here must have been very narrow, for the kitchen stood barely 30 feet south of the north corner of the main part, and the trees and fence on the north side of the house 15 to 18 feet distant were not destroyed. The full force of the current could not have been over 45 feet wide.



No. 5.

The house of Mr. M. L. Cook, No. XXIII, a very small and hastily built structure, 110 feet northeast of Mr. Williams, was entirely enveloped in dark smoke and violently shaken by a whirling current going from left to right, but it was not overturned.

The current seemed to be still stronger 350 feet to the NNE. of Mr. Cook's, at the house of Steven A. Bowdish, No. XXV, size 18 by 38 feet, and two stories high, which was carried bodily to the southeast a distance of 40 feet. The east end struck the ground and the building was then turned over, torn to pieces, and the fragments scattered out upon the prairie to the E. and SE. three-quarters of a mile. Some portions were found on the high bluffs across the Big Blue, 3 miles to the east. At the same time the small barn of Mr. J. C. Ward, No. XXIV, standing 80 feet southwest of Mr. Bowdish's, was carried away to the southeast.

Mr. Ward's house, No. XXVI, 100 feet north of his barn, marked the northern edge of the storm's path in this section of the city. The house was severely shaken and battered with flying *débris* but not seriously injured. The storm has now reached the eastern skirts of the town and completed the last destruction within its limits. It left the track of *No. I* and passed with a much contracted form to the ESE. through the third natural gateway out of the plain upon which the town of Irving rests. For a distance of 2 miles over the naked flats it passed (almost entirely above the ground) filled with flying *débris* and accompanied with an awful roar. When it crossed the Big Blue about 60 rods south of the course of *storm No. I*, and near the mouth of Game Fork Creek, it cut a swath about 20 rods wide through the heavy timber for a distance of half a mile. The storm now struck the high prairie between the houses of Mrs. Cook and Mr. Boyd, about 1 mile apart, but causing no damage to either. Here the cloud broke up and all traces of its peculiar shape and whirling motion gradually disappeared, but a heavy storm of rain and hail continued across the prairie for several miles. Mr. Charles Preston, who was watching the disappearing cloud from his house in Irving, stated that upon reaching the high prairie it immediately changed its dense, dark color to a lighter gray, when its strange form vanished and the clouds scattered in several directions. People living 3 or 4 miles east of this point knew nothing of the second storm, but experienced the effects of the first.

Before proceeding with *storm No. I*, I will present several statements of persons who witnessed the approach of the two storms, also other matters of interest, particularly the relative time of appearance, &c.

Storm No. I crossed the railroad track after leaving Mr. Gallops's, at 5.35 p. m., railroad time, or 5.14 p. m., local time, according to the statements of several very reliable persons. The passenger train west, on the Central Branch of the Union Pacific was due at 5.25 p. m., Jefferson City time, which is 21 minutes faster than local time. The train stopped at the road-crossing before reaching the depot, and about in line with the center of the approaching storm, in doubt whether to proceed or not, as the terrible cloud could be seen some distance to the southwest coming down the creek. No one knew precisely how long the train waited, but thought it must have been five or six minutes. By the time the cloud reached Mr. Ship's house, 1⅞ miles southwest of the railroad track, the engineer and conductor doubtless felt more certain about the course it would pursue, as they proceeded rather slowly to the depot, a distance of 80 rods. The train had hardly arrived ere the storm cloud passed with terrible fury over the very spot it had vacated not two minutes before. Based upon the time above furnished, the progressive velocity of *storm No. I* was about 30 miles per hour. When *storm No. II* reached the depot the shaking of the building stopped the large regulator at exactly 6.45 p. m., and the agent's clock stopped at his house at 6.40 p. m. These clocks still remained undisturbed as the storm had left them, leaving no doubt as to the precision of the time. *Storm No. I* reached the railroad track at 5.35 p. m., and *No. II* at 6.45 p. m., but at a point 80 rods to the northwest, a difference in time of one hour and ten minutes. The relative width of the two storms are given as follows: When *storm No. I* was at Mr. Ship's it measured half a mile from east to west, but narrowed down to less than 40 rods at Mr. Gallops's. After leaving the latter's house the cloud lifted from the ground, descending at Captain Armstrong's, where it widened out to a quarter of a mile, again contracting until it reached the river beyond. *Storm No. II*, when it reached Mr. Preston's farm, was about 1½ miles in width, taking up a large portion of the valley. At the edge of the town, near Mr. Johnson's, its width was 1 mile. At Messrs. Walker's and Kenney's it was three-quarters of a mile. Between the depot, on the north, and the barn of Mr. Warden, on the south, it had narrowed down to 125 rods; at the church and school house to 1,360 feet. At Messrs. Griffin's and Williams's the storm widened out again to something over half a mile, contracting again after passing to the southeast, so that at the river its path was about 400 feet.

As to the relative velocities of the two storms through the city, nothing can be said of greater importance than to repeat the general and harmonious statement that *No. I* moved most rapidly. Several reliable persons stated that it passed through the builded portion of the town, a distance of 1¼ miles, in 1½ minutes; others said 1 and 2 minutes. In regard to *storm No. II*, the time is put at from 2 to 3½ minutes. The following are portions of letters and verbal statements received concerning the peculiarities of the two storms. Mr. D. S. Giles, proprietor of the Irving Hotel, states that upon May 30th, while returning from his farm in the country, at 3.30 p. m., he experienced a moderate rain with a southerly wind. No rain before during the day, which had been quite sultry, with a continued alternation of clear and cloudy sky. During the forenoon, while upon the high prairie, he felt an alternation of hot and cold currents of air in a manner which seemed very unusual. Soon after noon the clouds began to gather quite thickly in the west and south, and succeeding the first rain the wind changed to the SW., W., and back again to the S., followed during the last wind by rain and a small quantity of hail. After the hail had nearly ceased, the strange, funnel-shaped cloud appeared in sight about 5 miles to the southwest. The upper part of the cloud appeared to be about the size of an ordinary barrel. It stood out clear and well defined against a background of comparatively clear sky. As the cloud drew nearer and passed down Game Fork Creek, scud-like clouds from the N., S., and W., which shortly before seemed to be agitated by an unseen force, now dashed into the lower portion of the funnel, then up through its vortex and out at the top. Immediately after the cloud had passed through the city, perfect sheets of rain fell with a strong south wind, the latter of sufficient force to nearly throw people from their feet. After the hardest precipitation ceased, the sun came out very beautifully for about fifteen minutes, but it was still considerably cloudy in the NNW. and SW., looking very much as if the entire storm had not passed. In about 40 minutes an exceedingly dense black cloud appeared in the northwest, 8 or 10 miles distant. Its darkness became intense with fearful rapidity, sending terror into the hearts of the bravest. People were trying to collect their wits and accustom themselves to the great calamity already befallen them, but upon the advent of this second monster all hope fled and the wildest terror reigned supreme. Many thought the millenium was surely at hand. The cloud was not ragged, irregular, or funnel-shaped, but presented a square and perpendicular front, moving steadily forward like the broadside of an immense mountain a mile in width, its summit lost in the impenetrable darkness above. The wind at Irving was from the SW., very strong, attended with lighter clouds of smoky appearance. When these two sets of clouds drew together, no funnel-shaped column was seen to descend, but there followed great commotion among them. The northwest cloud moved forward more rapidly, and for the first time the awful roar broke upon the ears of the terror-stricken people like the belching and bellowing of trains of artillery. The noise throughout the course of storm *No. II* far exceeded the first storm, although at the time the rumbling of *No. I* was considered deafening.

Mr. William Wells stated: "I live 6 miles southeast of Irving; was in a tornado on the plains of Nebraska in 1860. As soon as I saw this one, I said to my wife, 'It will tear everything to pieces that it touches.' At first it seemed to stand still, but soon hurried by. I could see it for a distance of from 25 to 30 miles. It took three-quarters of an hour to travel that distance." This communication refers to storm *No. I.* Mr. W. H. Cheesman, of Irving, stated that he watched the second storm while forming. The cloud presented a heavy, solid, nearly square front, reaching from the earth to the sky. Its form and movement were awe-inspiring, and quickly impressed one with the idea of inconceivable power and majesty. With its approach there came from the southwest hail and rain, the former small, but in large quantities. When the two clouds came together the precipitation ceased and the northwest cloud moved rapidly forward (but not in funnel shape) with the most indescribable roar. After it had passed the city there followed from the west the heaviest rain of the season (without hail), succeeded by a most painfully cold northwest wind, necessitating overcoats and causing the wounded and dying to shiver and moan from its penetrating effects. No lightning was seen with either storm cloud. Dr. Chase, physician at Irving, stated that his attention was particularly directed to the shape and direction of motion of storm *No. I.* The cloud tapered from top to bottom like an elephant's trunk and whirled invariably from right to left. He thought the wind during most of the day was from the east and southeast, attended with rather cool and pleasant weather until an hour or two before the first storm, when the air became very oppressive. The first rain and hail came with an ENE. wind about 20 minutes before the funnel came in sight. This statement does not really contradict that of Mr. Giles, who was stationed about four miles southwest of the city upon the high prairie, while Dr. Chase was in the extreme northeastern portion of the town where a current of air would be experienced moving toward the approaching storm. The hail was very large but scattering. After the funnel had passed over the bluffs to the east an exceedingly heavy rain followed for about ten minutes, stopping as soon as the sun came out (others say it rained while the sun was shining). In about 30 minutes an intensely black cloud filled the western horizon, piled up layer upon layer in the most unusual manner, apparently from the earth to sky. As the cloud drew near to the city another very hard rain with some hail fell. While it was passing through the city a slight precipitation was experienced on the extreme edges of the cloud to the north and south. About in the center of the black cloud a spot apparently 15 or 20 feet in diameter seemed much blacker than its surroundings. Within this small area a whirling motion was discerned, but no funnel-shaped mass was seen to descend such as witnessed in storm *No. I.* No thunder or lightning attended either cloud while within the range of vision, yet both were accompanied by rain and hail though not of unusual intensity.

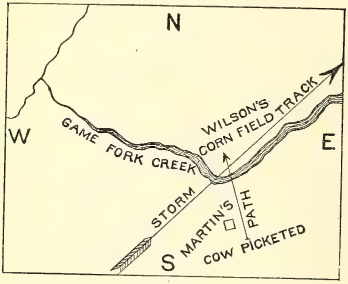
Mr. Pumphrey, 3 miles due south of Irving, upon the high bluffs overlooking the town, felt no influence of the storm at his place, but saw both of the clouds with equal clearness during their passage. There was a slight fall of hail at his house but none farther south. Mr. Morgan, 2¼ miles north of Irving, experienced quite a severe wind from southwest and west, unroofing a two-story log house and blowing down a few small trees. Hail fell in quite large quantities and extended about 1½ miles farther north. At the house of Mr. Strange, about 5 miles north of Irving, there was no strong wind or hail. Taking into consideration these statements, we find the width of the hail storm to have been about 7 miles in this vicinity and 1 mile wider to the north of Irving than to the south. The path of destructive winds was fully a mile and a half wider on the left than on the right side of the area of destruction through the town, caused by the direction taken and the large proportions of the second storm, whose center was at times one-fourth to one-half mile north of *No. I.*

Mr. James Patterson, one of the most self-possessed men in the town during the passage of the storms, stated that while they were moving through the village there was experienced on their extreme edges an upward pressure, which acted so powerfully as to apparently reduce a man's weight about two-thirds. Small articles of every kind were observed rising from the ground from localities where no strong wind was felt, and finally drawn into the tornado cloud. It was necessary to hold your hat on, even when you felt no pressure against the side of your body. Shavings, straws, and other light objects would ascend in a straight line for a considerable distance and then all at once dart with lightning rapidity downward to the base of the funnel cloud, then upward through its vortex and out at the top. Nothing was seen to descend from the top through the funnel, but always ascended from the base, flying out in every direction from the top. In a similar manner did the light scud clouds, floating naturally about in the surrounding atmosphere until they came within the compass of the powerful suction, shoot downward on the outside of the funnel with inconceivable velocity, and then upward through the vortex. After the storm passed a downward pressure was directly experienced to such a degree that the rim of a slouch hat would fall down over the eyes, and small limbs upon the trees were noticed to bend downward. These sensations were experienced by several other persons, but very few were out of their cellars and "dug-outs" to make these observations. Immediately after storm *No. I* passed, rain seemed to come in sheets on either side of the track, as if poured over from the edges of an overhanging cloud. It did not rain in the wake of the storm for some two minutes, until the clouds could gather, as it were, from each side.

Mr. D. T. Ward, of Irving, stated in a letter of July 2d, in reply to several requests I had made about the distance heavy objects were carried, &c., as follows: "The tool-chest of Mr. J. H. Case, weighing 320 pounds with contents, stood by the south side of his house (the latter west of the storm center). It had remained upon the ground long enough to sink itself several inches into the soil. While the family were watching the approaching storm, and before its effects were felt upon the house, the tool-chest was observed to rise from the ground about 2 feet and move quite evenly to the southwest toward the storm, a distance of 35 feet, where it was deposited without disturbing the tools. A hand-car situated on the side track near the elevator was totally wrecked; two of the wheels with axle attached were carried 350 feet to the east and nearly twisted off.

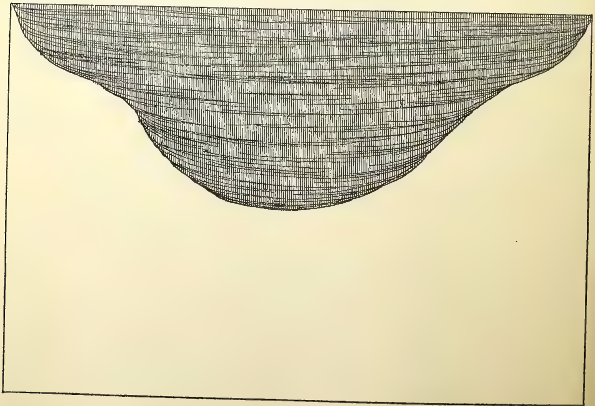
Mr. Frank Seaton, who was in Mr. Sabin's house at the time of the storm, was carried out of the top of the building after the roof was blown off and found 320 yards to the east. He and others who saw him say that he was carried at least 40 feet before landing for the first time; was taken up again but not so high, and partly carried and rolled about 100 yards, after which he became unconscious, and was lost sight of by those who were watching him. From the house of Mr. Gallops a piece of cottonwood window-frame was carried 100 yards to the east and imbedded so firmly in an elm log that it could not be withdrawn. A great many portions of broken lumber-wagons and carriages had not been found up to the date of this letter, although miles of territory were traversed in their search. Heavy tires were found broken and twisted or straightened out like bar iron. North of Frankfort on the west fork of the Vermillion River, where the storm crossed, a large stone, weighing from 600 to 800 pounds (partially raised out of the quarry on the west side of the bluffs), was carried up to the top, a distance of 30 feet and then rolled over the prairie for 350 feet.

Mr. Ward also stated that there were several instances where people were carried out at the tops of the houses after the roofs went off and before the building went to pieces; also cases where the sides and roof went together over the heads of the unfortunate inmates, who were left upon the ground floor where they received ugly scalp or back wounds. Mrs. Griffin's black-velvet bonnet with ostrich feathers was found 3 miles east of the city upon the high prairie above the bluffs, torn, wet, and dirty. Mr. Keeney's pants, with pocket-book containing $1.60 and a note upon one of the business firms in the town, was found 2½ miles to the southeast, on the farm of Mr. Day. A new rag carpet was taken from the floor of Mr. Keeney's house, and carried nearly half a mile to the southeast without tearing a seam. It was securely tacked down about the entire room. A window blind, recognized by its color, was carried from Captain Armstrong's house 5 miles to the northeast. Letters and papers were also found in the same direction, a distance of 7 miles. A window-weight of 5 pounds was carried from the house 40 rods to the northeast and imbedded in the ground. Among the most wonderful freaks of the first storm was that displayed in the transportation of a cow belonging to Mr. Jasper Martin, whose house stood on the eastern edge of the storm's path, near Game Fork Creek. (Diagram 6.) By a very careful consideration of the circumstances attending the probable transportation of the cow, it was found that she was picketed near his house before the storm, but after it subsided she was noticed walking towards Mr. Casey's house on the north side of the creek, having a portion of the lariat rope still upon her horns and her body in a dreadfully muddy condition. On tracing her track backwards about 100 rods down the creek to the northwest a point was reached where the tracks terminated in a full imprint of the beast in the plastic mud. From this spot the distance was measured back to the picket pin on the opposite side of the creek, covering nearly 140 rods. The growth of timber along the creek, averaging 30 to 40 rods in width, was very heavy and almost impenetrable, making it impossible for the cow to have passed through it alive, so that the most rational conclusion to come to was, that she was carried over the tops of the trees, a height of from 30 to 60 feet (although perhaps not as high when the wind was blowing, bending down their tops), and landed in a cornfield, three-eighths of a mile to the NW.



No. 6.

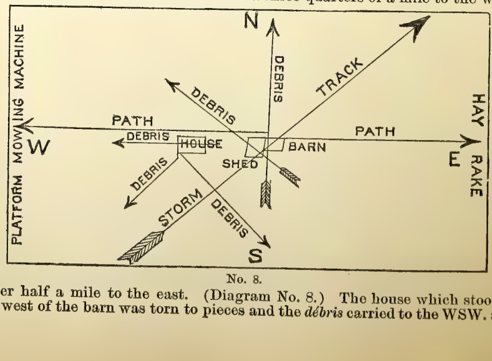
Mr. Charles Preston stated, in a letter written at my request, that he was watching the second storm approach from the roof of his seminary about 6 p. m. Saw the storm 10 or 12 miles to the northwest. A huge and heavy mass of dark clouds lined the northern part of the western horizon, rapidly increasing in size and portentous appearance. In a few moments a lighter mass of clouds shot up from the SSW., while a similar action obtained in the north. These two clouds met at a point some distance southwest of Waterville, and at what appeared to have been about 1½ miles above the ground. They ran forward and wound round each other in a most fantastic but awful manner, as if in a death struggle to see who should gain the mastery. In a few seconds a large fragment was thrown off from the main mass in the shape of a cornucopia. This smaller cloud spun round and round with great rapidity like a top, and ran to the earth at an angle of about 45°, taking a northeast direction between Waterville and Blue Rapids. It was about one-half mile wide at the top and tapered down to a few yards at the bottom. Its speed could be discerned much better than the main cloud moving to the southeast. This "fragment" spoken of here is the "Waterville tornado," which is fully described elsewhere. The main cloud took the shape of a huge basket over 1½ miles wide and rounding off at the bottom. (Diagram No. 7.) All at once it made a sudden descent towards the earth, the lower part lengthening out and



No. 7.

growing narrower, reaching the surface at an angle of about 45°. It now ceased the forward movement and standing upright on its narrow base, spun around like a top, throwing up angry jets of vapor through the vortex. As the cloud raised from the ground it swung over a little to the northwest and then gradually back on its course again, moving rapidly to the east, bounding over the hills, swinging first to the right and then to the left, then standing upright upon its base and again whirling violently for an instant. It now seemed to enlarge and fill up on the sides, pressing down to the earth until nothing but a broad, heavy storm cloud appeared. In a few seconds another small neck ran down, resembling a funnel, but the huge mass of cloud was so near the earth that the column appeared to almost lie upon the ground, as it ran forward over the surface with lightning rapidity. The large cloud during this time was spitting out angry forks of dark smoke, which would dart and flash in every direction. They now disappeared again, leaving but the broad heavy cloud as before described. The storm had now reached Mr. Preston's farm near the city, enveloping it in a dense, milky mist, but the cloud was very dark near the top. Mr. Preston now came down from his place of observation to provide for the safety of his family. He further stated that for five or six days previous to the storm a warm south wind had prevailed. On the afternoon of May 29th a stiff upper current was noticed by the action of the clouds to be passing southward, producing considerable commotion in the latter, throwing them backwards and upwards as if caused by contact with the warm southerly current moving at the surface. On Friday morning the opposing currents were still running rapidly, but accompanied with greater commotion in the clouds, especially in the afternoon, which now, instead of disappearing as before, began to thicken and concentrate in the southwest and northwest in a most threatening manner. The peculiar approach of this remarkable cloud, its strange manifestations, and its still stranger destructive effects, when considered in connection with the invariable accompaniments of the true tornado, will, I think, define its isolated position. Its incipient stages were attended with some of the characteristic attributes, but it lost them before its work commenced, resulting possibly from the peculiar condition of counteracting currents then violently confused by contemporary storms. This closes the analysis of the two storms at Irving, and we now resume our examination of storm, *No. I.*

After reaching the high prairie beyond the Big Blue it passed to the northeast over the gently undulating surface of a region very thinly inhabited, a distance of 3½ miles to the house of Milo Wicks, on Corndodger Creek, a small stream running from northwest to southeast and emptying into the Black Vermillion. His building stood on the very edge of the stream, about the center of the storm's path, and 50 or 60 feet, on a gradual descent, below the surrounding level. House, barn, corn crib, and farming implements were entirely destroyed and scattered over the prairie in the direction of the storm's course. The house of Mr. Riley Somers, 10 rods to the south of the former residence, had the northwest corner of the roof taken off, but no other damage resulted. The cloud after crossing the intervening valley raised up a gradual ascent of 60 feet to the high prairie, where it moved above the ground, for a distance of 2 miles, when it reached a little ravine running from northwest to southeast, like many others it had already passed over. Up this ravine the cloud moved a distance of 50 rods, demolishing the small house of Mr. Earl, drawing it inward to the storm's center and carrying the *débris* to the southwest and southeast. Rising to the high prairie again, and passing on 3½ miles to the northeast, it simply overturned the small house of Mr. Goodnight. Mr. David Webb's house, a few rods to the west, was moved from its foundation to the west, and the kitchen on the south end turned completely over. For a distance of 1½ miles to the northeast the storm passed over a portion of the prairie which gradually descends to the banks of Johnson's Branch, a small stream running southeast into the Black Vermillion. Under the western bank and about 5 rods from the creek stood the small dwelling of Mr. Roper, which was entirely swept away, hardly leaving a vestige of the foundation. Fifteen rods to the northwest, and a little higher than Mr. Roper's, stood the house of Mr. Caywood, on the west side of the storm's center, which was thrown over and crushed in falling, but the *débris* was not carried away. On the opposite side of the track and 10 rods southeast of the storm's center the house of Mr. Fitch was turned over and torn to pieces, the *débris* being carried to the northeast and north. His young son was carried over the tree tops and the creek a distance of a quarter of a mile to the northwest and landed unhurt. In crossing the creek the storm spread out to about 1 mile in width, destroying six small houses, scattered farther down the stream. The house of Mr. William Trosper, which stood as near the storm's center as that of Mr. Caywood's, but about 40 feet higher, was not touched. Rising upon the high prairie again, and pursuing its course to the northeast, the storm threw over a small building, but not otherwise damaging it. The storm now reached the west fork of the Vermillion, 3½ miles northwest of Frankfort, just above the mouth of Snipe Creek, where it destroyed the houses of Messrs. Fox, Ceasen, and Vaughn. The former was situated on the east side of the storm's center in the creek bottom, where it was torn to pieces, and most of the *débris* carried to the north and northwest. The two latter were on the west side of the storm's center and the *débris* carried to the west and southwest. Mr. Vaughn's chickens were completely stripped of their feathers, some living through the ordeal, but most of them were killed and scattered over the prairie. Just before the tornado passed to the northward, a heavy storm of rain and hail passed over the city of Frankfort from the southwest, damaging several small buildings, but committing nothing serious. No influence was felt from the tornado cloud, for at the place of its passage over the west fork of the Vermillion, the path of destructive winds was not over 1½ miles wide. The storm now started up Snipe Creek through Rock Township to the NNE., sometimes keeping close to the creek and then again bearing more to the north on the high land, between the west fork of the Vermillion and the two branches of Snipe Creek. The storm path over this section spread out to an unusual width, destroying houses in some portions of the track over 2½ miles apart, east and west. Perhaps the most immediate cause for the storm thus embracing a larger extent of country was due to the fact that there were three large creeks running almost in the same direction to the NNE. within less than 1 mile of each other, and all branching out from the same locality, viz, where the storm crossed the Vermillion. The ground between these creeks was not what you might call high prairie, as it was generally to a considerable degree below the level bounding the creeks to the east and west. The first house encountered upon Snipe Creek was that of Mr. Henry Johnson, about 50 rods east of the storm's center. The cloud was now moving northeastward one-quarter mile northwest of the creek. The building was entirely demolished, and the *débris* carried to the north and northwest. Mrs. Johnson was killed by the falling timbers. Mr. Waxtel's house, 100 rods to the northeast, was partially destroyed and the *débris* carried more to the north. The residence of Mr. James Downs, one-quarter of a mile to the northeast but on higher ground, and still on the east side of the storm's center, was utterly swept away, and Mr. and Mrs. Downs carried out upon the prairie to the NNE. several hundred yards, killing both. The buildings of Mr. Grove, 35 rods ENE. of Mr. Downs's, and on the western bank of the creek in the timber, were dreadfully demolished, and the *debris* scattered among the trees, and also to the north and northwest over the bottoms. Mr. Grove was carried to the N. some distance from the house and killed. The house of Mr. Colwell, 70 rods to the north, was destroyed, and the *debris* carried to the northwest. The houses of Messrs. Lane and Perry, the former to the north 50 rods, and the latter nearly half a mile to the west, but still east of the storm's center, were carried to the northeast. One-half mile directly north, the houses of Messrs. Vite and Conors were carried to the north and northwest. The storm had up to this point confined its destruction to the immediate boundaries of Snipe Creek, its center passing from one-quarter to one-half mile west of it, along the bottoms, over sections 17 and 18, township 3 N., range 9 E. It now spread out to the west fork of the Vermillion, about 1 mile farther, but with much diminished energy, which is shown by the fact that only the roofs were taken from the houses of Messrs. Cramer, Walker, and Foley in that vicinity. Between these houses and those of Charles and George Kieper and William Cassidy, destroyed within the storm's center, there stretches a broad tract of open prairie 1¼ miles in width, where no doubt the wind blew with great violence, but there was no material upon which to demonstrate its powerful force, and thereby leave evidence of its path. The barn of Mr. Cassidy, east of the house, stood directly in the storm's center. The main part was carried to the north, torn to pieces, and scattered along the track for a mile. The shed was carried to the northwest and converted into kindling wood. The platform of a mowing-machine, together with a hay-rake, were lying in the barn quite near to each other. The former was carried three-quarters of a mile to the west, and the latter half a mile to the east. (Diagram No. 8.) The house which stood about 200 feet west of the barn was torn to pieces and the *débris* carried to the WSW. and SE.



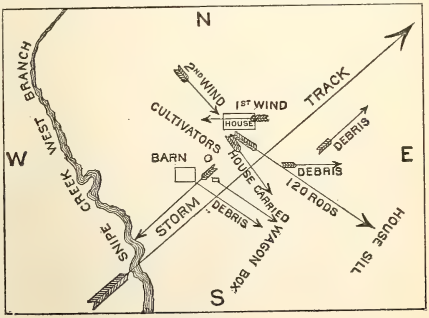
No. 8.

East of the houses occupied by Kieper brothers, and across Snipe Creek 1¼ miles, the house of Mr. James Bowman was destroyed and several of the family badly bruised. The destructive winds at this point extended 2½ miles east of the storm's center and 1½ miles west. This width still continued for one tier of sections farther north, but with somewhat diminished energy.

In sections 9 and 10, along Snipe Creek, the following destructions occurred: The house of Mr. Schults, east of the creek, in section 9, was unroofed and the *débris* carried to the northwest. Mr. A. J. McGee's house, in section 9, half a mile farther north, and Mr. Henry Boatman's, in section 10, one-quarter of a mile to the east, were entirely destroyed, and the ruins carried to the northeast, north, and northwest. In the northwest corner of section 8, and west of the storm's center, Mr. Buffon's house was destroyed, and 1 mile further west, in section 7, the houses of Messrs. Satterfield and S. S. Martin were only unroofed.

In the southwest corner of section 6, the stable of William Life was destroyed. In passing 1 mile farther to the north the path of destruction diminished nearly as much in width. Leaving entirely the wide bottoms of the Vermillion, in order to preserve its northeast course, it confined its destruction hereafter to the east and west branches of Snipe Creek, and finally to the east branch alone, which ran more directly northeast. On the west branch of Snipe Creek, the houses of Messrs. Bulkley and White, standing east of the storm's center, were demolished and the *débris* carried to the northeast, north, and northwest. The district school house 3 miles south and 1 mile east of Beattie, standing upon the high prairie between the east and west branches of the creek, and east of the storm's center, was a complete wreck, hardly a vestige of the building remaining near the foundation. The *débris* was scattered to the northeast and north.

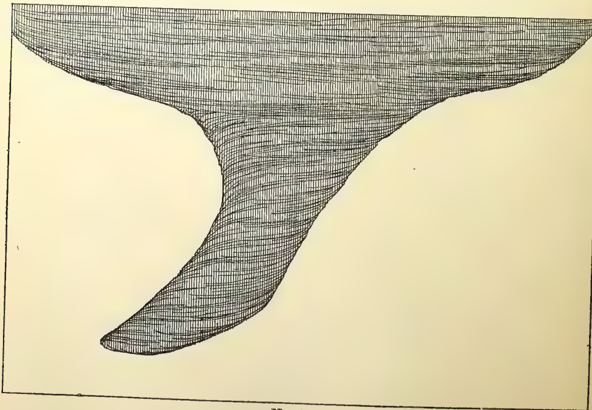
One mile south and half a mile east of Beattie the storm reached the house of Mr. Leroy Sample, standing west of the storm's center about 100 yards, on a rise of ground descending westward to the west branch of Snipe Creek. (Diagram No. 9.) The building was taken up bodily, except the ground floor, and carried to the southeast 5 rods, twisted to pieces, and the *débris* carried to the east, northeast, and north, covering nearly a 40-acre field. Three members of the family, who were left upon the floor while the body of the house was carried over their heads, were considerably injured. Mr. Sample, jr., was carried several rods to the southwest and nearly stripped of his clothing. A stable 20 rods southwest of the house was blown to pieces and the *débris* carried to the southeast. A round five-pound weight was carried from the house 40 rods to the southeast. One of the house sills, 6 by 8 inches and 10 feet long, was carried 120 rods to the southeast. Two sulky cultivators, weighing several hundred pounds each, and standing five rods northeast of the barn, were carried into the creek 20 rods to the southwest. A wagon box, 30 feet southeast of the barn, was carried 40 rods to the southeast and blown to pieces. A spring wagon standing close by the house, was torn to pieces and not a spoke left in any of the hubs, some of which were found over a mile to the east. A tin-type picture, 6 by 8 inches, was blown out of its frame which hung up in the house, carried 1½ miles to the northeast, and found with one corner driven into an elm tree to the depth of half an inch. Mr. Sample stated that the weather had been very warm during the day, with rather a brisk southerly wind, which had been the prevailing direction for some time past. At about 3 p. m. a gentle rain set in with a southwest wind, continuing showery until the appearance of the tornado, which was about 6 p. m. About fifteen minutes before the tornado passed, hail fell of very large size, but few in number. Both rain and hail ceased, as the funnel-shaped cloud drew near, whirling in a fearful manner and in a direction contrary to the hands of a watch. The wind first struck the house on the east side and with the quickness and concussion of a cannon-shot, bursting in the windows and doors. Then a calm ensued for a few



No. 9.

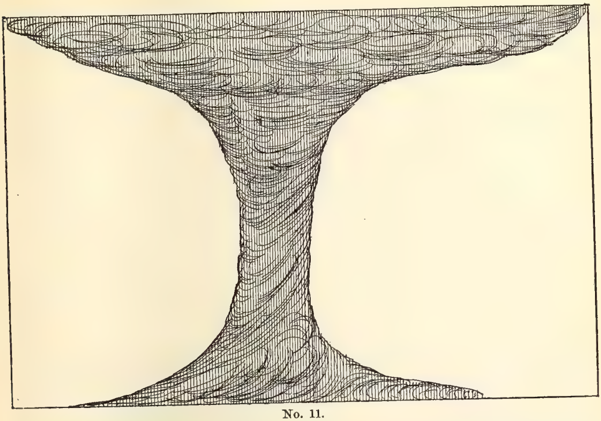
seconds, when the wind came again with redoubled violence from the northwest, taking the building from its foundations. After the hard wind commenced, the rain again set in, accompanied with large quantities of hail. When the cloud had passed, the precipitation entirely ceased for three or four minutes, when heavier rain and larger hail fell, with an easterly wind, changing ultimately to the west, followed by very cool weather, which continued throughout the night and succeeding day.

At the house of Mr. James Spiller, 2 miles southeast of Mr. Sample's, a three-gallon tin pail with covered top and full of water was taken up and carried 45 rods to the northeast. The pail was found right side up still containing the water, and the bail removed without injury to the ears of the pail. Mr. Spiller's house stood on the extreme eastern edge of the storm's path, escaping everything but a strong SE. wind, which committed no injury. One-half mile to the north, the storm ascended the high prairie in Guittard Township, ESE. of Beattie about 2 miles. Here it destroyed the houses of Messrs. White and Morgan. The path of destruction had now diminished to less than half a mile, but the the storm retained the same degree of force. The house of Mr. Morgan stood nearly in the storm's center. The wind first struck it on the east side, lifting it bodily to the west, off the foundation, when it disappeared out of sight in the dark boiling mass of whirling clouds. Mr. Morgan and family were in the cellar, and saw the house pass from over their heads in the manner above described. Most of the *débris* was carried to the NE. and N. During the storm's passage up Snipe Creek, the timber along the banks, especially on the west side, was twisted and broken in a fearful manner for a distance of about 6 miles. Large elm, oak, cottonwood, sycamore, and other trees, from 2 to 3 feet in diameter, were wrenched from the earth as if they had been but bean poles. Thousands of cords of excellent timber were piled in promiscuous heaps, choking up the stream or obstructing roadways at the fords. At least one-third of the houses destroyed were new, having been erected in the spring, and not in all cases very substantially. The loss was exceedingly severe, and one hard to be borne by the "newcomers," under the peculiar circumstances, having just commenced to "break" the new prairie and prepare a scanty subsistence for the coming winter, and also the fact that there were no available sources from which to obtain lumber to rebuild. The storm now entered upon the high prairie, crossing it between Beattie, 3 miles to the west, and Axtell, 4½ miles to the east, leaving the heads of the two branches of Snipe Creek. Mr. Martin, an old resident of Beattie, a small town of 150 inhabitants, situated upon high ground overlooking the west fork of the Vermillion, stated that about 6 p. m. on May 30th, saw distinctly, to the eastward about 2½ miles, a strange-looking cloud, shaped like a cone, and resting upon its apex. During his residence of twenty-five years, had never seen anything like it before. The lower portion of the cloud seemed to be thrown forward at an angle of about 45°. (Diagram No. 10.) At times, when it descended to the ground, it would straighten up and the smaller end would



No. 10.

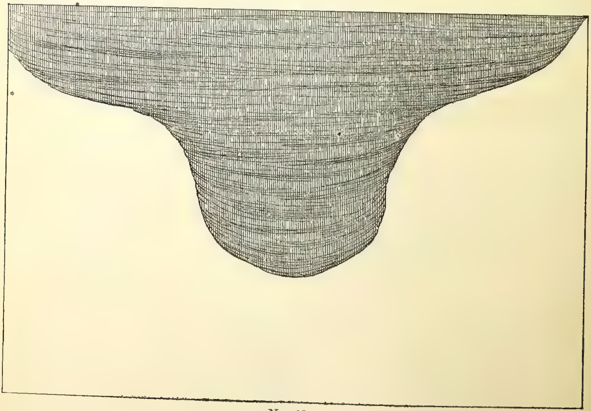
spread out to nearly the dimensions of the upper portion. The roar was distinctly heard, sounding like the rumbling of several trains of cars passing through a ravine. (Diagram No. 11.) During the day the weather had been quite warm, especially in the afternoon, when it seemed very hard to breathe comfortably. About 40 minutes before the tornado appeared, rain commenced, followed soon after by hail as large as hens' eggs. This precipitation was accompanied by a strong northwest wind, which came in gusts, the clouds moving towards the mouth of Snipe Creek, where other clouds could be seen moving from the southwest. The southwest current seemed to be the stronger of the two, and to control and beat backward the clouds from the north. Finally, they mixed together and shot off to the northeast with greater rapidity of motion. From that time, hardly five minutes intervened before the storm had passed Beattie, having traveled a distance of over 10 miles. Succeeding the storm, the wind changed to the west, and rain poured down in torrents, continuing with diminished energy, during the night and half the following day. During the evening and night it was very cold, necessitating overcoats for those who were rescuing the dead and wounded. In many instances, the homeless sufferers were found huddled together over the ruins of their property, shivering with cold from the chilly, piercing current.



No. 11.

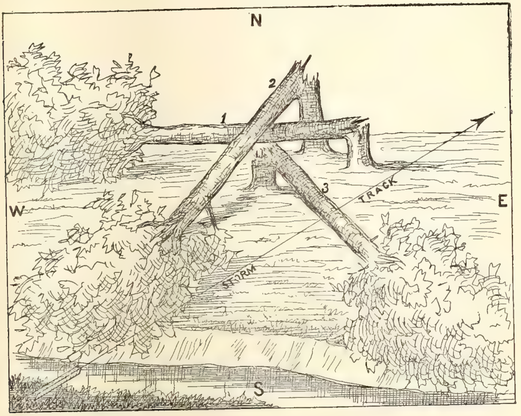
Mr. M. A. Tucker, proprietor of the Sherman House, Beattie, stated that on the afternoon of the 30th threatening clouds began to collect in the southwest and northwest, with a brisk southerly wind. Rain commenced between 4 and 5 p. m., and at 6 p. m. while the tornado was passing it was so dark (although the sun was still over one hour high), that it became necessary to light a lamp. The wind now changed to the northwest accompanied with very heavy rain and large hail, veering to the north and backing to the west again, when the hail ceased, but the rain continued at intervals through the night and part of the following day. At 7 p. m. the sun came out very bright for a few moments, lighting up beautifully the western horizon. This was the first good rain during the past eight months. All the rain that fell during the winter and spring would not have wet the ground 6 inches; in consequence the latter had become very dry and many were expecting a severe drought and loss of crops.

Mr. J. Brawner, of Axtell, stated that it was about 6 p. m. when the tornado passed to the westward of the town, where it could be distinctly seen. About 5 p. m. light rain commenced with a northerly wind (during the day the wind had been from the south), ceasing a few minutes before the tornado passed. The wind now backed to the east, continuing steady for a few moments, when it veered to the SSW. W. and NW. as the storm cloud passed to the northeast. Hail and rain now fell in large quantities, with a very strong wind for nearly one hour, accompanied by an unusual decline in the temperature. South of Axtell, which, like Beattie, stands upon the highest ground in the surrounding neighborhood, the wind from the northwest did considerable damage in the timber and blew down several houses. At the small town of Guittard, 4 miles north of Beattie, no damage was done, although there occurred heavy rain with some hail and a strong northwest wind as the storm passed to the eastward. After crossing the Saint Jo and Denver City Railroad, between Beattie and Axtell, the cloud turned from NNE. to due northeast, passing over a thinly inhabited region, for a distance of 11 miles. This portion of the country abounded in deep-wooded ravines and small streams, interspersed with rather narrow belts of rich, high, rolling prairie. During nearly the entire distance the cloud (preserving its characteristic shape), now descending, now rising and swaying from side to side as if suspended from an unseen hand, remained above the ground, committing no damage of any significance. This motion was visible for a distance of several miles on either side of its course. Five miles northeast of Beattie and 6 miles southwest of Saint Bridget, the cloud swooped down upon the small frame structure of Mr. Fuger, lifting it out of its inclosure of small cottonwood trees, carrying it over their tops (about 15 feet high), where, in falling, it crushed to pieces, and the *débris* was strewn along the storm's course for one-fourth of a mile. This was the only damage to speak of, until Saint Bridget was reached. As the cloud passed over, or near to, some isolated settler, a loud rushing or roaring noise was heard, accompanied by a strong southwest wind, which at times was very severe, although the cloud did reach the ground. This violence of the southwest current was sufficiently attested by the large poles that were found placed against either side of the buildings to secure them upon their foundations, showing that in each case they had been badly shaken up. About 1 mile south of Saint Bridget, the cloud passed over the broad belt of heavy timber lining the rather precipitous banks of Manly Creek, which ran eastward quite irregularly to Turkey Creek, in the adjoining county of Nemaha. It now descended upon the highest point of ground at the Catholic mission, destroying an old school house 50 rods southwest of the church. Brother Lambert, of the Order of Saint Benedict, and attached to this mission, stated that the storm passed about 6.30 p. m. It came up with a terrible roar and a basket-shaped cloud, whirling fearfully, and completely enveloping the place in darkness. (Diagram No. 12.) About twenty minutes before the tornado came, a light shower fell with a gentle northerly wind, which changed to the northeast as the storm cloud approached from the southwest, blowing with considerable violence, but ceasing as the latter came near, and by the time it had reached a point within one-fourth mile of the church, almost a dead calm ensued. After the tornado cloud passed by, a most violent wind succeeded it from the west, accompanied with torrents of rain and large hail. The change was frightfully sudden, severely wrenching the new frame parsonage, a strong two story and a half building, which must have been thrown over had it not been bolted down to its stone foundations, but only the chimneys were blown off. The cloud after passing over the hill to the northeast struck Willow Creek, half a mile to the north, a very small stream with broad bottoms, and running ESE., emptying into Manly Creek about 2½ miles east of Saint Bridget. (Diagram No. 13.) On this creek, directly north of the mission, the



No. 12.

storm unroofed the house of Dennis Morian, carrying the *débris* to the east. Passing down Willow Creek to near its mouth, uprooting and twisting off the scanty timber in places, it left it, at the Nemaha County line, passing gradually up to the high prairie, over which it remained above the ground for about 1 mile, when it again struck Manly Creek where it bends to the northeast. Here, on a slight rise of ground, but rather below the general level, it destroyed the log house of Mr. Corcoran. It now reached the bottom of the valley and crossed a portion of it which cut into the high prairie to the northwest. Ascending the high ground which bounded this small inlet to the east, the storm destroyed the small stone house of Mr. Hickman, situated about half way up the southern slope of the hill. The *débris* in this instance and the former was carried along the storm's path to the northeast for from 50 to 80 rods. Passing over this high point of land which pushed out into the valley, the cloud again encountered the creek, keeping near its western bank and destroyed the timber in a fearful manner for a distance of about 2 miles, when it bore slowly to the north, leaving the creek which ran nearly due east. Its course now became ENE., as it ascended the high prairie where it demolished a school house in district 26, Clear Creek Township, Nemaha County. The building stood on the north side of the storm's center and fronted the south. It was first struck on the south end, bursting in the door and carrying the building off the foundation 60 feet to the north, where it went to pieces and the *débris* scattered to the northeast and east.



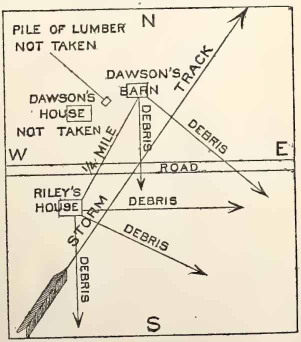
No. 13.

One-quarter of a mile to the east the large stone house of Mr. McCaffrey was unroofed, and several of his out-buildings demolished. Part of the roof was deposited a few rods east of the house, but the largest portion had not been seen since the storm, though vigilant search in every direction had been made for it. Large cottonwood trees from 12 to 18 inches in diameter, standing a few yards east and southeast of the house, were broken off from 8 to 15 feet above the ground. The width of the storm track at this point was about 300 yards. The storm passed at about 6.45 p. m., after which the sun came out quite pleasantly, but the air was very chilly, with a strong westerly wind prevailing. It rained very heavily after 7 p. m., with a northwest wind, and at intervals through the night. The following day was fair, but very cool. Mr. McCaffrey's house stood one-quarter of a mile west of Turkey Creek and three-quarters of a mile north of Manly Creek upon a considerable rise of ground sloping to the southeast. The latter creek empties into the former at this point, and both pass into Clear Creek 1½ miles to the southeast, which empties into the Nemaha River 5½ miles to the east. In crossing Turkey Creek to the northeast five small buildings, situated along the creek bottom, were unroofed and partially demolished. The heavy timber for a width of half a mile north and south was torn and twisted in the usual manner. Directly east of McCaffrey's the eastern banks of the creek were very precipitous, but about 80 rods further to the north a little ravine 150 yards wide cut up through the bluffs to the high prairie beyond. Up this "draw" the storm cloud passed with the utmost display of violence, tearing up and breaking off nearly every tree and bush throughout its extent.

Half a mile from the top of the bluffs and on still higher ground the storm unroofed the small house of Mr. Gopelt, a German farmer. The cloud now rose entirely from the ground, and passed over the high "divide" between Turkey Creek and the Nemaha River for a distance of 6 miles, crossing the latter where it passed the Nebraska line, 1½ miles south of Cincinnati, a small town in the extreme southeast corner of Pawnee County, Nebraska. During this part of its course no damage was committed so far as careful examination could reveal. Over the many little wooded ravines which it passed there was not the slightest evidence of its destructive energy, but a strong southwest wind followed in its wake, succeeded by heavy rain and some cases hail, with a cold westerly wind. Dr. A. H. Jackson, of Cincinnati, stated that the storm passed between 1 and 2 miles south of the town at 7 p. m., or perhaps a few minutes later. During the day the wind had been mostly from the southeast, but very changeable, as well as the clouds, which sometimes covered the zenith and portions of the horizon, and then entirely disappeared. It was very warm, especially in the afternoon. About 4 p. m. the clouds began to gather thickly and threatening in the west, and looked very peculiar, sometimes red, changing alternately to muddy, grayish blue and black. After this series of changes had been going on for some time, small scud clouds were seen to break off from the larger masses and move rapidly about each other finally concentrating in the southwest, the wind at the surface being still from the southeast. In the course of a few minutes the wind entirely ceased, followed by a short period of calm, when, upon looking again to the southwest, distant about 3 miles, a peculiar barrel-shaped cloud of a dirty smoky color was seen rather high up in the air. The wind now sprang up very strong from the southwest, and the cloud passed by to the south, disappearing from view in the heavy timber along the Nemaha River, which it tore up badly on the property of Mr. J. P. Cone for a width of 240 yards. While the tornado was passing the wind changed suddenly to the northwest and blew very violently for from ten to fifteen minutes, whipping off the tops of some of the trees in the town and overturning several rods of fence. The wind was accompanied with heavy rain and some hail, but it ceased with the decline of the heavy wind, and no more fell during the evening or night.

The clouds seemed to break away and clear up in the west, but a very cool westerly wind continued even through the following day—a very unusual occurrence for this time of the year. The storm cloud again lifted from the earth while upon the high prairie east of the Nemaha River, and passed over the southwestern portion of Richardson County, Nebraska, to the small town of Dawson's Mills, on the Nebraska and Atchison Railroad. During this portion of its course, about 20 miles in length, it left scarcely any evidence of its destructive power, except while again crossing the southern branch of the Nemaha, where it bends to the northwest, and about half way between the towns of Athens and Salem. The timber was twisted and broken in considerable quantities, sufficient at least to unquestionably decide the work as the result of the tornado's characteristic whirl. The track was comparatively narrow, and the destruction mostly confined to the tree tops, especially on the western bank, where its work first commenced. The cloud might have reached the earth in several places previous to its crossing the river, but no evidence from any source could be obtained of such a fact, principally because no portion of the storm's entire path was so completely devoid of creeks, timber, and habitations. The entire distance from Cincinnati northeastward to the northwest bend of the Nemaha, about 12 miles, was a bare prairie offering nothing but a monotonous surface of grass, yet not by any means level, as it was perhaps the most abruptly undulating of any portion of the whole track. The remaining portion of its course lay over the high divide between the south branch of the Nemaha and the main river, which runs from northwest to southeast, through the southeastern portion of Richardson County, and empties into the Missouri. On the eastern bank of the Nemaha, and at the foot of high bluffs surrounding it on the west, north, and east, stood the town of Dawson's Mills, the last village encountered in the track of the storm. Michael Riley, the principal merchant of the place, stated that the storm reached them about 7.10 p. m. There had been no rain during the day until about ten minutes before the storm cloud came upon them. The rain was accompanied with hail of very large size but scattering. The tornado came up from the southwest, over the bluffs along the river, looking like a waterspout, and attended with great commotion in its interior and a loud, roaring noise. As it passed, a strong current from the southwest crushed in the front of the store and tore down all the shelving on the north side. Mr. Mead, another merchant at Dawson's Mills, stated that during the day the wind had been from the southeast, and the weather was very pleasant until just at evening, when it clouded up a little with a southwest wind. About 30 minutes before the storm, dark, threatening clouds began to appear in the southwest and north, gradually approaching each other until covering the western horizon. The two seemed to join in the northwest, when there resulted a great commotion in the clouds, some moving one way and some another. The entire operation was not distinctly visible, as the observer was too low down behind the western hills to watch all of the changes. A great roaring was now heard, like the rumbling of several trains of cars, while the wind was still from the southwest. As the roaring became louder, indicating the approach of the storm, a peculiar cloud, shaped like a waterspout, made its appearance. The wind now commenced to lull, and soon a calm ensued, as on the eve of some awful catastrophe, which filled the inhabitants with terror. It had now become so dark that few things could be distinguished. The cloud did not dip down into the valley, as was expected, but moved over the bluffs to the north of the town, distant about one mile. From all appearances it had hardly passed ere a violent wind sprang up from the northwest, accompanied with a few large hail stones and rather heavy rain, which dashed down the bluffs and through the valley, committing considerable destruction. The northwest current slacked up a little in a few seconds, when it was succeeded by an equally violent wind from the north, the rain continuing. The wind gradually veered to the west, with a much lower temperature, producing a chilling effect upon the atmosphere for the next 48 hours. The rain continued until about 10 p. m., when all was quiet, commencing again with a westerly wind shortly before morning. The Catholic church, 26 by 50 feet, with 16-feet studding, was lifted bodily from the foundation and carried to the southeast, the southeast corner 10 feet, and the northeast corner 14 feet. After striking the ground the building moved 6 feet to the south, plowing up the surface to a depth of several feet, when it fell to pieces. There were at the time about 50 persons in the church, in attendance at evening meeting; none were killed, but several seriously injured; most of the people sought protection under the seats, upon which the *débris* fell, thus saving many from a painful death. One piece of flooring 12 feet long and 6 inches wide was carried 120 yards to the southeast, and considerably lighter *debris* was carried 150 yards in the same direction and deposited in the garden of Mr. Webb. The wagon-shop of Mr. S. C. Barlow, 18 by 40 feet, and two stories high, with an addition to the south 12 by 20 feet, had its east end moved 18 inches to the south, but the west end remained firm. His stable, a few rods west of the shop, 12 by 17 feet, and 9 feet high, was picked up and blown entirely through two board fences, about 60 feet apart and five boards high, tearing them down for a width of 25 feet. The barn contained 1½ tons of hay, which was pretty thoroughly scattered about the town.

Upon the prairie above the town, which formed the high divide between the Muddy and the Nemaha Rivers, the house of Mr. Riley and the barn of Mr. Dawson were entirely destroyed. Here the tornado performed its characteristic work. (Diagram No. 14.) The house stood about 200 feet west of the storm's center, and was very solidly constructed with oak sills and studding. The wind struck it first from the northwest, moving it from its foundation and then tearing it to pieces, scattering the *débris* to the south, southeast, and east, some parts being found half a mile distant. Only about one-third of the flooring could be found at all. Two of the house sills 10 by 12 inches and 16 feet long were carried, one to the south 200 yards and the other 300 yards to the southeast. One-fourth of a mile in a direct line to the NNE. stood the barn of Mr. Dawson, a large and firmly-built structure 30 feet square with 16-foot posts. It was torn to pieces on the foundation, the wind striking it broadside from the west, crushing in the heavy oaken frame as if it had been a toy shop, and scattering the *débris* to the south and southeast. Two of the sills 14 inches square and 30 feet long were found 23 yards to the southeast. A pile of loose lumber 50 feet WSW. of the barn was not harmed, also the house, 300 feet in the same direction, escaped. Grass, hay, weeds, pieces of furniture, clothing, and boards were scattered along the storm's path for a mile or more. This constituted the last destructive act of the true tornado so far as any reliable information could be obtained. Nothing was seen or heard of further on, in the way of a peculiarly shaped cloud or of any destruction where a whirling current or cloud became a factor. Of course by the time the tornado reached Dawson's Mills it was very nearly sundown, and any observation upon the movement or appear-



No. 14.

ance of the cloud would be attended with much difficulty, especially as it was now moving above the ground, and therefore much diminished in size.

Rev. J. W. Taylor, an itinerant Methodist minister at Saint Deroin, 18 miles due northeast of Dawson's Mills, and on the Nebraska side of the Missouri River, stated that in his travels to and fro between these points he had found only one instance of destructive action (a farmer's house), which occurred in the vicinity of Baraday, a small village six miles southwest of Saint Deroin. The building, situated in a small "draw" up which the storm evidently passed, was completely destroyed, together with all of the outbuildings. The house was very well built, being much stronger than the buildings of most of his neighbors, which were perfectly unharmed, though not a quarter of a mile distant on the high prairie. The family, consisting of four, were in the house at the time, but none were seriously injured save the father. The broken furniture, parts of bedding, clothing, boards, and shingles were strewn along the track to the southeast and east for a distance of from one-half to three-fourths of a mile. The time of this destruction was given as 7.30 p. m., which would agree very well with the time at Dawson's Mills of 7.10 p. m., making the progressive velocity of the storm between these two points (supposing this destruction to have been caused by the tornado) at about 36 miles per hour, rather above the average velocity for the whole storm track, but not at all excessive for small portions. As no one mentioned to Mr. Taylor in connection with this destruction anything about a tornado, and as no questions were put by him respecting the possibility or nature of such a storm, we are left somewhat in doubt concerning the course and conditions of the tornado after leaving Dawson's Mills. At Saint Deroin, as stated by Mr. Taylor, there was no severe storm of wind during the day, but an exceedingly heavy fall of rain, mixed with some hail, which came from the northwest between 7 and 8 p. m. No damage was committed. Thought that the heaviest part of the storm went west of him. It was clearly determined by the unanimous testimony of many people, and a considerable amount of destruction, that a very heavy northwest storm of wind and rain, but not much hail, prevailed between the hours of 7 and 9 p. m. over the eastern portion of Richardson County, Nebraska, the southwestern part of Iowa, and the northwestern part of Missouri. Now, it is more than likely, from the coincidence of time and place, that the tornado finally lost its identity in this heavy storm, which had come many miles from the northwest, in Iowa and Nebraska, crossing the path of the tornado east of Dawson's Mills. But notwithstanding what may be thought or said, it is an indisputable fact that the identity of the tornado was extinguished where the northwest storm began its work. I obtained no reports of any northwest storm west of Dawson's Mills, but its track seemed to be confined to the sections east of the Nemaha River.

On the farm of Mr. John J. Hart, 2½ miles southeast of Dawson's Mills, and between 7 and 8 p. m., a large stable, 36 by 40 feet, and containing eight horses, was blown to pieces by a heavy northwest wind. The house of Mr. James Harrison, 1¾ miles SSE. of Dawson's Mills, was completely demolished about the same time, a heavy northwest wind prevailing, accompanied with rain and hail. Three and a half miles to the southeast, the house of Mr. John Fisher had the doors and windows blown in, from the northwest; the wind was attended with rain and hail and lasted for about 20 minutes.

Mr. W. D. Easley, of Humbolt, a small town eight miles northwest of Dawson's Mills, reported a very heavy northwest wind with torrents of rain, but not much hail, as occurring between the hours of 7 and 8 p. m. and lasting about 30 minutes. It was accompanied with an unusual display of thunder and lightning. Several small outbuildings and chimneys were blown down, and a new drug store badly racked. Had had no rain before for several weeks, during which time the wind had been southerly and most of the time very brisk.

Mr. M. O'Brien, of Falls City, about 14 miles southeast of Dawson's Mills, reported a strong northwest wind with very heavy rain and small hail about 7.30 p. m. Two small houses were moved from their foundations and several outbuildings were blown over. The house of Henry Shaw, 7 miles north of the town, was completely wrecked by the same storm. This storm also visited the town of Craig, just across the Missouri River, in the northwestern part of Nodaway County, Missouri, at about 7.30 p. m., and still later the southern portions of Nodaway, Holt, and Andrew Counties. Mr. Fred. Meyers, of Craig, reported that a heavy northwest storm visited that place at the time above given. Very heavy, dark clouds began to gather in the north and northwest rather early in the afternoon, and between 6 and 7 p. m. other threatening clouds appeared in the southwest, apparently moving up the Missouri River. As they swung around to the northwest the two sets of clouds apparently joined, resulting in an unusual commotion and wrestling of the opposing forces, when the wind suddenly veered from the south, where it had been during most of the day, successively to the W., NW., and N., blowing with great violence from all the points. It was accompanied with exceedingly heavy rain, thunder and lightning, and some hail. From 40 to 50 chimneys were demolished, the front of a large drug store blown out, and the building itself (24 by 100 feet) was careened over to the south and east. A photograph car was turned over several times, and a large and costly wind-mill, belonging

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On the farm of Mr. John J. Hart, 2½ miles southeast of Dawson's Mills, and between 7 and 8 p. m., a large stable, 36 by 40 feet, and containing eight horses, was blown to pieces by a heavy northwest wind. The house of Mr. James Harrison, 1¾ miles SSE. of Dawson's Mills, was completely demolished about the same time, a heavy northwest wind prevailing, accompanied with rain and hail. Three and a half miles to the southeast, the house of Mr. John Fisher had the doors and windows blown in, from the northwest; the wind was attended with rain and hail and lasted for about 20 minutes.

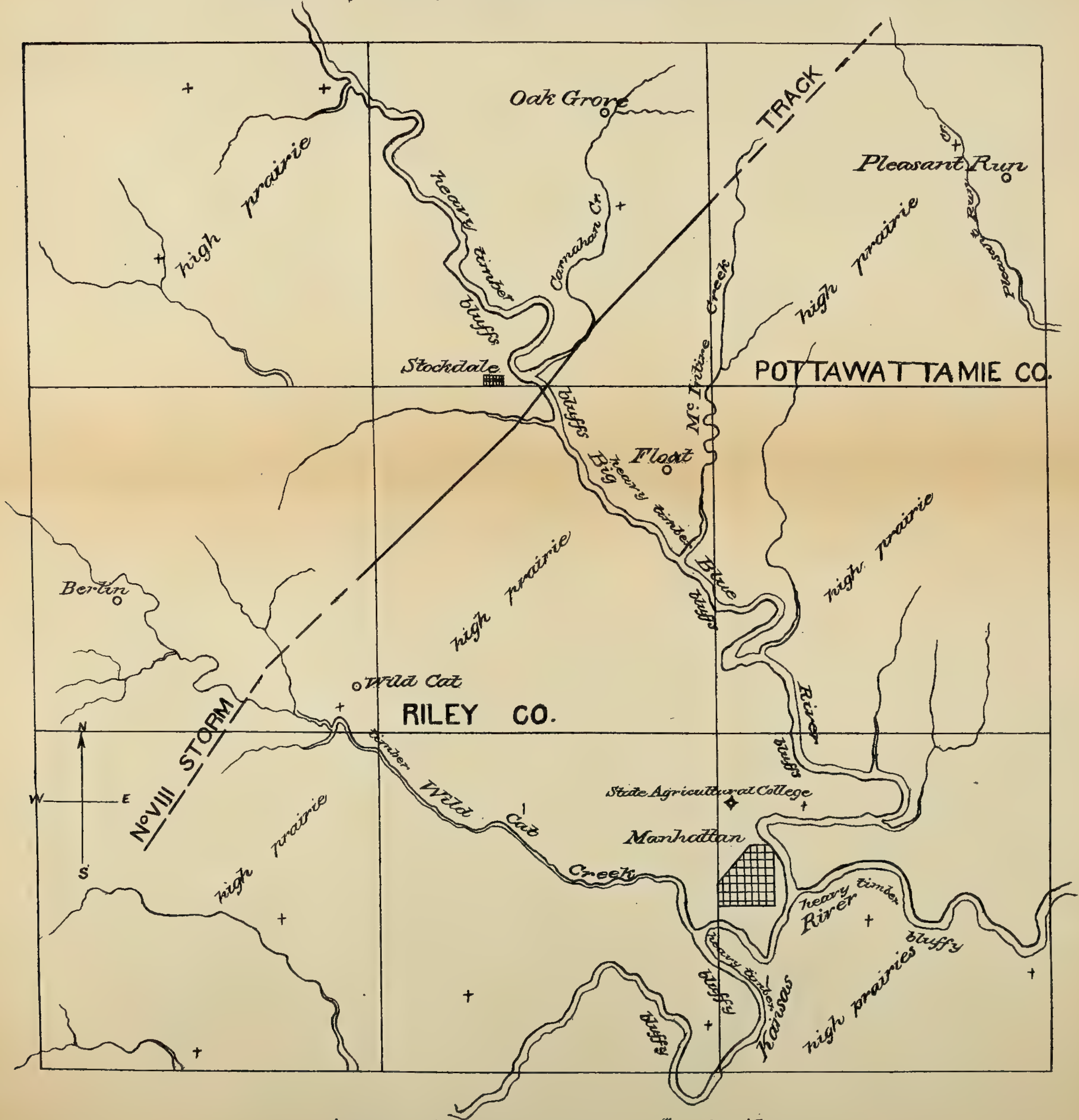
Mr. W. D. Easley, of Humbolt, a small town eight miles northwest of Dawson's Mills, reported a very heavy northwest wind with torrents of rain, but not much hail, as occurring between the hours of 7 and 8 p. m. and lasting about 30 minutes. It was accompanied with an unusual display of thunder and lightning. Several small outbuildings and chimneys were blown down, and a new drug store badly racked. Had had no rain before for several weeks, during which time the wind had been southerly and most of the time very brisk.

Mr. M. O'Brien, of Falls City, about 14 miles southeast of Dawson's Mills, reported a strong northwest wind with very heavy rain and small hail about 7.30 p. m. Two small houses were moved from their foundations and several outbuildings were blown over. The house of Henry Shaw, 7 miles north of the town, was completely wrecked by the same storm. This storm also visited the town of Craig, just across the Missouri River, in the northwestern part of Nodaway County, Missouri, at about 7.30 p. m., and still later the southern portions of Nodaway, Holt, and Andrew Counties. Mr. Fred. Meyers, of Craig, reported that a heavy northwest storm visited that place at the time above given. Very heavy, dark clouds began to gather in the north and northwest rather early in the afternoon, and between 6 and 7 p. m. other threatening clouds appeared in the southwest, apparently moving up the Missouri River. As they swung around to the northwest the two sets of clouds apparently joined, resulting in an unusual commotion and wrestling of the opposing forces, when the wind suddenly veered from the south, where it had been during most of the day, successively to the W., NW., and N., blowing with great violence from all the points. It was accompanied with exceedingly heavy rain, thunder and lightning, and some hail. From 40 to 50 chimneys were demolished, the front of a large drug store blown out, and the building itself (24 by 100 feet) was careened over to the south and east. A photograph car was turned over several times, and a large and costly wind-mill, belonging

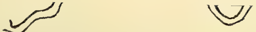
Exhibit A.

Map of the Track of the "Stockdale Tornado".

Portions of Riley and Pottawattamie Co's, Kan.



Average width of bottoms, from ½ to 2 miles.
Timber Belts, ¼ mile.



Average width of bottoms, from ½ to 2 miles.
Timber Belts, ¼ mile.

to the railroad company, completely destroyed. A "Woods harvester" weighing about 1,200 pounds was moved along the ground for 80 yards to the southeast. The storm, after leaving the town, passed out on the high prairie to the southeast, destroying a great amount of fencing and timber and several small buildings. At Mound City, 8 miles southeast of Craig, the Methodist church was moved from its foundation, and several small buildings blown down. Three miles further to the southeast the outbuildings on the farm of Mr. McIntyre, in Benton Township, were entirely destroyed.

Concluding the tornado's track at Dawson's Mills, or a few miles eastward, we find that its entire course from the northwestern portion of Riley County, Kansas, measured between 98 and 100 miles, which it traversed in 2 hours and 55 minutes, or at the rate of 30.5 miles per hour. In some portions of its track the rate was perhaps somewhat greater, several persons estimating 40 to 50 miles per hour as quite within the range of its progressive velocity. The tornado's general course was due northeast, but subject to several variations, as I have carefully noted in this description, and as will be seen by reference to the accompanying topographical map of its track.

THE STOCKDALE TORNADO.

This tornado first made its appearance on the afternoon of May 30th, over the farm of Mr. William Eddlebute, on Wild Cat Creek, one mile northwest of Wild Cat post-office. At about 6 p. m. Mr. Eddleblute, whose attention for some time had been drawn to the very curious manifestations of the clouds in the southwest and northwest, saw in about the twinkling of an eye a narrow, rope-like cloud, of a lighter color than those surrounding it, shoot outward from the front of the southwest cloud and rapidly twist itself downward to the ground, which it reached about 60 rods southwest of his house, taking up clods of prairie grass and rails for a width of 30 feet. Outside of this diameter not the least destruction occurred and no strong wind was felt. After it passed it blew strong from the southwest, changing finally to the northwest with a lower temperature. Previous to the formation of the funnel, rain and hail had fallen with a southerly wind, and some large hail-stones fell on the outer edges of the cloud while it was passing. From this point it raised from the ground and passed northeastward towards Stockdale, having remained upon the earth but for a distance of 40 rods. Mr. Eddleblute's property is situated along the bottom of the creek, bounded by high divides to the northeast and southwest. The funnel formed over the latter and passed a considerable portion of the valley before descending. To all appearances there was no influence exerted by the contour of the country, as the cloud rose before it left the valley and passed over several others before reaching Stockdale, where it first descended on the highest elevation in the surrounding region.

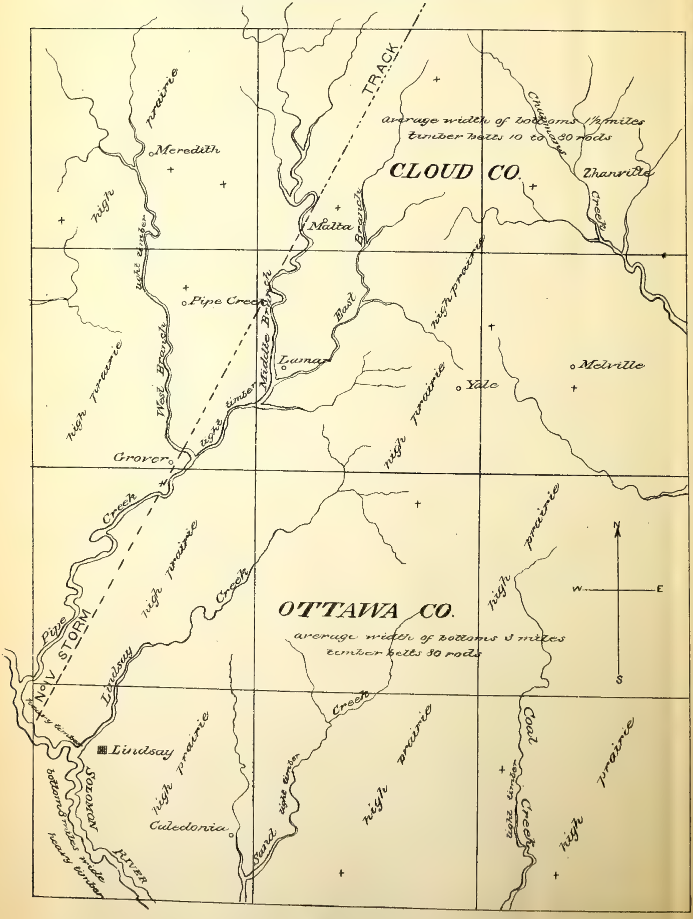
On the afternoon of May 30th, at about 6.30 p. m., Mr. Jos. Condray, of Stockdale, saw a funnel-shaped cloud suddenly appear upon the high bluffs above his house to the south and west. The building, a large stone structure 22 by 34 feet and two stories high, stood on the western banks of Mill Creek at the very foot of the bluffs, which rise almost perpendicularly to the height of from 300 to 400 feet. Mr. Condray had just returned from Manhattan as the cloud made its appearance. It rose and fell, alternately contracting and expanding, and rotating in a direction contrary to the hands of a watch, which motion and direction Mr. Condray could easily distinguish. While over the summit of the bluffs the funnel seemed to halt for a moment or two, whirling very rapidly, and then, as if shot from the mouth of a cannon, it darted down the eastern declivity, tearing up the trees which lined its side, but in the creek bottom twisting off only the tops of the highest trees. In an instant thereafter it struck the southwest corner of the house, throwing in the south end and lifting the roof directly upward, twisting it into atoms and distributing the *débris* over a width of about half a mile in a complete circle from right to left. The cloud had entirely passed the house in three or four seconds. Mr. Condray and family, and Mrs. Tatlock, with her infant babe, were in the house when the storm struck it. The latter were the only ones in the south end, and when the wall fell in Mrs. Tatlock was crushed to death, but the babe in her arms was uninjured. Two members of the family received slight injuries from falling timbers. Mrs. Condray stated that as the cloud passed it enveloped the house in complete darkness, she experiencing a burning heat against her face which almost stopped respiration. The sensation lasted only a few moments, when she was relieved by a cool current of air. A pig-pen 20 feet east of the house was torn to pieces and thrown to the east. Two hundred and fifty feet southeast of the house stood a small schoolhouse, old and quite insecurely built, which was not even slightly injured. The entire width of the path of destruction was not over 40 paces, yet the storm was of sufficient power to uproot and break off trees 2 and 3 feet in diameter, and destroy the strongest buildings. During the day the weather had been sultry, continually threatening, and about half an hour before the storm there was a light fall of rain and hail, the latter very large. Mr. E. D. Somers, a merchant at Stockdale, and living about 80 rods west of Mr. Condray's, watched the storm during its approach and passage, standing on the front porch of his store. First saw the funnel a distance of two or three miles southwest of the bluffs, moving to the northeast at a considerable height above the ground. When it reached the bluff it seemed to hang over it for a short time, and its whirling motion, which was against the sun, was distinctly apparent. It then rushed down the eastern declivity, drawing the trees inward toward its center from either side. The base of the funnel was sufficiently raised above the tree tops for Mr. Somers to see the manner and direction in which their trunks were being bent, which was also verified by a personal inspection of the track afterwards. When it struck the house of Mr. Condray, Mr. Somers was positive that the roof was carried to a perpendicular height of nearly 200 feet. The whole action was plainly visible, and viewed with composure, as from the direction and dimensions of the cloud he was certain that it would not reach him. The roof was lifted, apparently as easy as if it had been a feather, shot upward in the very center of the cloud, and fairly ground to pieces, the *débris* whirling in circles about the upper portion of the cloud, and finally dropping to the ground one-fourth of a mile from the center of the storm's path. Mr. Somers stated very positively that the funnel divided when it struck the house, a smaller one shooting off from the main one as if sliced off by a sharp-edged tool. The small one came toward him a distance of about 100 yards, and then bore around to the northeast, to be absorbed again by the main cloud about 60 rods from where they parted. Mr. Condray did not see the small one, which, of course, can be explained by the fact that the whole operation of dividing and reuniting was over before he had recovered from his terrible experience. When the cloud crossed the Big Blue River, one-fourth mile to the northeast, Mr. Somers stated that a large amount of water was drawn upward and thrown upon the opposite bank, which was indicated by the manner in which the bank was washed, the grass beaten down, and the trees covered with mud. At Mr. Somers's store, only 80 rods west of Mr. Condray's, hardly a breath of air stirred during the passage of the funnel, and it was very warm, but by the time the storm cloud had crossed the river there sprang up a cool breeze from the west, growing very cold during the night.

Hon. Nehemiah Green, ex-governor of Kansas, who lives one-fourth mile east of Mr. Condray's, very kindly furnished me with important information concerning the tornado, which he watched with no little interest from the first. At 11 a. m. Mr. Green began at first to watch the clouds, which attracted his attention from their peculiar form and movements. He walked to the top of the high bluffs twice during the day to obtain a good view to the south and west. From 11.30 a. m. to 4 p. m. black strips of clouds were moving from the southwest to the northeast, accompanied occasionally by showers of rain. Between 5 and 6 p. m. scud-like clouds of a light color were noticed shooting out from black clouds in the west and southwest, accompanied by fleecy clouds from other directions, all concentrating near Wild Cat Creek, about 7 miles to the southwest, forming a central black spot or core, darker than the dark clouds surrounding it. In a short time a light, woolly-appearing cloud, of very narrow dimensions, commenced to descend from the center of this dark spot, and during its formation twisted about like a rope. While twisting it would dart downward at times in a spasmodic manner, then draw itself upward more slowly, each time descending lower and lower, until it struck the earth, when it again bounded upwards like a rubber ball. It now advanced, at a height of several hundred feet above the surface of the ground. The dark, heavy clouds from which the funnel depended, covering about 50° of the central portion of the sky, would move backwards and forwards on either side as the funnel lengthened and contracted. Mr. Green, who was then upon the bluffs, immediately descended to provide for the safety of his family. As the cloud reached the bluff, and while it hung thereon for a few seconds, the family waited in painful suspense for the result, which they were fully convinced was, from all appearances, a matter of life and death. It would certainly take Mr. Condray's house or his own, and perhaps both. Mr. Green shut his family within the house and awaited outside the result, which soon followed. As the funnel descended the bluff, and while passing Mr. Condray's, the wind blew so strong from the southwest that he could not stand upon his feet without grasping a tree. "When it reached Mr. Condray's the roof literally went up the spout" (to use Mr. Green's words) to a height of fully 250 feet, where it was broken to pieces and thrown outward to the ground on the edges of the storm. While the funnel was upon the bluff, hail of unusual size, but scattering, fell in his yard, mingled with a few large drops of rain.

Mr. William Denhof, of Manhattan, 12 miles southeast of Stockdale, stated that previous to the passage of the tornado at the latter place the wind at Manhattan was from the south and threatening rain, but afterwards it changed to the northwest very strong and cool, lasting only a few moments, when it was succeeded by short gusts from all directions.

Mr. Henry Condray, of Randolph, 11 miles northwest of Stockdale, father of the gentleman whose property was destroyed, stated that during the passage of the tornado at the latter place a strong northwest wind prevailed at Randolph with light rain, the air being very cool. The wind just mentioned succeeded a tornado, which originated northwest of Randolph about two hours before, and afterwards passed northeastward to Irving. After leaving Mr. Condray's house the tornado crossed the Blue River near

Exhibit A.
Map of the Track of the "Pipe Creek Tornado".
Ottawa and Cloud Counties, Kansas.



the mouth of Mill Creek, and passed northeastward into Pottawatomie County, between Carnahan and McIntire Creeks, and thence across the high divide between Blue River to the southwest and Rock Creek to the northeast, where it finally disappeared. Over this portion of its track the funnel remained above the ground, doing no special damage, as the country was thinly settled. The entire length of the storm's track from Wild Cat Creek to the "divide" beyond Blue River was about 13 miles, and the course from southwest to northeast. As to the progressive velocity of the storm I am obliged to depend entirely upon the statement of Ex-Governor Green, who estimated it at between 25 and 30 miles per hour. The topography of the country over which the storm passed was especially rugged. According to the report of the State Board of Agriculture for 1878, it is known as the hilliest portion of Riley County, and comprises an area of 15 square miles, intersected by no less than seven different streams besides Blue River. The average width of the bottoms are from one-half to 2 miles, and the bluffs range from northwest to southeast.

THE PIPE CREEK TORNADO.

Pipe Creek derives its source from three small branches rising in the southern part of Cloud County, Kansas, all of which flow south and empty into the main channel at intervals of about 2 miles. The latter runs from northeast to southwest, and empties into the Solomon River near Minneapolis, about 10 miles southwest of where the last branch strikes the main creek. The cloud made its first appearance on the afternoon of May 30th at about 4 p. m., a few miles southwest of the small town of Grover, situated on Pipe Creek near the mouth of the western branch, 10 miles east-southeast of Delphos. It was above the ground and did not reach it in this vicinity, although the wind was strong enough from the south during its passage to prostrate the entire north side of the fence inclosing the cemetery. Several other fences were more or less damaged, and a few outbuildings were overturned. The tornado was preceded about twenty minutes with hail and rain, accompanied by a southeast wind. During the day until about 3 p. m. the weather had been sultry, cloudy, and at times threatening, with a brisk southerly wind. After leaving Grover the cloud still remained above the ground, passing to the northeast over the high prairie between the western and middle branches of the creek, crossing a section of country about 10 miles east of Delphos. At this stage of the storm's advance Mr. James Courtney and others in Delphos saw this funnel, as well as the other, which came nearer the town. The former was a considerable distance ahead, moving rapidly, and surrounded by clouds which were rolling and tumbling in a fearful manner. Mr. Courtney stated that from all appearances it would have done as much damage as the tornado south of Delphos, had there been as many houses within its course. As the storm crossed the line into Cloud County, 7 miles northeast of Grover, it dipped down and destroyed a small house which was occupied by a lone woman, who was carried out of the building a considerable distance and found insensible. Mr. B. Tracy, who lives about half way between this point and the track of the Delphos storm, stated that he saw both funnels distinctly as they passed by, high above the earth, and at least 10 miles apart. The one east of him was a few miles ahead and somewhat smaller. Mr. Jos. Courtney, whose buildings were destroyed in the Delphos tornado, had his attention from the very first drawn to the one passing along Pipe Creek, which he had been watching with considerable interest and freedom from apprehension, because of its distance and height. While taking to himself a large share of satisfaction on account of his lucky escape, a sudden darkness fell upon him, and to his utter dismay he found himself within the jaws of a huge monster like the one which was moving at a safe distance to the east. He had heard heavy roaring on all sides of him, but had not for a moment ascribed its source to any other cause than the cloud passing away from him to the eastward. About two miles northeast of this point part of a "dugout," consisting of the roof and one side, was carried away in a northeasterly direction. The width of the storm track was very narrow at all places of destruction, averaging about 60 feet.

Ten miles northeast of the Cloud County line, a stone school-house standing alone upon the prairie had the west side of the roof and the north gable end carried away and the *débris* scattered to the southeast and east. This was the last evidence of the storm's fury, and persons in the vicinity who could remember its passage stated that it did not again descend to the earth, but rapidly drew itself up into the clouds, entirely disappearing a few miles further to the northeast. The destruction caused by this storm was comparatively small, but it still possessed similar attributes of power to those of its companions, rendered notorious by their unparalled fierceness and length of path. Throughout its entire course of sixteen miles it met little else but high, rolling prairie, and, of course, left but slight evidences of its path. Setting the time of its appearance over Grover at 4 p. m. and the time of its disappearance at about 4.30 p. m., as roughly estimated by people in the vicinity, we have a velocity of progression of the storm cloud of 32 miles per hour. It no doubt moved more rapidly than its companion, being most of the time above the earth, still it is a very uncertain calculation upon which to base any comparisons of relative velocity. Of course it was next to impossible to obtain exact time, or even an approach to it, in this sparsely settled country. Very few of the residents had any clocks; those who had did not note the time, and those who had not depended upon the varying height of the sun.

THE DELPHOS TORNADO.

On the afternoon of May 30th, at about 3 p. m., there was noticed to the south of Churchill, in Pleasant Valley Township, Saline County, Kansas, the first manifestations of what proved to be a very severe tornado. From the house of Mr. F. S. Trew, near the south line of Ottawa County, could be witnessed angry clouds gathering in the SW. and NW. and rapidly approaching each other, from which soon after a funnel-shaped column of cloud was seen to descend. For about two weeks previous to the storm strong and continued southerly winds had prevailed with hardly a momentary change in the direction. No rain had fallen for several weeks, the ground was baked hard in the open fields, and vegetation suffered severely in consequence. During the 30th the weather had been extremely hot and oppressive, with a southerly wind, and the sky partially cloudy, but nothing of a threatening nature appeared along the horizon until about 2 p. m., when clouds came up rapidly in the west and south, followed in 15 or 20 minutes by a copious fall of rain and hail (wind SE.), the latter very large and scattering. This precipitation cooled the heated air very perceptibly, and by the time it had ceased the funnel before mentioned was seen dangling from the southwest cloud, which was in frightful commotion several miles to the west. Other eye-witnesses saw two or three smaller funnels, like whip-cords, darting downward in close proximity to the larger one, but finally to all appearance absorbed by it, leaving nothing but the main funnel cloud. The tornado advanced a distance of about 8 miles, at a considerable height above the ground, until it reached the timber along Saline River, in section 18, Culver Township No. 12, Ottawa County, range 5 W., where it reached only the tops of the trees, destroying the foliage and limbs, but did not descend to the river bottom. Mr. Trew's house was not injured, as the funnel was at too great a height in the air, and for a distance of four miles to the northeast several other buildings were left untouched, although situated alternately upon high and low ground. The funnel had now nearly reached the high divide between Saline River and Salt Creek, which trends from WNW. to ESE., and averages about 200 feet above the general level. In passing up the southern slope the house of Mr. J. K. Disney was first unroofed and then swept clean from its foundation, the *débris* being carried along the track to the summit of the divide, where it was thrown about in every direction during a momentary halt in the progressive movement of the cloud. It was reported by a neighbor of Mr. Disney's that during the storm which preceded the tornado three hail stones were picked up which weighed together 6½ pounds, one of which, very jagged and irregular, turned the scales within a fraction of three pounds. As the tornado descended the northern slope, it next encountered the house of Mr. Henry Kinsey, on the west side of the storm's center, injuring it but slightly, but entirely demolishing his granary, not 60 feet to the east, scattering the grain and timber to the southeast. On the farm of Mr. Peter Bock, in the adjoining township of Fountain, about four miles west of the storm's center, and during the prevalence of the severe hail storm that preceded the tornado, masses of ice fell as large as a man's head, breaking in pieces as they struck the earth. One measured 13 inches in circumference, another 15, and a hole made by one that fell near the place of Mr. J. H. Kams measured 7 inches across one way and 8 the other. This immense fragment of aerial ice broke into small pieces, so that its exact size could not be determined. Strange as it may seem, no appreciable harm was done to the standing crops, excepting the harvesting of a considerable quantity of peaches. The storm cloud, now at a point 8 miles west of Minneapolis, entered Salt Creek Valley, pursuing nearly a direct northeast course, and after rising from the ground beyond Mr Kinsey's it simply overturned the house of Mr. T. C. Deardoff, 1½ miles distant, injuring some of the family. I will now introduce a short report of the storm, as kindly furnished me by Mr. C. C. Olney, land agent at Minneapolis, a very intelligent gentleman, and one who took considerable interest in matters connected with the storm. He traveled over, quite carefully, that portion of the track between Minneapolis and Delphos:

"My observations of the tornado passing through a part of Ottawa County, Kansas, on May 30th, 1879, were as follows: About 2 p. m. a light shower with some hail, coming from the southeast, lasted about ten minutes. Afterwards it was cloudy, wind from several different directions, but light, continuing for an hour, followed by a second shower very much like the first. Some few hail stones were picked up 2¼ inches in diameter. I was standing on an eminence at the outskirts of the town, overlooking more than half the county. The rain cloud which preceded the tornado, after passing, seemed to meet a second cloud coming from the northwest. The clouds were

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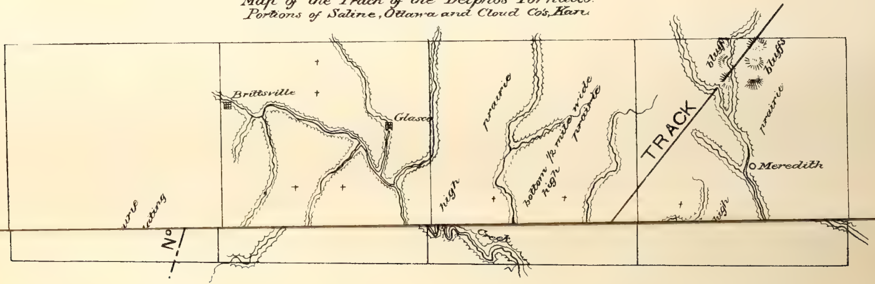
Portions of Saline, Ottawa and Cloud Co's, Kan.



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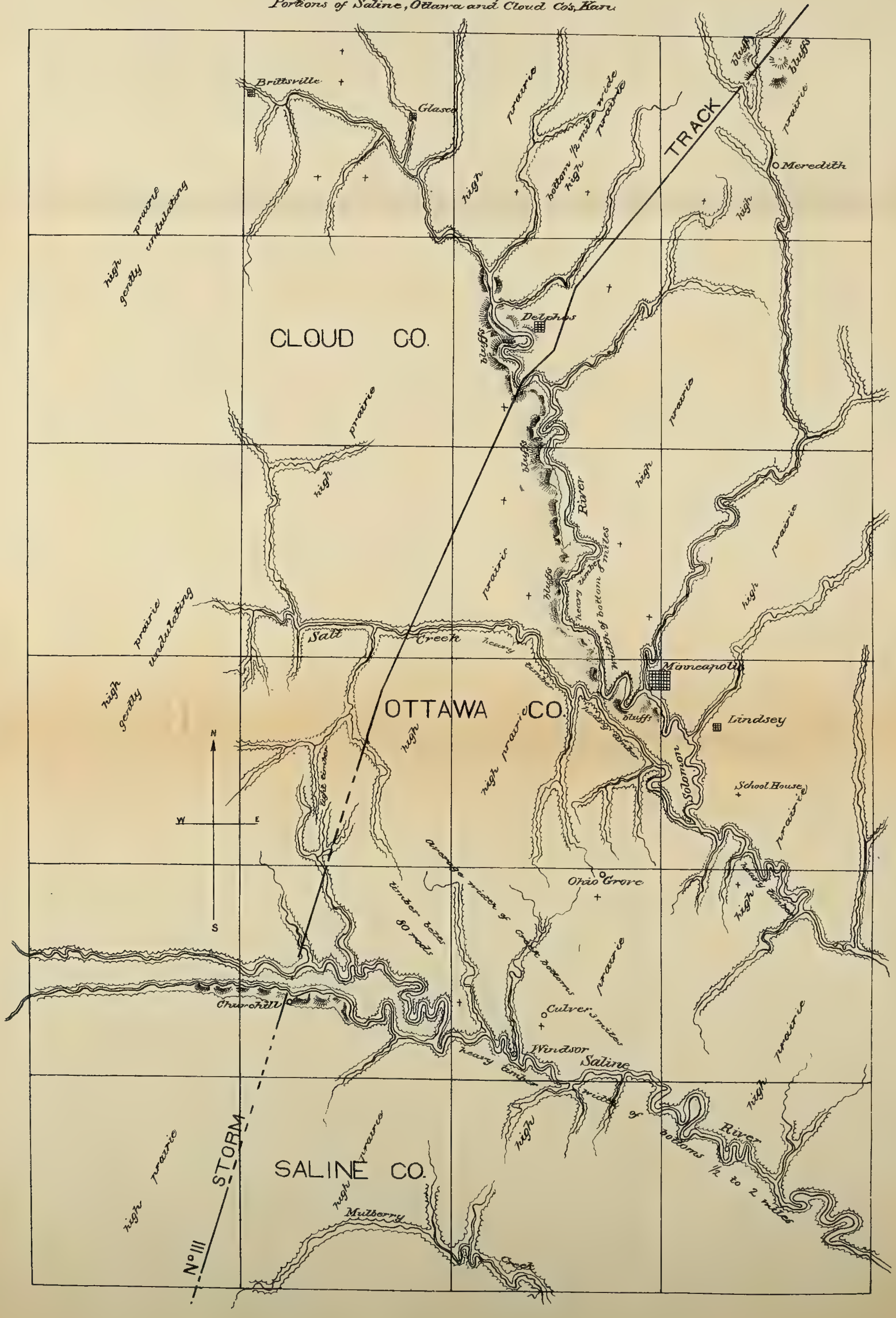


quite black and rolling about in a fearful manner. The first appearance of anything in the shape of a funnel was a whirling cloud about the diameter of the full moon, which rapidly stretched downward towards the earth, but in a few minutes was broken up and disappeared at a point of about 12 miles WSW. of the town. About ten minutes thereafter, a portion of cloud a trifle south of west, began to descend from the main body, shaped like a tea-cup, and apparently about four times the diameter of the full moon. This passed in a northerly direction, growing larger and getting lower, until at a point directly northwest of here, between 5 and 6 miles, it struck the earth. From this point to where it left our county was about 10 miles, the storm passing very nearly in a right line, going east 2 miles and north 10. The circular motion of the cloud was reverse to that of the hands of a watch, and the diameter of the cone at the earth about three-quarters of a mile, and its height apparently between three and four diameters of its base. The rotary motion of the outside of the cone, near the earth, was such as to make a complete revolution in from half to three-fourths of a minute. Its direct motion was about 20 miles per hour. It crossed the Solomon River, cutting a swathe through the timber from half to three-fourths of a mile wide, stripping all of the trees of foliage and limbs. Large trees from 2 to 3 feet in diameter were twisted off; oak trees from 6 to 12 inches through were twisted around till their trunks for several feet looked like ropes of wood. Very little water fell during the storm, only enough to stick fast the dirt taken up by the wind. I examined the banks of the river closely for any sign of the water having been taken out of it, but could not find any. The grass was dirtied by dust and the sprinkling of rain, but not plastered down as by any large amount of water, nor was there any evidence of a large amount of water having fallen for 5 miles northeast of the point where the storm cloud left the river, that being as far as I followed the storm track."

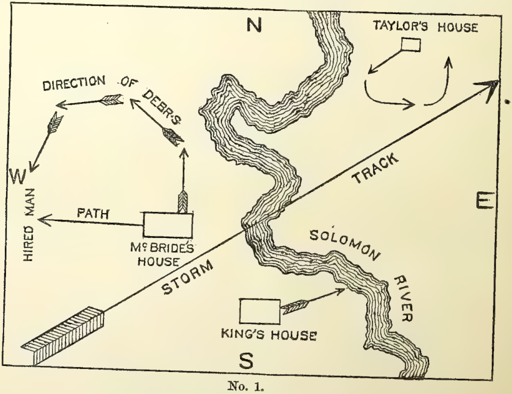
Mr. William Goddard, editor and proprietor of the Minneapolis Independent, kindly furnished me with the following description of the storm:

"About 3.30 p. m. of Friday, the 30th of May, a thin film of clouds gathered like a dark sheet just above the horizon, in a southwesterly direction from this city, spreading itself and making very little progress in its struggle to mount higher and higher into the heavens against a strong easterly wind, which had kept up a steady and interminable sweep athwart the heavens, carrying dense masses of clouds, which occasionally spattered the earth with rain and hail, laying the dust and cooling the atmosphere. The storm cloud in the southwest seemed to gather in density, and occasional sharp strokes of thunder rolled ominously through the air, without raising any suspicion of the terrible danger that lay slumbering in those elements and the sad scenes that would follow the wake of that seething mass of clouds of rain and hail, which was so soon to lay its destructive hand on the unsuspicious watchers of its progress. For some time the cloud seemed to be mounting the heavens and coming directly over the city, with no apparent danger in its folds other than deluging the earth with rain and hail. At this juncture the storm had gained a large audience of citizens, and on the southern edge was noticed an unusual commotion in the clouds. They seemed to stir around and intermingle in a state of ebullition, as if one of the opposing currents of air, which met each other obliquely, was about to gain a passage into and beyond the mass of storm clouds, with their strong backing from the southwest. In and among, round and round, went the clouds, until plainly could be seen the rotary structure, and all doubt was dispelled as to the nature of the storm. A tornado was forming, and to all appearances was making straight for the city. Its distance from the town seemed to be about 7 or 8 miles, when, in fact, it was double that distance. For a time it moved on, coming straight across the divide, between the Saline and Solomon Rivers. The funnel-shaped cloud looked like an elephant's trunk, as it depended from a dark and irregular mass of clouds above. Its body was very dark and dense, and appeared to be about 20 feet in diameter at a distance of 10 miles. The weather previous to the storm had been oppressively hot and very enervating; everything was drying up in the fields and gardens under the influence of a sultry southerly wind."

After the tornado crossed Salt Creek it descended near Mr. Rathgiber's, in the southeast corner of the northwest quarter of section 21, township 10 N., range 4 W., Ottawa County. House stood east of the storm's center half a mile. The roof was blown off, carried 50 rods to the northeast, and torn to pieces. His granary, 50 feet south of the house, was likewise unroofed. For a distance of 2½ miles the storm cloud passed over the open prairie, where but little or no material existed that might leave evidence of its course, until the house of Mrs. Sophronia Clark was reached, located in the center of the storm's path and in the northeast corner of the northeast quarter of section 9, three-fourths of a mile southwest of the Solomon River. The building, 16 by 28 feet, and 1½ stories high, was lifted bodily from its foundation and carried a distance of 90 feet to the northeast, where it fell in a shapeless mass of ruins, which were scattered towards every point of the compass. The granary, only a short distance west of the storm's center, was simply unroofed. The tornado had now reached the wide bottoms of Solomon River, stretching out a distance of 3½ miles to the east and 1½ miles to the west, where on either side they gradually ascended 250 feet to the high, rolling prairie beyond. Mr. James Potter's stone house, 120 rods north of Mrs. Clark's and 40 rods west of the storm's center, was unroofed, the walls falling in upon the floor. The roof was torn in pieces and portions carried to the west and southwest. The family escaped with slight injuries by going to the basement.

The place of Mr. Samuel McBride, 4 miles due south of Delphos and 150 yards south of the river, which at this point bends to the west, but whose general course is from northwest to southeast, was next reached. The house, standing about 60 feet north of the storm's center, size 20 by 30 feet, and 1½ stories high, was moved from its foundation first 10 feet to the north and then 12 feet to the northwest, when it was torn in pieces and the *debris* scattered from 60 to 80 yards to the NW., W., and SW. Mr. McBride, who was in the cellar at the time, escaped injury; but Mr. Frank Zeck, a hired man who was within the house, was carried out (when it went to pieces) 100 yards to west, dislocating his hip and arm. Mrs. McBride's father was badly crushed about the head and shoulders by falling timbers, dying from his injuries shortly after the storm. After the cloud had passed, an attempt was made to draw water from the well, but it was found to be impossible, although there was a depth of several feet before the storm. The well-curb was blown away and it was thought that the violent suction of the whirling clouds had drawn the well dry.

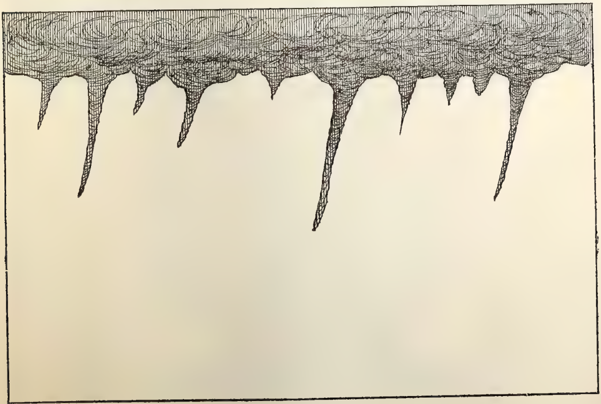
Another freak of the storm was manifested in the destruction of a strong iron-bound trunk, containing some $4,000 in greenbacks. The money was tied up in $500 packages, containing smaller packages of $100 each, which crossed each other at right angles, and the whole was firmly bound together by strong cords; then all the large packages were tightly bound together and placed in a bag, which was securely tied, deposited in the trunk and locked therein. After the storm all but $500 was picked up in separate bills, scattered here and there throughout the rubbish. This story was confirmed by Mr. Olney, of Minneapolis, who, previous to the storm, had visited Mr. McBride to receive purchase-money for land, and noticed the trunk and the peculiar manner in which the money was secured. (Diagram No. 1.)



No. 1.

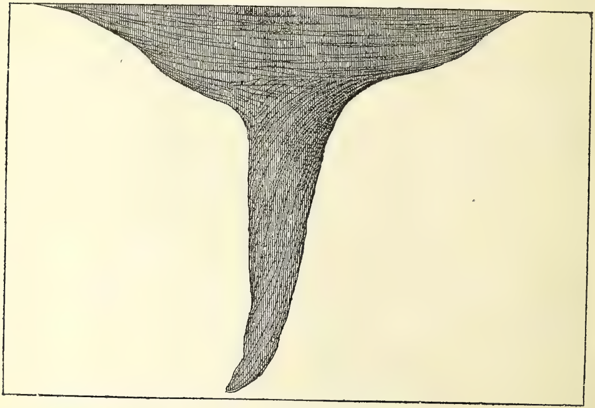
The house of Mr. J. W. King, southeast of Mr. McBride's, and on the same side of the river, but south of the storm's center, was lifted bodily from its foundation, carried 300 feet to the ENE., and deposited within 50 feet of the edge of the river. It was not torn to pieces but badly racked. In crossing the river, which runs from northwest to southeast, but very irregularly, the storm cloud spread out to a width of 1¼ miles. Here in the timber, as usual, it manifested the most terrific power, breaking off cottonwood trees 3 feet in diameter close to the ground and twisting others of smaller diameter into ropes. Many of the trees were entirely stripped of their limbs, leaving bare trunks for a height of from 50 to 60 feet. The timber had been so dense and high that from a point one mile east of the river the high hills to the westward could not be seen, while now the low lands along the river bottom, and even the very edges of the opposite banks, were plainly visible. Every little bend in the river was equally shorn of its covering and brought into view, and the bed of the stream was choked up with the shattered trunks of trees, broken limbs, large logs, and timber from the adjoining houses, over and through which the water bubbled and boiled in eddying whirls. It was reported by some and denied by others that the water was sucked out of the river as the funnel passed over. The small log house of Mr. James McBride was the first building demolished on the eastern side of the river; it was unoccupied at the time. On the south side of the track, only a short distance to the northeast, the house of Harry Gable was unroofed and the *débris* carried to the east. His horse was killed by flying timbers, and a wagon torn into pieces.

On the north side of the track, and three-fourths of a mile northeast of Mr. McBride's, stood the new story-and-a-half house of Mr. C. S. Taylor, which was lifted from its foundation and carried 25 rods to the southwest, then torn to pieces and the *débris* scattered to the east and north. A large portion was carried into the peach orchard, directly south of the house about 15 rods. The family escaped by going to the cellar, with the exception of Mr. Taylor, who ran out of the house to the west and grasped tightly about a small sapling, around which he was whipped, receiving several injuries. One mile east of the river and three miles southeast of Delphos stood the house of Mr. J. D. McLaren, upon a slight rise of ground, surrounded by an osage hedge and a grove of young cottonwoods. As the funnel sped onward to the northeast it left the house half a mile to the eastward unharmed, although the wind blew exceedingly strong from the southwest and the building was enveloped in darkness and constantly peppered with flying *débris*. Mr. McLaren was so situated that the storm could be watched almost from its inception, and from him I obtained a very interesting account of its formation and progress. On Friday morning the weather was very pleasant, but warm, with the wind from the southeast, from which direction it had blown for several days. The ground was very dry, and no rain had fallen for a number of weeks. About 2 p. m. threatening clouds appeared very suddenly in the west, attended in a few minutes by light rain, wind still in the southeast. It stopped in about five minutes and then commenced again (wind the same) accompanied by hail, which was thick and small at first but rapidly grew less in quantity and larger in size, some stones measuring 3½ inches in diameter, and one was found weighing one-fourth of a pound. This last precipitation continued for about 30 minutes, after which a cloud in the shape of a waterspout was seen forming in the southwest and moving rapidly forward to the northeast. The cloud from which the funnel depended, seen at the distance of 8 miles, appeared to be in terrible commotion; in fact, while the hail was falling, a sort of tumbling in the clouds was noticed as they came up from the northwest and southwest, and about where they appeared to meet was the point from which the funnel was seen to descend. There was but one funnel at first, which was soon accompanied by several smaller ones, dangling down from the overhanging clouds like whip-lashes, and for some ten minutes they were appearing and disappearing like fairies at play (Diagram No. 2). Finally, one of them seemed to expand and extend downward



No. 2.

more steadily than the others, resulting at length in what appeared to be their complete absorption. This funnel-shaped cloud now moved onward, growing in power and size, whirling rapidly from right to left, rising and descending, and swaying from side to side (Diagram No. 3). When within a distance of three or four miles, its terrible roar could be heard, striking terror into the hearts of the bravest. About this time Mr. McLaren judged that the cloud from which the funnel depended would cover about 45° of the heavens, and that the funnel itself would reach a height of about 500 feet (Diagram No. 4). As the storm cloud crossed the river, a cone-shaped mass came up from the earth to meet it, carrying mud, *débris*, and a large volume of water (Dia-



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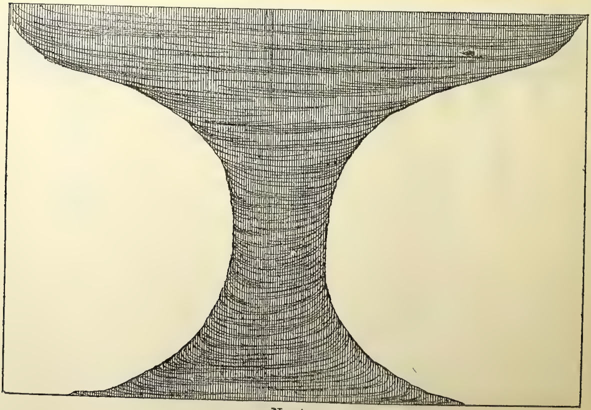
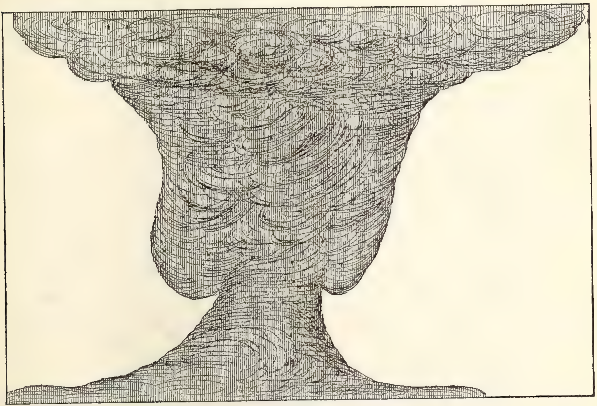


No. 4.

gram No. 5). The cloud passed Mr. McLaren's house at very near to 4 p. m., and he is positive that it could not have been five minutes either way from that hour. The progressive velocity at the time of passing was considered to be about 30 miles per hour, although at Delphos, 3½ miles distant, it had slackened down to near 20 miles. A few minutes previous to and during the passage of the funnel, the air was very oppressive, but ten minutes after, the wind was so cold from the northwest that it became necessary to wear an overcoat when outside (Diagram No. 6).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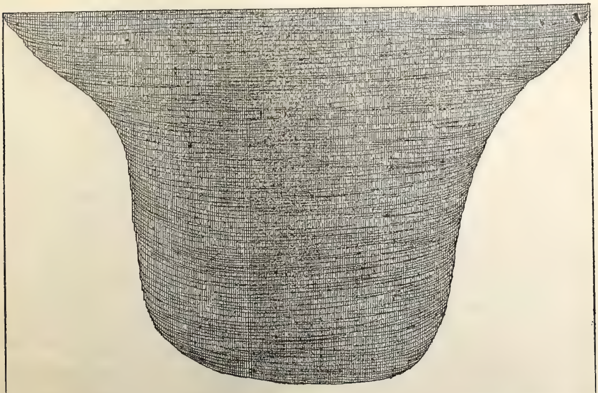
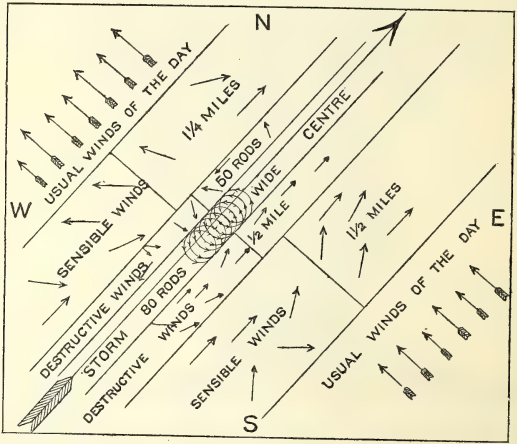

No. 6.

In the accompanying diagram I have arranged lines showing the comparative force of the winds within the storm's path at different distances east and west of the center of disturbance. The data was secured from parties living on opposite sides of the storm-track in the neighborhood of Mr. McLaren's, and prepared with his assistance (Diagram No. 7). The following description of the tornado is from the pen of a young son of Mr. McLaren, which presents some interesting facts in a pleasant but graphic manner:

"It rains so gently this afternoon that the weather is really enjoyable. Plants grow and flowers bloom as they never do when it is dry. The Solomon Valley seems almost a second garden of Eden. A short time before the clock strikes three some hail begins to fall, which rapidly increase in size. We gather some of the largest and find that it takes six of them to weigh a pound. But notice that hail cloud south of the river! What wonderful contortions, evolutions and twistings. The hail that is falling from it is plainly visible from here, although it is 4 miles to the southwest. A few strips of cloud like whip-lashes hang from it. The cloud now revolves rapidly from right to left. We gaze at the magnificent scene with awe and wonder. The center becomes lower and lower until it resembles a funnel. The truth now bursts upon us. *It is a tornado.* We hear its awful roar like an earthquake or distant thunder. The funnel rapidly descends till it reaches the earth. It moves rapidly northward. It rises, a dark cone ascends from the ground to meet it, and it descends. It strikes the river. All the water is drawn from the channel, perceptibly widening the cone. From the first the tornado has had the appearance of a waterspout at sea. We think it is coming near us. We can now see its fury. It is not far away. Shall we leave the house? No; for we are not certain on which side it will pass. We are apparently as safe here as elsewhere. We can only trust in Providence. The windows are nailed fast. Three of us lean against the door which is nearest the storm. The rest go into the cellar. It is about 4 p. m. A moment of breathless suspense and the storm strikes us. The timbers creak, the sides of the house sway in and out. Surely they cannot outlast it. We hear no well defined roar now, for on the outside boards and other *débris* are fiercely clashing. All is dark within. In about 15 minutes the storm is over. We leave the house. The center of the storm has passed to the west of us and we can see its dark form moving away in a northeast direction."

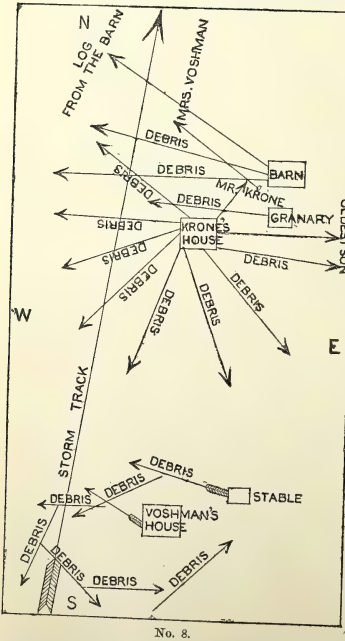


No. 7.

Returning again to the track of the storm, the next house visited after passing Mr. McLaren's was that of Mr. Henry Voshman, standing 20 rods east of the storm's center. It was entirely demolished, as well as the stable northeast of it, hardly leaving a trace of the foundation. Almost the entire wreck was carried in towards the center of the track to the northwest and then scattered in every direction. A large two-horse sulky plow, weighing about 700 pounds, was carried a distance of 35 rods, breaking off one of the iron wheels attached to an iron axle 1¾ inches in diameter. Two stoves were found broken into small pieces, not any of them larger than 6 or 8 inches square. Wagon-hubs without a single spoke in them, wagon-tires curled into fantastic shapes, pieces of clothing and bedding wound about sticks and timbers or scattered over the prairie were the only signs of the once thrifty home. The tornado at this point turned almost due north, bearing but little east throughout the remainder of its course, which lay along the wide valley of the Solomon to the east of the river. Where this change was made in its course there was present no peculiar feature in the topography. Mr. Voshman's house stood out upon the level bottom of the prairie nearly 5 miles from the surrounding bluffs, which rise gradually to a height of 250 feet, exemplifying, as many other instances have, that the course of the funnel was determined almost altogether by some force above the earth, in all probability the opposing currents which formed it. One quarter of a mile north of Mr. Voshman's stood the house of his father-in-law, Mr. Gehart Krone, about 80 feet east of the storm's center. Mr. Krone saw the cloud, which to him looked like a waterspout at sea, coming from the SSW., at a distance of 2 miles. It was a dark, heavy, black mass of smoke and flying *débris*, with well defined outlines, and to all appearances separated from all surrounding clouds. He could easily distinguish that the tornado's rotary velocity was much greater than its progressive, and that the direction of the motion was against the sun. The funnel was also rising and falling continually, contracting in size with the former motion, but expanding with the latter. He waited until the cloud reached within half a mile of the house, and then, calling together his family, with several friends and strangers, numbering in all 20 (the latter having sought shelter from the impending danger), he bade them start out from the house, which was sure to be destroyed, and find safety elsewhere.

Mr. Krone had hardly gone 30 rods to the northeast when the house was struck on the east side and carried directly into the storm's center to the west. Most of the *debris* was scattered to the west and northwest, but portions were found to the SW., SE., and E. Mr. Krone was thrown to the ground, afterwards lifted several times and rolled about, his head and body being badly bruised by the flying *debris*. While he was bumped about he felt a suffocating heat, which he likened very much to that experienced while working over an iron smelting furnace. This sensation was shortly followed by a comparative calm in the atmosphere, lasting a few moments, when a cold wind came from the northwest that made his teeth chatter. That night frost occurred along the valley, which was seen by several persons early the following morning. Mrs. Voshman, Mr. Krone's daughter, who stood near her father after they left the house, was carried to the northwest 200 yards, lodged against a barbed-wire fence, and instantly killed; her clothing was entirely stripped from her body, which was found covered with black mud, and her hair matted with it. The posts along the entire fence, a distance of 25 rods, were covered, on the south side only, with mud, straw, chaff, and bits of rags to a depth of nearly three inches, and near the bottom of the posts it was one foot thick. It was plastered on as if thrown with the greatest velocity, requiring a sharp instrument and considerable physical exertion to remove it. Five of the posts were pulled out of the ground, into which they had been sunk to a depth of 28 inches. The wire was entirely stripped off and wound up into a ball, which was about the result with every wire fence along the storm's path. The oldest son of Mr. Krone was carried 30 rods to the east into a wheat field, his clothing torn into shreds, and his body covered with black mud. Mrs. Anna Vosh, another daughter of Mr. Krone, had a piece of board driven nearly through the fleshy portion of her thigh, cutting a gash about 7 inches wide; the board was pulled out during the storm, probably by the violence of the wind. The ghastly wound, upon being examined by the attending physician, was found to contain pieces of nails, straw, mud, and splinters of wood. The other members of the family were carried to the north and northwest short distances, all receiving more or less injury. The women suffered the most, as in every instance they were entirely divested of their garments, and left perfectly at the mercy of the flying *débris* that filled the air. The hair of all the persons was so matted with mud that their heads had to be shaved in order to clean them, or, as one gentleman remarked who witnessed the scene, "it seemed as if the mud belonged there naturally, and that the hair was but a mere usurper." Their eyes and ears were also filed with mud, so that they could neither see nor hear. All of the wounds received were torn and jagged, and found mostly upon the back of the body and running upward. Two men, by the names of T. W. Carter and Jacob Garber, who stopped to seek shelter, were seriously injured. The latter, who crawled into the granary standing northeast of the house, received injuries from which he died, being rolled and blown about the ground until his clothing was filled with mud and his body badly mangled. The former took refuge in a straw stack north of the house, which was turned over upon him by the wind, and then scattered in every direction, leaving him to the complete mercy of the storm, which lifted him, how high he did not know, but while above the ground he came in contact with the tail or mane of a horse, which he grasped, but was finally separated from, coming down to the earth with hat in one hand and hair in the other. This statement was made to me by a reliable gentleman who received the same from the lips of the unfortunate æronaut. Mr. Krone, while upon the ground, saw what he positively asserted was a light two-horse wagon with one horse attached, go up together, but could not say how high. Upon further examination this proved to be a portion of the property belonging to Mr. Kine, of Beloit, who had driven up before the storm and hitched at the granary. One of the horses had jerked away from the wagon in some manner, and the other with the wagon was left standing until taken up as before described. Hardly a vestige of the wagon or harness could be found, and one of the animals was killed.

Mr. Krone's granary stood three rods ENE. of the house, and was filled with several hundred bushels of corn. Only the roof and a portion of the west end with some of the grain were carried away. The large barn, 40 feet square with 16 foot posts, standing 20 feet north of the granary, and 65 feet northeast of the house, was completely demolished, and every timber carried away from the foundation. The *débris* was scattered to the west and northwest. Six horses were killed, two outright and the others so seriously injured by flying *débris* driven against and into their bodies that they had to be shot. One was badly mangled about the body, and had nearly all its bones broken, having fallen from a considerable height, making a large depression in the tough sod of the prairie. Eighteen fat hogs, weighing from 300 to 500 pounds each, were killed outright, and six others died afterwards from their injuries. One weighing 300 pounds had a scantling 7 feet long and 6 inches square driven lengthwise through its body; another had a fence board driven through it in the same manner, and still another had a sharp-pointed post driven through the body from side to side; one was carried 300 yards to the northwest on the prairie. Two new lumber wagons were carried, one 35 and the other 40 rods to the northwest, and broken into pieces; one of the wheels, nearly whole, was found a distance of one mile northwest of the barn; the other wheels were broken from the axles, divested of their spokes, and the large heavy iron tires were bent into every shape. A log from the barn, 12 feet long and 10 inches in diameter, was carried 320 yards to the NNW. The front iron axle of a top buggy (1½ inches in diameter) was found bent double, the two ends crossing each other and both wheels were torn off even to the hubs. The hind axle, with portions of the wheels attached, was not bent as much, but carried to the northwest nearly one-quarter of a mile. A sill from the house, 8 by 10 inches and 16 feet long, was carried 12 rods to the northwest. A cat was found half a mile northwest of the house (in which she was seen just before the storm) with every bone broken, and crushed as flat as if passed through a cider press. Chickens were stripped of their feathers and carried long distances, one being found 3 miles to the northeast upon the prairie. The iron mole board of a heavy wooden beam plow was found driven into the ground so firmly that it had to be dug out; the plow was no doubt first lifted and then thrown end foremost into the earth, and afterwards broken off. Osage hedges along the track north of the house were filled with *débris* as follows: Those running north and south on both sides, the east side with the forward part of the whirl, and the west side with the backward movement to the S. and SE.; those running east and west, were filled on the east side of the storm's center from the S. and on the west side from the N. The well bucket and rope were pulled out of the well and carried half a mile to the northwest, but the water was not disturbed. South of the house a few rods, the



No. 8.

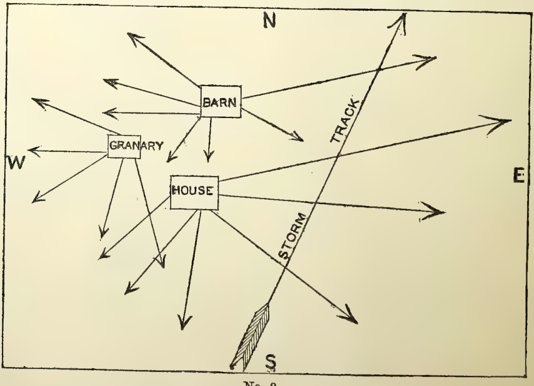
funnel cloud swept over a wheat field of about 6 acres, taking off the heads of wheat as cleanly as if done by hand. Heavy cast-iron wheels, broken from a large harvester, and weighing about 200 pounds each, were carried half a mile. (Diagram 8). Mr. McLaren, who came over to Mr. Krone's about ten minutes after the storm passed, stated that the scene presented baffled description. It was yet very dark. A cold wind was blowing from the northwest necessitating an overcoat. The ground was soaked with water and the surface covered with thick heavy black mud. As the terrible scene of desolation was approached the cries of the wounded people and the moans of the tortured animals were plainly heard, which, mingled with the distant roar of the storm, filled one with an indescribable fear and dread of the awful monster that was still in sight, and was a fearful reminder of its terrific force. Upon arriving at the ruins of the once happy home a dreadful sight was presented. Human beings could not be distinguished from animals as all alike were covered with mud and mingled with an interminable mass of *débris* in the most sickening manner. Women and children stripped of their clothing were found lying by the side of horses and hogs. Now an arm or a leg would be raised up from the filthy mass surrounding them, attended with a piercing shriek for help, and upon examination ugly gaping wounds were found filled with mud, straw, and bits of wood. This was the worst destruction in the whole course of the storm and was confined to a path about 80 rods wide.

The next place visited was the house of Mrs. A. Eames, half a mile to the north, and standing 160 feet west of the storm's center. The house, stables, and sheds were razed to the ground, and the *debris* carried to the west and southwest. One mile north of Mrs. Eames's the houses of Messrs. R. A. King, Silas McCalmut, and Robert Whitley, were reached by the storm about the same time, as they all stood on the same east and west section line and within short distances of each other. The funnel now bore more to the east in its course along the valley, and passed between the houses of Messrs. McCalmut and Whitley, the center being 120 rods west of the latter and 18 rods east of the former. Mr. King's house, which stood one-fourth of a mile west of the storm's center, was a new building, 18 by 20 feet, and one and a half stories high. It was completely demolished and the *débris* carried to WSW. and SE. The family escaped by going to the cellar. The residence of Mr. McCalmut was thrown in the same direction, but if possible, more badly wrecked, the timbers being fairly ground into splinters. Mr. McCalmut was killed by flying *débris* while trying to find a place of safety. The house of Mr. Whitley was destroyed and the *debris* carried to the north and west. For a distance of one and a fourth miles the tornado now passed over the open prairie, with nothing particularly to mark its course except now and then a small corn-field, which, if ever damaged, had entirely recovered its natural condition at the date of my visit.

The large frame house of Rev. Joy Bishop was next reached, standing 50 feet west of the storm's center. The entire structure was swept from its foundation and most of the *débris* carried to the SW. and S. In the orchard on the west side of the house the trees were thrown to the SW., SE. and E. The cellar was filled with stoves, plows, cultivators, and broken timbers, except the northeast corner, in which very fortunately the family, six in number, had secreted themselves. The *débris* was piled up about them like corded wood. Two hogs were found in the cellar quietly eating sweetmeats and drinking milk as if nothing had happened. They must have been carried there by the force of the wind, as it would have been quite an unprecedented feat for a hog to have jumped, voluntarily, into a deep cellar. Two horses, weighing each about 1,200 pounds, were carried away from the west side of the house, in a circle by the south to the northeast, one three-fourths of a mile and the other about half a mile. The former was carried across a creek running from northwest to southeast, and when first seen after the storm was walking about in a very irregular manner as if dizzy, but not otherwise affected by his journey. The other animal was not seriously injured, but no one noticed his actions during or following his transportation. Along the path in which the horses were taken, several places were observed where their feet plowed the ground to a depth of 5 or 6 inches. One of the neighbors stated that a sulky-plow, standing east of the house and weighing several hundred pounds was driven through the north side before the building went to pieces. It must have been carried in the whirl of the cloud from right to left, as the direction of the *débris* from the house would indicate. One-fourth of a mile west of Mr. Bishop's stood the house of Mr. Robert Rollings, from which only the roof was taken and carried to the east. Mr. Joseph Morris, half a mile west of Rollings's, or three-fourths of a mile from the storm's center, reported a strong westerly wind while the storm was passing, and a strong current from the south following the storm. Dr. Davis, 45 rods WNW. of Mr. Bishop's, had his house violently shaken but not destroyed. The shed and stable 100 feet east of the house were torn to pieces and the *débris* carried to SWS., and SE. One of his horses was carried from the earth to such a height that upon reaching the ground its legs were broken and ribs crushed in, resulting in death.

The tornado was now within 1¼ miles of Delphos, which stood to the west of the storm's center. Not the least damage was inflicted upon any portion of the town as will be seen from the following statements of some of the residents who witnessed the storm for a considerable time before and after it passed the town. Mr. George W. Stickler, postmaster at Delphos, stated that the tornado passed the town at a few minutes after 4 p. m. First saw the funnel-shaped cloud about 8 miles south of Delphos moving to the northeast. After crossing the river it bore more to the north, passing the town about 1 mile to the east. When the cloud was first observed it appeared to be moving forward at the rate of about 10 miles per hour, but the velocity of the whirl within the funnel was beyond all comparison or estimation. The clouds above the funnel were moving from all directions toward it, and when near its circumference would then rush downward and disappear within its center, apparently moving upward through it to the top. About ten minutes before the storm passed, there came a small shower of rain and hail with a gentle southerly current. The hailstones were at first quite plenty but small, rapidly increasing in size as they diminished in quantity. Some measured 15 inches in circumference, one side being flat and the other oval. Others were jagged and about the size of a man's fist. The hail and rain entirely ceased after the storm passed the town. While opposite the town, Mr. Stickler judged the funnel to be about 30 feet wide at the bottom, spreading out gradually up to a height of several hundred feet when it embraced a dark overhanging cloud, covering one-quarter of the heavens. No strong wind was felt before, during, or after the passage of the tornado. Mr. W. A. Kiser, of Delphos, was out in his fields sowing grain a short time after daylight. As the day came on, a brisk wind from the southeast set in, which continued until rain and hail occurred about 3 p. m. Most of the rain came with the small hail which fell first, but the rain-drops were very large and scattering when the hail became larger, and both seemed to fall straight down. No damage of any kind was committed in the town. Mr. B. F. Billingsley, of Delphos, kindly furnished me this very interesting letter, which I take pleasure in giving in full:

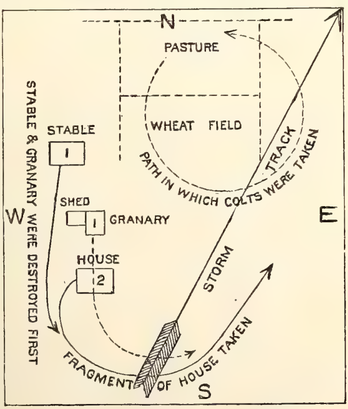
"On Friday morning, May 30th, 1879, the wind was blowing from the southeast, threatening rain. High temperature; sky overcast with clouds; steady wind all day until about 3 p. m., when it commenced raining, accompanied with hail which rapidly increased in size, several of which measured 12 to 15 inches in circumference and 1 to 2 inches in diameter. When the hail began to increase in size, the wind lulled and it was almost perfectly calm. The large stones seemed to drop almost perpendicularly. During this calm I noticed a commotion among the clouds in the southwest, on the south side of the Solomon River. The clouds would rush together, then separate, finally coming together again with the most dreadful contortions, evolutions, and twistings. Long points shaped like a cow's horn would reach toward the earth. The cloud now commenced a rapid revolving motion from right to left, the center reaching downward toward the earth in the shape of a funnel, and its awful roar could now be distinctly heard like distant thunder. The dark, inky, funnel-shaped cloud rapidly descended to the earth, which reaching, it destroyed everything within its grasp. Its whirling motion from right to left was inconceivably rapid, displaying irresistible power. Nothing could stand before it. Everything was taken up and carried round



No. 9.

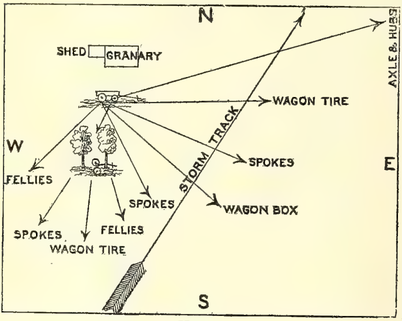
and round in the mighty whirl of the terrible monster. The surrounding clouds seemed to roll and tumble toward the vortex. The funnel now extending from the earth upward to a great height was black as ink, excepting the cloud near the top, which resembled smoke of a light color. Immediately after passing the town, there came a wave of hot air like the wind blowing from a burning building; it lasted but a short time. Following this peculiar feature, there came a stiff gale from the northwest, cold and bleak, so much so that during the night frost occurred and water in some low places was frozen."

After leaving Mr. Bishop's the storm bore still more to the northeast, and at the distance of one mile destroyed the house and outbuildings of Marshall Davis, standing 20 rods west of the storm's center. (Diagram No. 9.) The *débris* of the buildings was carried to the NW., W., SW., SE., and NE., and scattered over about 80 acres of ground. A sill from the house, 6 by 8 inches, and 10 feet long, was found 160 rods to the northeast. Several slabs, 10 inches wide and 4 inches thick, were found 150 rods in the same direction. The coupling pole of a lumber wagon with the iron castings upon it was found 230 rods to the north. Tin sheeting and boards were found along the track for a distance of 3½ to 4 miles. The top of a stove, weighing 50 pounds, was carried one-fourth of a mile to the east.



No. 10.

Mr. Joseph Courtney, 160 rods NNE. of Mr. Davis, and 30 rods west of the storm's center, was next visited. The house was completely torn to pieces and the *débris* carried in almost a complete circle from right to left, scattering it over about 100 acres. A stable, 18 by 20 feet, and 14 rods northwest of the house, together with a shed and granary, distant about 6 rods, were first destroyed, and the *débris* carried over the top of the house, which followed after, its fragments being carried in the manner above indicated. Three colts grazing in a pasture, inclosed by a hedge fence, situated 20 rods northeast of the house and a short distance west of the storm's center, were carried south into an adjoining wheat field, and then about in a circle to the E., NE., and NW., back into the pasture again. (Diagram No. 10.) Their path was clearly identified the next morning by holes plowed in the ground with their feet and the several openings in the hedge fence where they were driven through. In the wheat field there were indications that the animals had been rolled along over the ground, which was considered all the more probable from the fact that they were covered with mud from head to foot. A calf picketed west of the granary was dragged round and round at the full length of the rope, until it was strangled and badly mangled. A lumber wagon, which stood a few feet south of the granary, was broken in two, and the fore wheels with tongue and hounds were carried 4 rods to the south and wedged between two trees so tightly that the latter had to be cut down in order to secure their release. The hind part with the box was carried 30 rods to the southeast and torn to pieces; one of the wagon tires was found further to the south considerably twisted, and the other carried to the east. The axle and hubs, divested entirely of spokes, were found half a mile to the northeast. Not any two of the spokes or fellies were found lying together. (Diagram No. 11.) A large two-horse cultivator west of the granary, and weighing between 200 and 300 pounds, was torn to pieces, and the fragments carried in a circle to the north. Half a mile NNE. of Mr. Courtney's, and upon the open prairie, stood the house and stable of Mr. James Dinwiddie, 15 rods west of the storm's center. Both buildings were swept from their foundations, and the fragments carried to the west and south. Various farming implements, such as wagons, plows, and cultivators, were rendered competely unserviceable. The large stone house of Mr. J. A. Ostrander, 30 feet square and two stories high, situated three-fourths of a mile northeast of Mr. Dinwiddie's and 40 yards east of the storm's center, was unroofed, and the *débris* carried to the northeast, north, and northwest. The walls were badly torn down, destroying nearly the whole of the second story. A hired man standing in the west door of the house was carried 50 yards to the northwest and lodged in a small creek, considerably bruised. (Diagram No. 12.)



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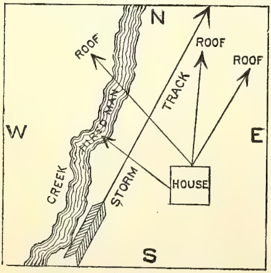

No. 12.

The storm now commenced the ascent of the bluffs forming the eastern boundary of the Solomon Valley, and, at the distance of one mile north of Mr. Ostrander's, unroofed the house of Milo Basnett, which stood one-quarter of a mile east of the storm's center. The *débris* was carried to the northeast and the body of the building severely wrenched, but not moved from its foundations. A young man standing within the house when the roof was taken off was whirled about and lifted from the floor several times. One-fourth of a mile to the north-northeast, and at the base of what might be called the line of most rapid ascent, stood the ("dug-out") house of Mr. J. H. Hane, the last building in the course of the storm. Just before reaching the house the funnel seemed to lift from the ground and pass directly over it, taking off the roof and badly wrecking a thrashing-machine which stood near. The *débris* was all carried up the bluffs in the course of the storm to the northeast. The funnel cloud now passed to the summit, where it threw down a stone monument made of large bowlders said to have been placed there by the Indians. A short distance further, and the cloud crossed the northern line of Ottawa County, a little west of its center, entering upon the high prairie over which it was seen to pass, a distance of four or five miles, greatly diminished in size and rapidly disappearing in the overhanging clouds. During a portion of this distance rubbish of all kinds was dropped to the ground over a width of from 60 to 80 yards. About 20 minutes before the tornado reached the bluffs a heavy storm of rain and hail passed to the north, cooling the atmosphere very perceptibly. The dark and heavy clouds accompanying this precipitation could still be seen in the distance, as the funnel lifted from the earth, and to all appearances eventually lost its identity therein. The entire length of the storm's track, embracing those portions at either end when the funnel was above the ground, was 42 miles, and the time occupied in passing over it one hour and twenty-five minutes, or about 30 miles per hour. This velocity is calculated upon the supposition that the funnel cloud was first seen at 3 p. m., passed Delphos at 4 p. m., and disappeared beyond the bluffs at 4.25 p. m. Mr. Ostrander considered the time as not far from 4.15 p. m. when the storm reached his house, 5 miles northeast of Delphos, which would make the velocity 20 miles per hour for that portion of the track. But all persons who watched the storm were unanimous in the assertion that it traveled much faster over the portion of the track south of Delphos. The general course of the storm was from SSW. to NNE.

THE WAKEFIELD TORNADO.

About 5 p. m. on the afternoon of May 30th, the inhabitants of Wakefield were startled by the appearance of a very strange and angry looking cloud in the southwest, shaped like the trunk of an elephant. The day had been warm and sultry, with a southerly wind. About 3 p. m. threatening clouds appeared in the west and southwest, attended soon afterwards by rain and hail. Although the clouds at first presented nothing unusual in their approach, it was soon discovered that those in the southwest were darting hither and thither, and tumbling about in a very novel and portentous manner. From [illegible] to 1/4 inch.

door of the house was carried 50 yards to the northwest and lodged in a small creek, considerably bruised. (Diagram No. 12.)

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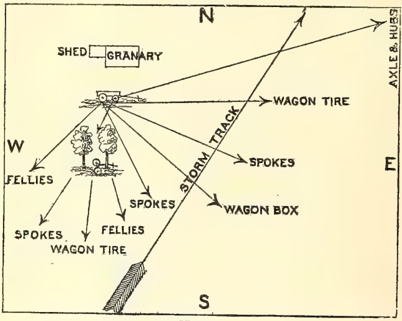

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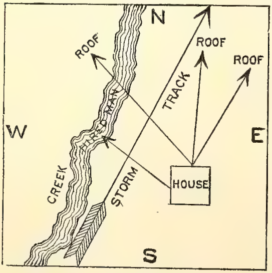


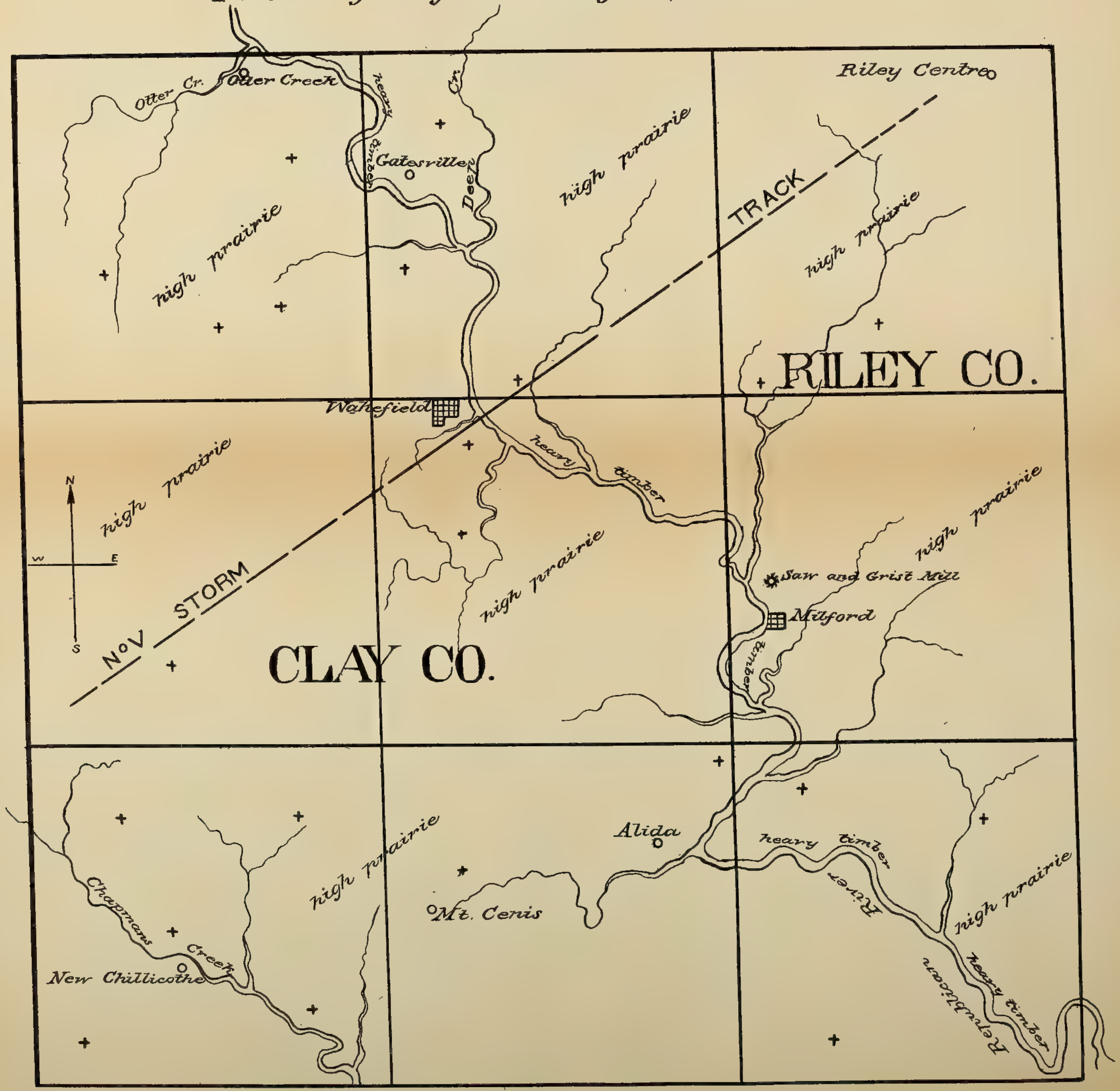
No. 12.

THE WAKEFIELD TORNADO.

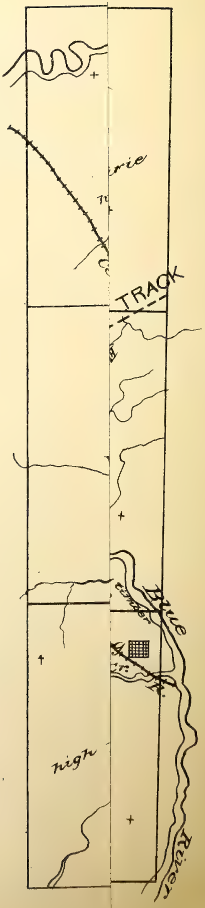
About 5 p. m. on the afternoon of May 30th, the inhabitants of Wakefield were startled by the appearance of a very strange and angry looking cloud in the southwest, shaped like the trunk of an elephant. The day had been warm and sultry, with a southerly wind. About 3 p. m. threatening clouds appeared in the west and southwest, attended soon afterwards by rain and hail. Although the clouds at first presented nothing unusual in their approach, it was soon discovered that those in the southwest were darting hither and thither, and tumbling about in a very novel and portentous manner. From

Exhibit A.

Map of the Track of the "Wakefield Tornado". Portions of Clay and Riley Co's, Kansas.



Average width of bottoms ¾ miles.
Timber belts, from 10 rods to ¼ mile.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TRACK
timber
Blue
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high
River

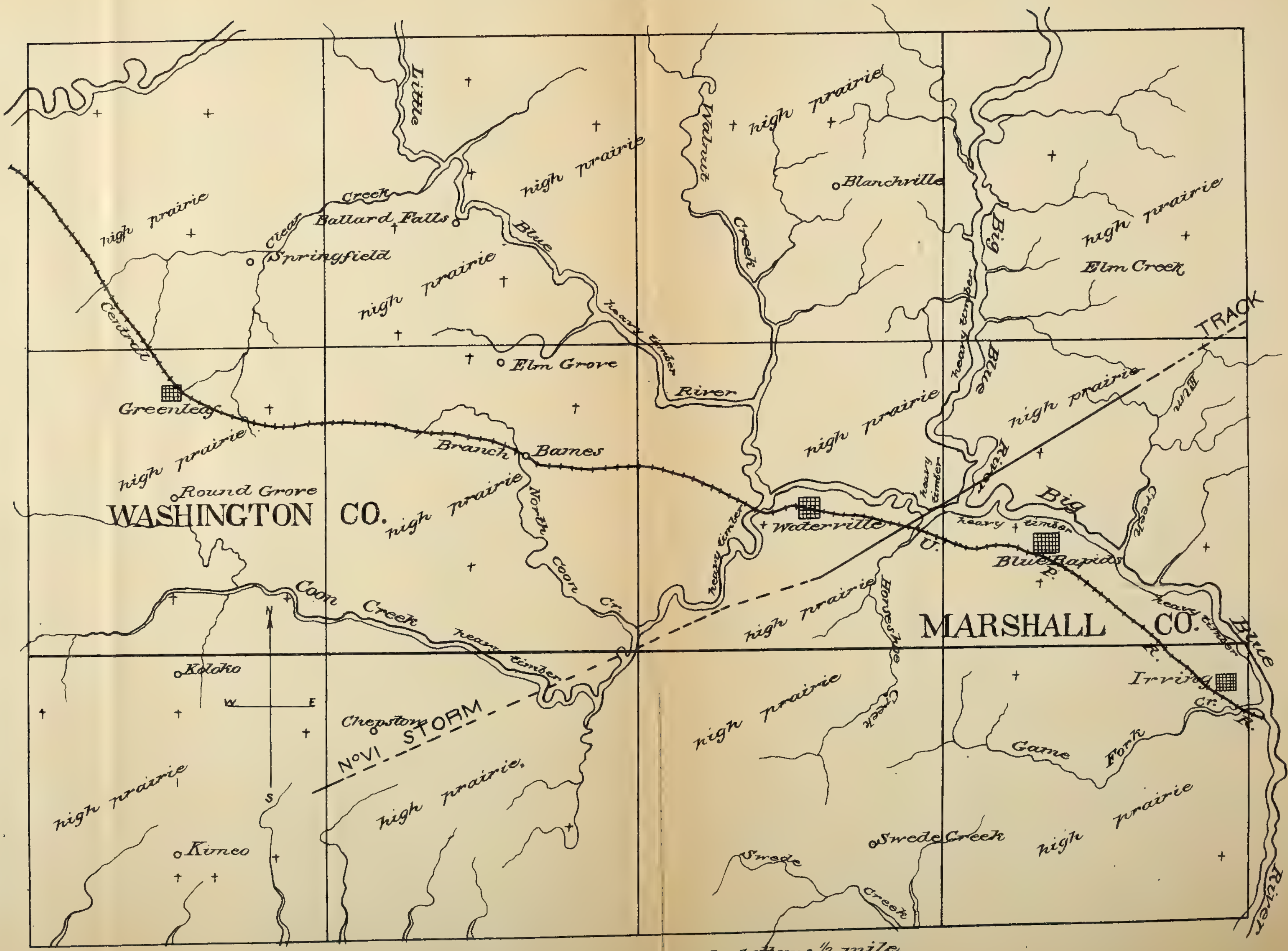
this seething mass of clouds the funnel was seen to dart downward, in the neighborhood of Chapman's Creek, about 8 miles southwest of Wakefield. The cloud remained above the earth while passing over the southwest and central portions of Republican Township, but finally descended to the high prairie about 1½ miles west-southwest of Wakefield, reaching soon after a small creek which runs eastward along the southern boundary of the town, and empties into the Republican River. Where the cloud first reached the surface no evidence was left of its track, as it was upon the open prairie, presenting no material for destruction, but upon reaching the southern edge of the town, several houses were blown down over a path averaging nearly 300 yards in width. The Sentinel, a paper published at Minneapolis, Ottawa County, Kansas, reported on June 13th, as follows: "At Wakefield considerable damage was done by a tornado. Eleven buildings were either injured or destroyed. Three persons were severely hurt, and a fourth fatally, the latter being Mr. Joseph Polly. The building in which he was living at the time of the storm was shattered to pieces." Ex-State Senator H. P. Dow, United States revenue collector, Manhattan, Kansas, stated that while traveling through Wakefield on June 12th he came upon the track of the tornado of May 30th, where he saw several buildings terribly shattered, while others were only unroofed or slightly injured. The latter seemed to be situated on the northern extremity of the storm's path, where to all appearances its fury was greatly diminished. The direction of the storm's course he considered to be from west-southwest to east-northeast, and its length about 13 miles. After crossing Republican River it entered Grant Township, Clay County, passing over the prairie 1½ miles to Timber Creek, where it destroyed the heavy timber with great violence. At this point in the storm's course very strong evidence existed of a powerful whirling motion of the clouds, as the trunks and limbs of the trees were twisted and broken in a frightful manner. After passing Timber Creek, where its path was about one-fourth of a mile wide, the cloud struck the high rolling prairie of Madison Township in the adjoining county of Riley. Here its path narrowed considerably, and after traveling a mile or more it rose from the surface and disappeared in the clouds. The Stockdale tornado, which occurred in the next township to the east, was not a continuation of this storm, because it formed about two hours later and at a point about 15 miles southeast of the terminus of the latter.

THE WATERVILLE TORNADO.

This storm was first seen to form over the various branches of Coon Creek, in the eastern portion of Lincoln Township, Washington County, Kansas, on the afternoon of May 30th, at about 6 p. m. The surface of the township is gently undulating and well watered, being traversed in almost every direction by small and heavily wooded streams. The bottoms are from one-fourth to three-fourths of a mile in width, rising in gradual ascent to the "divides" on either side. From its inception to a point south of Waterville, a distance of about 7 miles, the tornado passed over the rolling prairie, leaving no evidence of its course, being at too great a height above the surface. All along rain and hail preceded it, while it was accompanied by a strong southwest wind, which was succeeded several minuates later by a cold current from the northwest. In a letter dated May 31st, and addressed to the Chief Signal Officer, by Mrs. C. B. Phillips, sunset observer at Waterville, she stated that at 4.45 p. m. of the 30th heavy rain commenced with a southerly wind, lasting until 5.30 p. m., when it ceased for about fifteen minutes, succeeded by a furious wind from the southwest, tearing up sidewalks, destroying awnings and signs, and unroofing several barns and houses. The clouds were very dark and portentous in the southwest, and rolled with great rapidity to the northwest. In about twenty minutes the wind shifted to the west, continuing with a steady force for about fifteen minutes, when there were indications of an opposite movement from the northwest. The clouds, dark and heavy, came up very rapidly, approaching those moving from the southwest. At the junction of the two opposing currents, a cloud about the diameter of a barrel and apparently 100 feet in height formed, darting downward with an alternate rising and falling motion. The body of the curious cloud was of a very light color, while the top presented a decided contrast of a dark green shade. As the funnel, still a considerable height above the ground, passed by about 1 mile to the south, the wind blew stronger than ever from the southwest with rain and hail for about fifteen minutes, when it shifted to the northwest, growing colder and still blowing very violently, the rain continuing. At 7.30 p. m. the high wind ceased and at 8 p. m. rain and wind ceased altogether. Since the 25th the temperature (taken at about 7 p. m.) had ranged from 82° to 93°. On Friday morning and afternoon it was still very sultry, but at 7.45 p. m., the temperature had fallen from 90° to 78° during the prevalence of the northwest wind, and, twenty-four hours after, to 51°, the wind then changing to the northeast. After leaving Waterville the storm passed up Horse Shoe Creek to the northeast a short distance, crossing it about 1 mile south of where it empties into the Little Blue. It then moved to the mouth of the Little Blue, 1¾ miles northwest of Blue Rapids, and descended to the ground for the first time on the eastern bank, destroying the

Exhibit A.

Map of the Track of the "Waterville Tornado." Washington and Marshall Counties, Kan.



Average width of creek bottoms ½ mile.
" " of timber belts ¼ "

this seething mass of clouds the funnel was seen to dart downward, in the neighborhood of Chapman's Creek, about 8 miles southwest of Wakefield. The cloud remained above the earth while passing over the southwest and central portions of Republican Township, but finally descended to the high prairie about 1½ miles west-southwest of Wakefield, reaching soon after a small creek which runs eastward along the southern boundary of the town, and empties into the Republican River. Where the cloud first reached the surface no evidence was left of its track, as it was upon the open prairie, presenting no material for destruction, but upon reaching the southern edge of the town, several houses were blown down over a path averaging nearly 300 yards in width. The Sentinel, a paper published at Minneapolis, Ottawa County, Kansas, reported on June 13th, as follows: "At Wakefield considerable damage was done by a tornado. Eleven buildings were either injured or destroyed. Three persons were severely hurt, and a fourth fatally, the latter being Mr. Joseph Polly. The building in which he was living at the time of the storm was shattered to pieces." Ex-State Senator H. P. Dow, United States revenue collector, Manhattan, Kansas, stated that while traveling through Wakefield on June 12th he came upon the track of the tornado of May 30th, where he saw several buildings terribly shattered, while others were only unroofed or slightly injured. The latter seemed to be situated on the northern extremity of the storm's path, where to all appearances its fury was greatly diminished. The direction of the storm's course he considered to be from west-southwest to east-northeast, and its length about 13 miles. After crossing Republican River it entered Grant Township, Clay County, passing over the prairie 1½ miles to Timber Creek, where it destroyed the heavy timber with great violence. At this point in the storm's course very strong evidence existed of a powerful whirling motion of the clouds, as the trunks and limbs of the trees were twisted and broken in a frightful manner. After passing Timber Creek, where its path was about one-fourth of a mile wide, the cloud struck the high rolling prairie of Madison Township in the adjoining county of Riley. Here its path narrowed considerably, and after traveling a mile or more it rose from the surface and disappeared in the clouds. The Stockdale tornado, which occurred in the next township to the east, was not a continuation of this storm, because it formed about two hours later and at a point about 15 miles southeast of the terminus of the latter.

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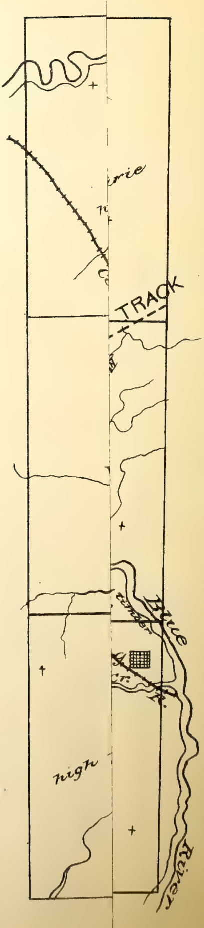

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high
River

this seething mass of clouds the funnel was seen to dart downward, in the neighborhood of Chapman's Creek, about 8 miles southwest of Wakefield. The cloud remained above the earth while passing over the southwest and central portions of Republican Township, but finally descended to the high prairie about 1½ miles west-southwest of Wakefield, reaching soon after a small creek which runs eastward along the southern boundary of the town, and empties into the Republican River. Where the cloud first reached the surface no evidence was left of its track, as it was upon the open prairie, presenting no material for destruction, but upon reaching the southern edge of the town, several houses were blown down over a path averaging nearly 300 yards in width. The Sentinel, a paper published at Minneapolis, Ottawa County, Kansas, reported on June 13th, as follows: "At Wakefield considerable damage was done by a tornado. Eleven buildings were either injured or destroyed. Three persons were severely hurt, and a fourth fatally, the latter being Mr. Joseph Polly. The building in which he was living at the time of the storm was shattered to pieces." Ex-State Senator H. P. Dow, United States revenue collector, Manhattan, Kansas, stated that while traveling through Wakefield on June 12th he came upon the track of the tornado of May 30th, where he saw several buildings terribly shattered, while others were only unroofed or slightly injured. The latter seemed to be situated on the northern extremity of the storm's path, where to all appearances its fury was greatly diminished. The direction of the storm's course he considered to be from west-southwest to east-northeast, and its length about 13 miles. After crossing Republican River it entered Grant Township, Clay County, passing over the prairie 1½ miles to Timber Creek, where it destroyed the heavy timber with great violence. At this point in the storm's course very strong evidence existed of a powerful whirling motion of the clouds, as the trunks and limbs of the trees were twisted and broken in a frightful manner. After passing Timber Creek, where its path was about one-fourth of a mile wide, the cloud struck the high rolling prairie of Madison Township in the adjoining county of Riley. Here its path narrowed considerably, and after traveling a mile or more it rose from the surface and disappeared in the clouds. The Stockdale tornado, which occurred in the next township to the east, was not a continuation of this storm, because it formed about two hours later and at a point about 15 miles southeast of the terminus of the latter.

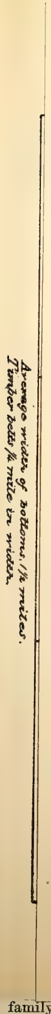
THE WATERVILLE TORNADO.

This storm was first seen to form over the various branches of Coon Creek, in the eastern portion of Lincoln Township, Washington County, Kansas, on the afternoon of May 30th, at about 6 p. m. The surface of the township is gently undulating and well watered, being traversed in almost every direction by small and heavily wooded streams. The bottoms are from one-fourth to three-fourths of a mile in width, rising in gradual ascent to the "divides" on either side. From its inception to a point south of Waterville, a distance of about 7 miles, the tornado passed over the rolling prairie, leaving no evidence of its course, being at too great a height above the surface. All along rain and hail preceded it, while it was accompanied by a strong southwest wind, which was succeeded several minuates later by a cold current from the northwest. In a letter dated May 31st, and addressed to the Chief Signal Officer, by Mrs. C. B. Phillips, sunset observer at Waterville, she stated that at 4.45 p. m. of the 30th heavy rain commenced with a southerly wind, lasting until 5.30 p. m., when it ceased for about fifteen minutes, succeeded by a furious wind from the southwest, tearing up sidewalks, destroying awnings and signs, and unroofing several barns and houses. The clouds were very dark and portentous in the southwest, and rolled with great rapidity to the northwest. In about twenty minutes the wind shifted to the west, continuing with a steady force for about fifteen minutes, when there were indications of an opposite movement from the northwest. The clouds, dark and heavy, came up very rapidly, approaching those moving from the southwest. At the junction of the two opposing currents, a cloud about the diameter of a barrel and apparently 100 feet in height formed, darting downward with an alternate rising and falling motion. The body of the curious cloud was of a very light color, while the top presented a decided contrast of a dark green shade. As the funnel, still a considerable height above the ground, passed by about 1 mile to the south, the wind blew stronger than ever from the southwest with rain and hail for about fifteen minutes, when it shifted to the northwest, growing colder and still blowing very violently, the rain continuing. At 7.30 p. m. the high wind ceased and at 8 p. m. rain and wind ceased altogether. Since the 25th the temperature (taken at about 7 p. m.) had ranged from 82° to 93°. On Friday morning and afternoon it was still very sultry, but at 7.45 p. m., the temperature had fallen from 90° to 78° during the prevalence of the northwest wind, and, twenty-four hours after, to 51°, the wind then changing to the northeast. After leaving Waterville the storm passed up Horse Shoe Creek to the northeast a short distance, crossing it about 1 mile south of where it empties into the Little Blue. It then moved to the mouth of the Little Blue, 1¾ miles northwest of Blue Rapids, and descended to the ground for the first time on the eastern bank, destroying the

partly-finished frame house of Mr. Sawyer, who, at the time, was engaged with carpenters putting on the roof. The storm struck it a few minutes after 6 p. m. The cloud was preceded about fifteen minutes by a southwest wind with rain and hail, the latter unusually large. It could be seen for a distance of about 3 miles to the southwest, well defined, of the shape of a funnel, about the size of a man's body, and several hundred feet above the ground. As it drew nearer the cloud worked itself gradually downward in a twisting manner towards the earth, reaching it about 60 rods west of the house, which was instantly demolished by a strong southwest current. The *debris* was carried to the northeast and north. One of the carpenters standing on the west side of the building was blown into a ravine 70 feet to the northwest, breaking his arm. After leaving the house the cloud cut its way through the heavy timber bordering the Little Blue, crossing the stream near where it empties into the Big Blue, and thereafter crossing the latter. For a distance of half a mile and a width of from 200 to 300 feet a path was cut through the timber bordering these streams, where the storm made its usual havoc, twisting off the tops and bodies of large trees and uprooting others. One and a fourth miles northeast of Mr. Sawyer's house, and in the center of the storm track, pieces of boards from the ruins were found driven into the ground in a complete circle, having a diameter of about 30 feet. This fact was reported to me by Mr. James Patterson, of Irving, who passed over the track directly after the storm. At Blue Rapids, 1¼ miles southeast of the storm's center, a strong wind was felt from the southwest as the cloud passed, but no serious damage was done. About three-quarters of an hour previous, and while the strong west wind was prevailing at Waterville, an equally violent northwest wind, with rain and hail, unroofed the woolen and gypsum mills, overturned small out-buildings, and caused other damage. After leaving the Big Blue, the cloud rose to a considerable height above the ground and moved in a northeasterly direction towards the head of Elm Creek, passing through portions of the townships of Blue Rapids and Elm Creek, where, in all probability, it disappeared in the clouds, as nothing was afterwards heard of it. During its passage over these townships the cloud was preceded by rain and hail, with a southerly wind, which was immediately succeeded by a strong southwest current of sufficient force to overturn small outbuildings and destroy fences. This change of current to southwest was in a few minutes followed by a cold northwest wind, with light rain. The entire length of the storm's track, including those portions where the cloud was above the ground, was about thirteen miles. Its course was from west-southwest to east-northeast. Respecting its velocity of progression, I am unable to furnish any data, except the mere statement of parties at Mr. Sawyer's that it moved at the rate of about 20 miles per hour, with a gyratory motion inconceivably rapid.

LINCOLN COUNTY TORNADO.

While at Minneapolis obtaining information respecting the Delphos tornado, I heard of this storm in the adjoining county of Lincoln, and made preparations to proceed on the following morning to commence its investigation, but during the night a heavy rain storm set in which continued during the next day, washing away bridges, converting streams into rivers, and rendering it impossible to make the journey by any available or ordinary means of transit until after the expiration of several days. In connection with an examination of the storm's path I received a very kind and valuable letter from Capt. L. W. Metcalf, of Monroe, whose house, standing on an eminence one mile east of the storm's center, afforded an excellent opportunity from which to watch the formation and progress of the tornado. Captain Metcalf traveled very carefully over the path of the tornado three times, being interested in obtaining a knowledge of its peculiarities, and also as a member of the relief committee appointed to ascertain the condition of the sufferers, and to solicit aid for their protection and support. This tornado was one of a series of seven which occurred on the afternoon of May 30th in the central portion of Kansas, over what is called the two-thousand-foot level; that is, the elevation compared with the sea level. During Friday the weather was very warm and partially cloudy with southerly winds, which condition had existed for eight or ten days. At 2 p. m. dark clouds were seen to gather in the southwest and northwest, at what appeared to be a distance of from 12 to 14 miles to the westward, rain and hail commencing soon after, with a strong south wind backing to the southeast and then quickly veering to west and northwest. At first the hail stones were about the size of marbles, but they rapidly increased in diameter until they were as large as hens' eggs and very uniform in shape. After the precipitation had continued about fifteen minutes the wind ceased and the small hail nearly stopped, when there commenced to fall perpendicularly large bodies of frozen snow and ice, some round and smooth and as large as a pint bowl, others inclined to be flat with scalloped edges, and others resembled rough sea shells. One of the latter after being exposed an hour to the sun measured 14 inches in circumference. At 2.30 p. m. the clouds in the southwest were seen to be in terrible commotion, some rising and descending, some whirling about, and others


Average width of bottoms 1½ miles.
Timber belts ½ mile in width.

family were injured. A horse of Mr. Hortman's, standing outside of the stable and on partly-finished frame house of Mr. Sawyer, who, at the time, was engaged with carpenters putting on the roof. The storm struck it a few minutes after 6 p. m. The cloud was preceded about fifteen minutes by a southwest wind with rain and hail, the latter unusually large. It could be seen for a distance of about 3 miles to the southwest, well defined, of the shape of a funnel, about the size of a man's body, and several hundred feet above the ground. As it drew nearer the cloud worked itself gradually downward in a twisting manner towards the earth, reaching it about 60 rods west of the house, which was instantly demolished by a strong southwest current. The *debris* was carried to the northeast and north. One of the carpenters standing on the west side of the building was blown into a ravine 70 feet to the northwest, breaking his arm. After leaving the house the cloud cut its way through the heavy timber bordering the Little Blue, crossing the stream near where it empties into the Big Blue, and thereafter crossing the latter. For a distance of half a mile and a width of from 200 to 300 feet a path was cut through the timber bordering these streams, where the storm made its usual havoc, twisting off the tops and bodies of large trees and uprooting others. One and a fourth miles northeast of Mr. Sawyer's house, and in the center of the storm track, pieces of boards from the ruins were found driven into the ground in a complete circle, having a diameter of about 30 feet. This fact was reported to me by Mr. James Patterson, of Irving, who passed over the track directly after the storm. At Blue Rapids, 1¼ miles southeast of the storm's center, a strong wind was felt from the southwest as the cloud passed, but no serious damage was done. About three-quarters of an hour previous, and while the strong west wind was prevailing at Waterville, an equally violent northwest wind, with rain and hail, unroofed the woolen and gypsum mills, overturned small out-buildings, and caused other damage. After leaving the Big Blue, the cloud rose to a considerable height above the ground and moved in a northeasterly direction towards the head of Elm Creek, passing through portions of the townships of Blue Rapids and Elm Creek, where, in all probability, it disappeared in the clouds, as nothing was afterwards heard of it. During its passage over these townships the cloud was preceded by rain and hail, with a southerly wind, which was immediately succeeded by a strong southwest current of sufficient force to overturn small outbuildings and destroy fences. This change of current to southwest was in a few minutes followed by a cold northwest wind, with light rain. The entire length of the storm's track, including those portions where the cloud was above the ground, was about thirteen miles. Its course was from west-southwest to east-northeast. Respecting its velocity of progression, I am unable to furnish any data, except the mere statement of parties at Mr. Sawyer's that it moved at the rate of about 20 miles per hour, with a gyratory motion inconceivably rapid.

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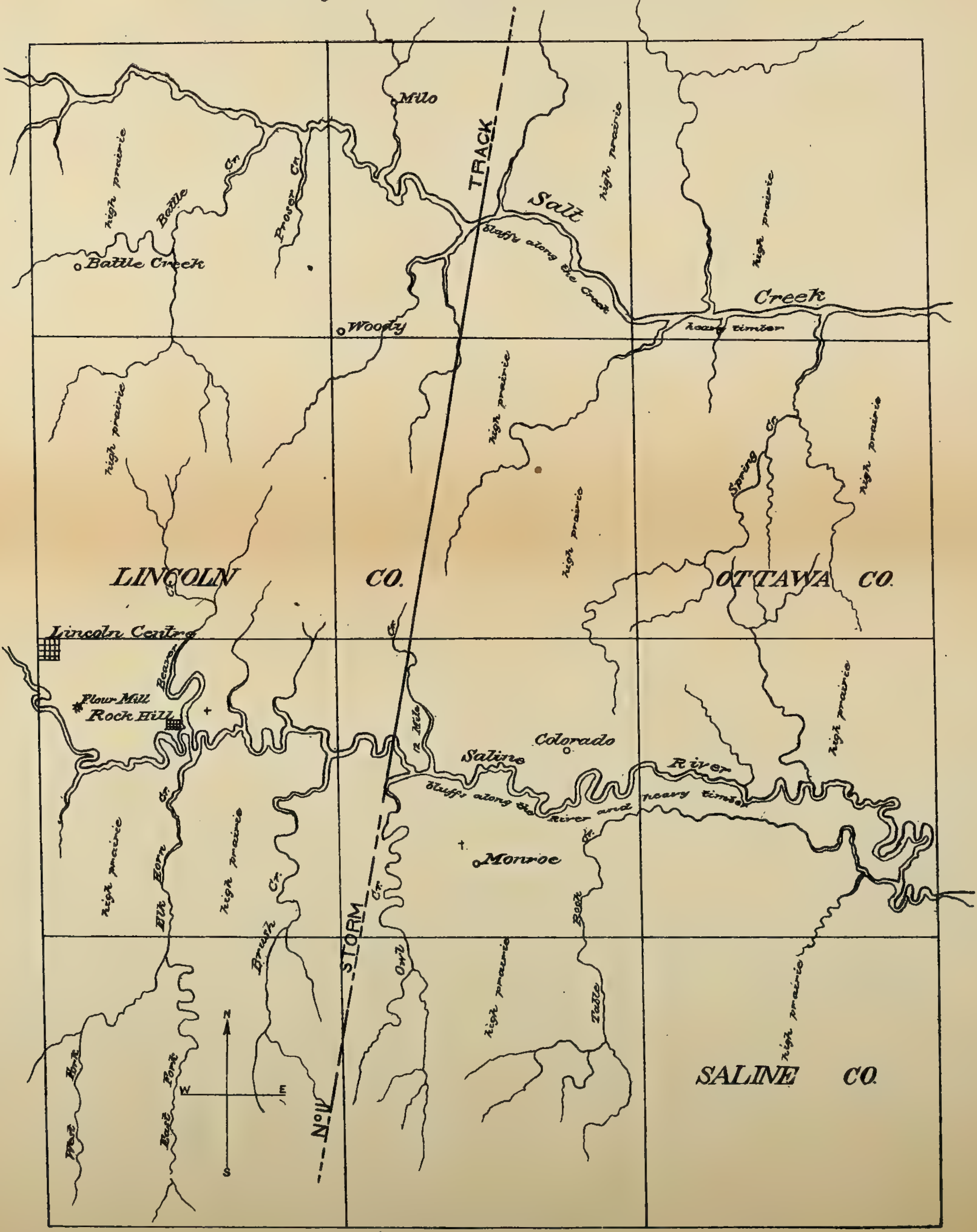
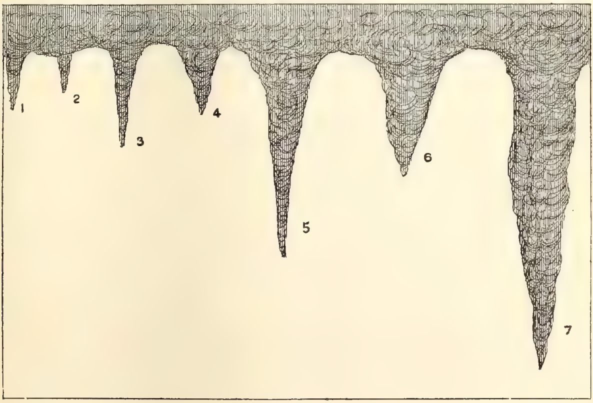
Exhibit A.
Map of the Track of the "Lincoln County Tornado."
Portions of Lincoln, Ottawa and Saline Co's, Kan.



Average width of bottoms, 1½ miles.
Timber belts ¼ mile in width.

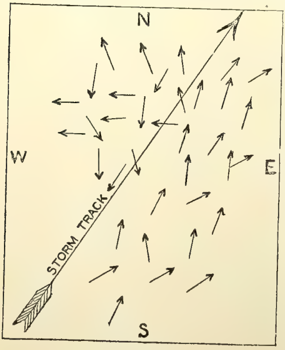
darting with lightning rapidity towards a common center. The northwest cloud at this time had nearly united with the one in the southwest, and soon there was discovered a small, narrow, funnel-shaped cloud descending from a point, which, to all appearances, formed the junction of the two clouds. While it rained and hailed the air was quite cool and pleasant, but as the tornado passed it suddenly became so oppressive that it was difficult to breathe. On the outer edges of the storm there was almost a dead calm, and the flying *débris* which was thrown from the top of the funnel came down in straight lines. The funnel, upon making its appearance, would descend a short distance from the cloud and then draw itself back almost the entire length.



No. 1.

(Diagram No. 1.) It continued this rising and descending motion, each time falling lower and growing larger and nearer, until it reached the ground. The great commotion in the clouds, spoken of before as occurring previous to and during the incipient stage of the funnel, ceased when the funnel assumed complete dimensions, all of the disturbance being confined to the tornado cloud alone. The funnel cloud first formed 7 miles south of the Lincoln County line, near the headwaters of Mulberry Creek, in Ellsworth County, and in crossing the creek some distance to the north sucked up quite a large volume of water. It then encountered the house of Dr. Boyle, unroofing it and deluging furniture and clothing with water; loss $300. Mr. Rose, near the line of Lincoln County, had his stable entirely demolished, and Messrs. McNamara and Stover, just across the line, had their houses unroofed. The bottom of the funnel had not yet reached the earth, as will be seen from the manner in which the buildings were injured, only the roofs being carried away. The high range of hills, called the "limestone bluffs," were then reached, over which the funnel passed, sweeping the ground until the house of Mr. Rogers was reached, just under the edge of the hills on the northern side. The roof was taken off and clothing with some of the furniture drawn up into the cloud. The articles so disappearing were never seen or heard of afterwards. A farmer (name unknown) driving along upon the road, and about in line with the storm's center, was caught up by the wind and carried out of his wagon a distance of several rods, breaking his arm. The wagon was completely torn to pieces and scattered in every direction. The harness was stripped from the horses, and one of them slightly injured. Mr. Albright's large frame house, containing two families, was next demolished. No one was killed, but Mr. Albright was severely injured. Here the funnel first reached the ground and began in earnest the performance of its most powerful and characteristic work. Mr. Green's house, near the head of Owl Creek, was completely swept from the ground, hardly leaving a vestige of anything to mark its original position. The father and three children were severely injured. Mr. Moore was located 200 yards west of the storm's center, and his house, 12 by 20 feet and 1½ stories high, was lifted bodily and carried, with the entire family in it, to the center of the track, in a direction a little south of east, where it went to pieces. None of the family were injured. A horse of Mr. Hortman's, standing outside of the stable and on the west side of the storm's center, was carried one-fourth of a mile to the southwest, nearly killing it, both of its eyes being destroyed by contact with flying *débris.* Mr. Valentine's house, further up the creek, was a large structure, built of limestone. The roof was taken off, and everything movable was blown out of the doors and windows and through the top. The family escaped by rushing into a "dug-out" as the storm came up. A new and heavy lumber wagon, standing near the house, was completely wrecked. The tires were stripped from the wheels, and either bent out straight or twisted into knots, and the hubs stripped of every spoke.

After overturning the granary of Mrs. Washam, on the western edge of the storm track, the funnel cloud struck the house of Mr. Geo. A. Myers, 12 by 18 feet and 1½ stories high, made of magnesia limestone, with walls 16 inches thick. The roof was made of heavy cottonwood poles and covered with 12 inches of black dirt and clay. The ridge pole was 18 inches in diameter and 18 feet long. The building was whirled into a shapeless mass of rubbish in almost an instant. Large stones weighing from 150 to 200 pounds were carried from 75 to 100 feet. There were five persons in the house at the time, all of whom were severely injured, but only one killed, a little boy eighteen months old, who was found with not a bruise upon his body, yet with life extinct. The width of the path of greatest destruction was 40 rods, yet even at the distance of 1½ miles east of the storm's center the wind was strong enough to blow down the house of Mr. Parker and tear his wagon to pieces, causing altogether a loss of $600. One mile northeast of Mr. Myers stood the house of Henry Hartman. It was made of heavy limestone rocks, but was razed to the ground, as was also his stone granary. Everything within the house was rendered unserviceable, clothing was torn into shreds and furniture and dishes broken to pieces. Mr. Kane, 80 rods east of Mr. Hartman's, and east of the storm's center, had the west end of his stone barn blown away, and also all of the lumber he had purchased for building a new house. At this point the tornado raised from the ground and descended one-fourth of a mile further on in the wheat field of Mr. John La Bar, whipping the heads of wheat from the stalks and beating the latter into the ground. One-half mile to the northeast the cloud struck his house, distributing the *debris* for several miles over the prairie. The structure was built partly of logs and boards and covered with a shingle roof. Some of the logs, 16 feet long and 10 inches in diameter, were carried 40 rods. The family sought shelter in a stone smoke-house close by, but even that did not escape complete destruction. Mr. La Bar had his arm broken, and his hired man received severe injuries upon the head. All of his farming implements, among which were a new reaper and steam thresher, were damaged beyond any manner of use. Loss, $2,000. Mr. Elam La Bar, who lived 35 rods to the northwest, had the roof of his house taken off and the contents scattered about the prairie. East of his house a short distance, and near the storm's center, stood the stable, in which were tied a pair of medium-sized horses. The building was blown to pieces and the horses carried over an adjoining wood-pile and into a wheat field 80 rods to the southeast. Mr. Landers, a neighbor, vouches for the truth of this statement. He would not say that the animals did not touch the ground during the entire distance, but that there was no evidence of such a fact, and from the terrific force the storm manifested at this point, and other places, he did not consider it more extraordinary than many other evidences of its violence. The storm next reached the Saline River, near the mouth of Owl Creek, where it destroyed the granary and stable of Mr. W. L. Gillmore, who was situated on the west side of the storm's center. His house escaped with slight damage, being on the extreme western edge of the storm. As it crossed the river it mowed a swath through the timber from 75 to 250 yards in width. (Diagram No. 2.) The largest trees were broken off near the ground, while small trees, with a tough, elastic fiber, were twisted into ropes. Here was undisputed evidence of the whirl of the cloud from right to left, easily detected in the twisting of branches and the trunks of the smaller trees. On the north side of the river, and east of the storm's center, the house of Mr. Bloomheart was destroyed and the *debris* carried along the track to the northeast. Mr. Hordesty, who had lately transported a large quantity of lumber and considerable machinery to this point of the Saline River, preparatory to the construction of a flour mill, found his machinery



No. 2.

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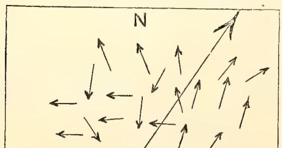
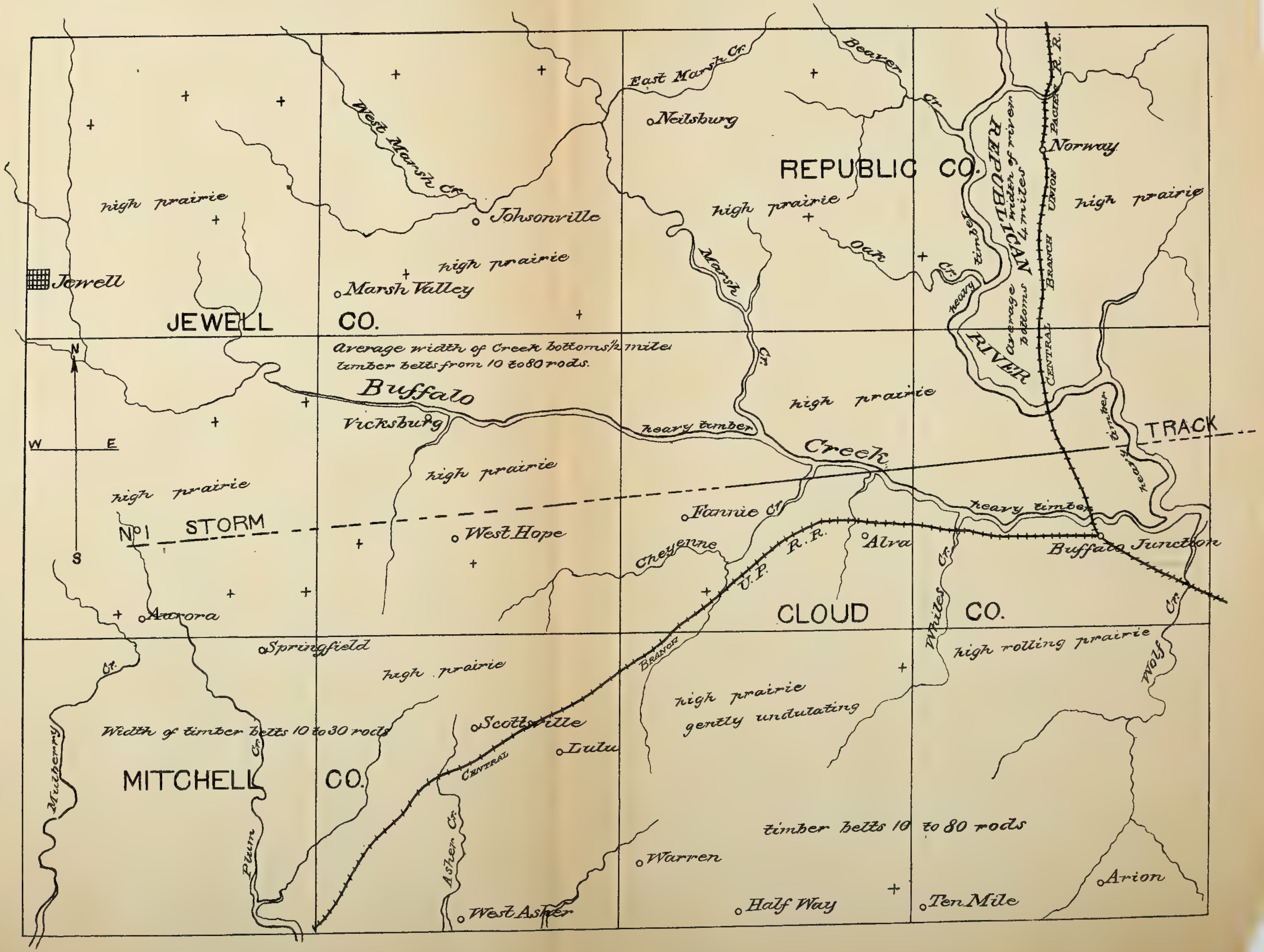
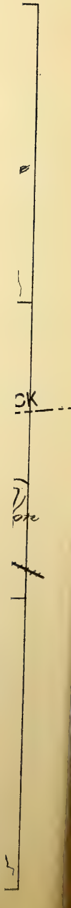


No. 2.

Exhibit A.

Map of the Track of the "Buffalo Creek Tornado." Jewell Mitchell, Cloud and Republic Co's, Kansas.

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broken to pieces and the lumber converted into kindling wood and scattered to the winds. Loss, $1,700. Several reliable persons, who secreted themselves in the curve of the river near the mill-site to escape the fury of the storm, stated that as the funnel passed over the water was sucked up to such a degree that the bed of the river was exposed. There were no means of verifying this statement from any resulting action of the funnel after the occurrence as there was no evidence given of its depositing any large volume of water further on in its course. It may not have taken much, if any water from the river, but through the display of its terrific whirling power, have driven the waters back each way, thus exposing to view the bottom of the river, as was the case on the Big Blue at Irving. For a distance of three miles north of the Saline River the tornado still continued to move along the surface, during which time three houses were destroyed and one person severely injured by falling timbers. It had then nearly reached the high divide between the Saline River to the south and Salt Creek to the north, over which it was seen to disappear, drawing itself up into the clouds above. Captain Metcalf stated that the strongest suction appeared to be on the east side of the storm's track, which throughout the entire course was wider (that is, the area of destruction) than the west side, and furnished repeated evidence of strong inrushing currents from the south and southeast. The widest portion of the storm's track, meaning the path of greatest destruction, was at Mr. La Bar's, where it spread out to nearly 100 rods, but the wind was very strong on the east side to a distance of one mile from the center. The width of the hail-storm which preceded the tornado was in no locality less than 2 miles, and in many places it was 3 miles wide. The course of the storm was from south-southwest to north-northeast. Commencing 7 miles south of the Lincoln County line, the funnel cloud moved almost directly north across it and up the entire length of Owl Creek to Saline River and across the latter, following the course of Twelve Mile Creek, bearing a little east of north. It left this creek as it encountered the high divide, having completed a distance of 23 miles (9 of which were above the ground) between 2.30 and 3.30 p. m., showing the velocity of progression to be 23 miles per hour, or thereabouts. Over some portions of the track the storm traveled more rapidly than at others, especially when above the surface of the ground.

THE BUFFALO CREEK TORNADO.

The region over which this storm is reported to have originated in the southeastern part of Jewell County is traversed by no less than four creeks, the largest being called Buffalo, of which the others are tributaries. The general course is easterly, those branches from the north running to the southeast, and those from the south running to the northeast. The width of the bottoms, which are heavily timbered, vary from one-half to three-fourths miles, bounded by a gently undulating prairie, with gradual ascent from the streams. The following communication is from Mr. L. C. Preston, jr., who witnessed the approach of the storm from the small town of Scottsville, about 12 miles northeast of Beloit, on the Central Branch of the Union Pacific Railroad:

"On May 30th, between 3 and 4 p. m., my attention was directed to very threatening manifestations of the clouds in the NNW. Soon other clouds of a portentous character began to lift above the southwest horizon and approach the opposite formation. As the two sets began to cover the western horizon, the clouds commenced to roll and twist in a very strange and frightful manner. Their movements were made with lightning rapidity, presenting a sight which it had never been my opportunity to witness before. The disturbed clouds seemed ultimately to concentrate in one intensely black spot, a little north of west, and over the high divide between Buffalo Creek to the north and Fannie and Cheyenne Creeks to the south. On this ridge the dark cloud seemed to divide, one part passing south towards Beloit, and the other passing along Buffalo Creek toward Concordia, a little north of east. The latter portion was more distinctly visible, and at times, as it came from behind belts of timber and ranges of hills, presented the features of a waterspout. I made up my mind that a terrible storm must be raging in the course of this cloud, and determined on the following morning to verify my presentiments. Upon reaching Buffalo Creek, where it strikes the northwestern corner of Cloud County, I found terrible destruction along the low banks of the creek. In traveling four miles I found five houses and the accompanying outbuildings completely wrecked. Heavy stone houses were torn down level with the ground, while straw sheds near by were unharmed. Roofs were blown from one-half to three-quarters of a mile, and trees from 2 to 3 feet in diameter were either twisted, broken off near the ground, or uprooted. The width of the path of destruction varied from 50 to 80 rods, and its course seemed to be from WSW. to ENE. At times the cloud would follow very closely the bend of the creek and then suddenly leave it. The people all along that portion of the track I visited concurred in their testimony regarding the funnel shape of the cloud, its whirling motion, and the almost instantaneous rapidity of its destructive action."

Several persons were seriously injured, but none killed. Mr. Preston further reported that a man came into Scottsville on the morning of the 31st from Phillips

County, about 60 miles west, and stated that a terrible hail-storm, accompanied by violent winds, passed through that county, from west to east, on the afternoon of May 30th, between 2 and 3 p. m. Buffalo grass was beaten into the ground and hailstones gathered five feet deep in the small ravines.

Mr. Halladay, resident of Scottsville, watched the storm from its inception, and corroborates the testimony regarding its funnel-shaped appearance. This storm, no doubt, came very close to Concordia, as will be seen from the following statements of some of its most reliable citizens, and perhaps would have visited it had it not been for the peculiar topography about the town to the north, west, southwest, and east. The town is situated about 2 miles south of the Republican River, 2½ miles east of Wolf Creek, and 1¾ miles west of Oak Creek, upon the Central Branch of the Union Pacific Railroad. Buffalo Creek empties into the Republican River 4½ miles WNW. of the city. The banks of these small streams ascend gradually to form high ridges or divides of a mile or so in width, which again descend to the east, west, and south, resulting in a natural basin, where the thrifty town is cosily nestled. From all appearances it would seem that these ramparts of nature secured the town against a terrible foe, the storm cloud appearing to divide or break up west of the town, as in several other cases similar storms were reported to have done. Mr. B. H. McEckron, of the United States land office, furnished me the following information:

"From about noon on May 30th, the sky was overcast, a strata of light clouds running low from the southeast. This continued until about 3.30 p. m., or possibly 4 p. m., with occasional distant rumblings of thunder, when suddenly it began to grow dark, and the darkness increased to such an extent that we could not see to write in my office without lamps lighted. At this time there was every indication of a severe storm. The light strata of clouds still continued to run with the lower current of the wind from the southeast, while a very heavy, black, and angry looking storm cloud was approaching from the northwest, and another heavy storm cloud seemed to be moving directly from south to north. I watched the black, threatening cloud in the northeast more closely than the one from the south, as it was the most likely to visit us, and looked far more dangerous than the one in the south. For some time it seemed to approach steadily, but finally it appeared to divide, or grow lighter to the left or west of the center of the cloud, part going north of us and a much larger portion going south of this place. The latter was very heavy; the roaring which it made was distinctly heard at Concordia after the storm here had ceased. At Concordia, as the storm approached, the wind changed suddenly to the northwest, and the storm of wind, rain, and hail was very severe, though no damage was done. Many of the hailstones here were nearly as large as hens' eggs."

Mr. J. S. Paradis, editor of the Concordia Exposition, writes:

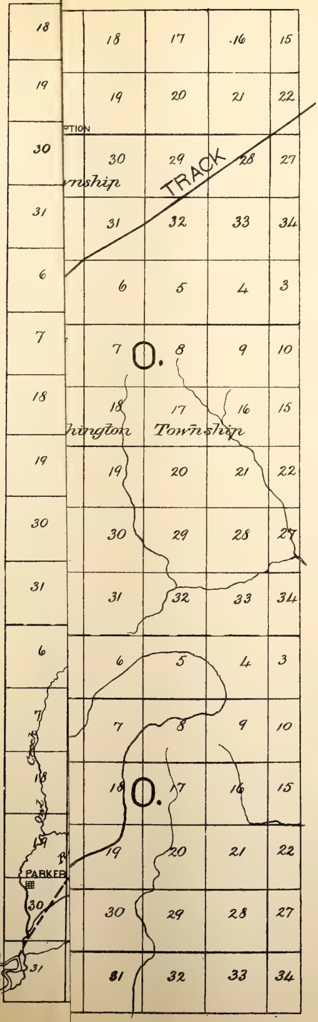
"During my observation of the approach of the storm which passed near Concordia, Kansas, on the 30th day of May, 1879, I noticed a stratum of very thin, white clouds moving slowly in a westerly direction, and very close to the earth, while above that a stratum of heavy black clouds was moving rapidly with a rolling motion in opposite directions, some going north and some going south. The wind during that time was blowing with great velocity from the northwest. A short distance southwest of Concordia the clouds appeared to be moving in every direction. At every ten or fifteen seconds some of them would shoot up nearly out of sight, and others would descend almost to the ground."

Mr. J. D. Wilson, sheriff of Cloud County, resident of Concordia, reported that about 3 p. m. the appearance of unusually dark and heavy clouds in the northwest was noticed. For some time previous threatening clouds had been moving from the southwest and northwest, the former most rapidly. Between 9 and 10 a. m. his chemical barometer indicated a violent disturbance in the atmosphere and the formation of a very heavy storm, as shown by the precipitation in the bottom of the tube, which kept in constant commotion, at times rising near the top. Proposed going to Delphos, but gave it up, although everything about the sky appeared favorable. We had had no storm of any kind for three or four weeks, which had brought on a severe drought. Wind had been in the south for about two weeks, becoming at last almost as hot as a simoon. At 9 a. m. the temperature was 84°, rising to 91° by 1 p. m., when very heavy rain commenced with large scattering hail. The wind accompanying it did not seem to blow from any one direction, but rapidly changing currents from the southeast, southwest, and northwest were experienced, attended with strange commotion in the clouds.

I obtained no reliable information regarding the length of this storm's course, or the rapidity of its progressive movement. It could not have been less than 12 or 14 miles long, and I presume from the severity of a portion of its course that its velocity of progression was not far from 20 or 25 miles per hour.

THE BARNARD TORNADO.

This storm first made its appearance as a funnel-shaped cloud, on the afternoon of May 29th, in the southeastern portion of Holt County, Missouri, near where the southern



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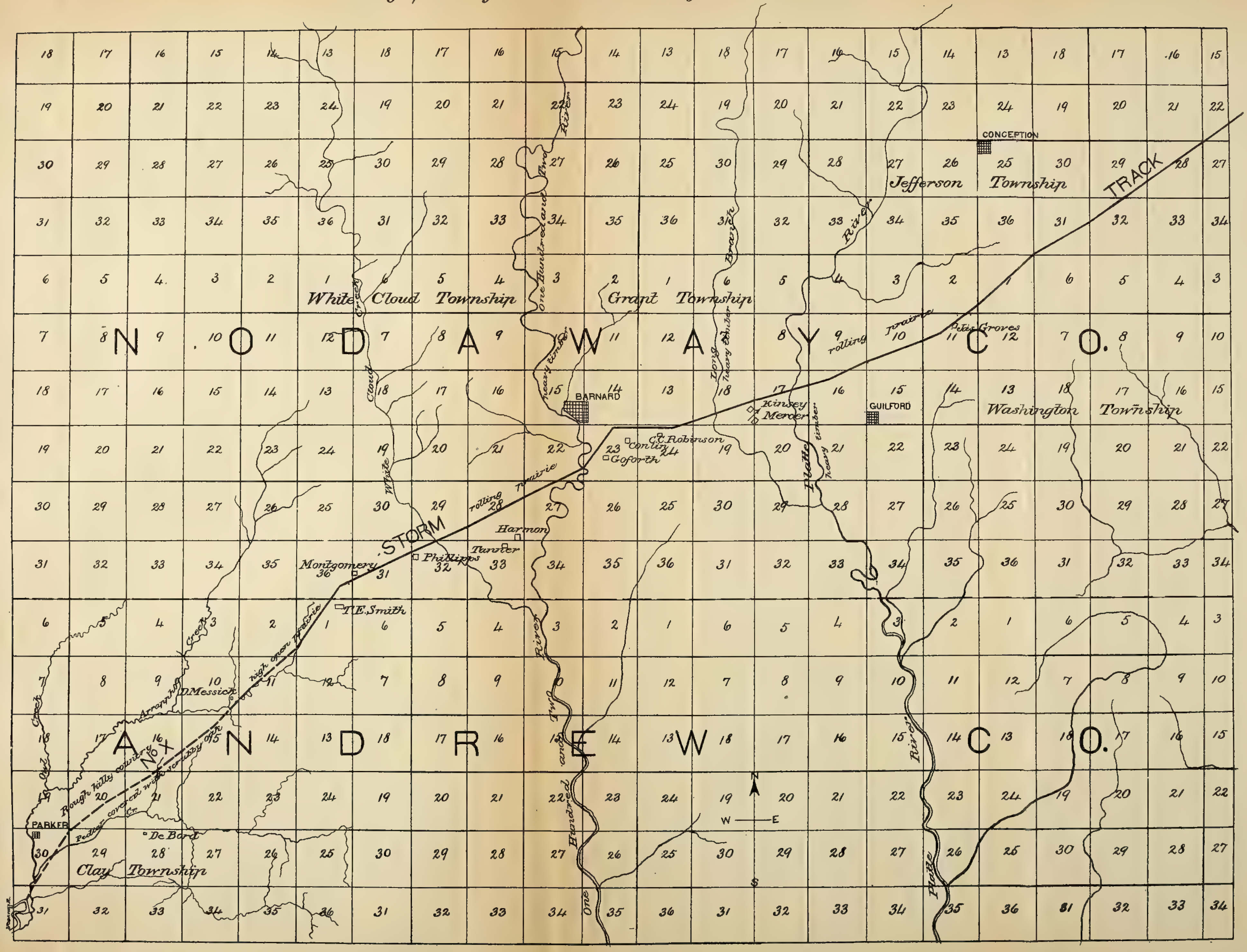
Map of the Track of the Barnard Tornado.

Through portions of Andrew and Nodaway Counties, Missouri.



boundary of Nodaway County strikes the Nodaway River. From this locality it pursued a northeast course through portions of Andrew, Nodaway, Gentry, and perhaps Worth Counties. Previous to the formation of the funnel cloud there prevailed to the southwestward two heavy hail storms, as reported by Mr. William Kaucher, of Oregon, Mo., voluntary observer, Signal Corps, U. S. A. One of these storms passed north of Oregon, Holt County, between 5 and 6.30 p. m., and the other passed south, between 4.20 and 4.50 p. m. With reference to these storms Mr. Kaucher stated that while out traveling to the northward of Oregon he encountered one of them moving eastward. Before the storm came up he had stopped for means of observation upon the high divide between the Nodaway and Missouri Rivers, where the country could be easily seen within a radius of 30 miles. The Kansas timber on the opposite side of the Missouri could be clearly distinguished, and also dark and ominous clouds coming up suddenly, foretelling the approach of a severe storm at least 10 miles further westward. The storm moved up very rapidly, attended by heavy thunder and lightning, and an unusual commotion in the clouds. Some of the hailstones were the size of hens' eggs. Just before the clouds passed to the east of him he experienced an alternation of hot and cold puffs of air, from the southeast and northwest respectively, presenting a difference in temperature which was estimated at 20°. The interchange was not gradual, but painfully abrupt. As the storm passed to the southeast, traversing the dividing line between Nodaway and Andrew Counties, the commotion in the clouds became more intense, especially in the direction of Barnard, where the tornado passed shortly afterwards. On the 27th and 28th Mr. Kaucher reported at Oregon a continued southerly wind, with clear weather and a mean daily temperature of 75° to 78°. On the morning of the 29th a thunder shower prevailed, with a south wind, from 10.55 a. m. to 11.25 a. m.; precipitation, 0.10 inch. At 2 p. m. the wind changed to southwest, with a temperature of 82°, and at 9 p. m. to the southeast, with a temperature of 68°, a fall of 14° in seven hours. At 4.20 p. m. a second thunder shower, but attended with hail, ended at 4.50 p. m.; precipitation, 0.06 inch.

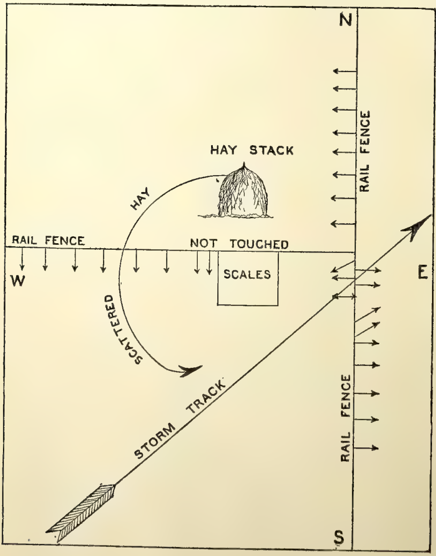
Mr. George W. Coakley, editor of the Barnard Times, was, on the afternoon of the 29th, 12 miles northwest of Barnard, and about the same distance northeast of the point of Mr. Kaucher's observations. While traveling southeastward towards Barnard he encountered, about 3 p. m., a heavy storm of rain and hail, attended with thunder and lightning, wind from the WSW. The hailstones were the largest he had ever seen, but the precipitation was soon over. Before reaching home several short showers of rain and hail were experienced, cooling the oppressive air considerably. As Barnard was approached a deep, heavy roaring, like the rumbling of cars, was heard in the direction of the town, but could not at first determine its cause, as a dense timber belt obstructed the view; after reaching the town Mr. Coakley ascertained that it was caused by the passage of the tornado. Coexistent with the noise, an alternation of hot and cold puffs of air was experienced, which seemed to be a very strange occurrence, following the cooling effects of the late showers of rain and hail.

Mr. E. V. Leonard, who lives at Island City, 14 miles east-southeast of Barnard, did not experience any storm during the 29th, except a light shower in the evening; wind southwest throughout the day.

These reports present rather briefly the extent and peculiarities of the general atmospheric conditions preceding the formation of the tornado, and would seem to indicate its very probable origin. Following the first appearance of the funnel-shaped cloud near the Nodaway River, and about 4 miles south of where it strikes the northwestern corner of Andrew County, it passed northeastward at a considerable height above the ground, crossing Arapahoe Creek, about three-quarters of a mile south of Parker. It now entered a rough, hilly section, covered with a scrubby undergrowth, together with some heavy timber, and divided into farms ranging from 40 to 160 acres, with only now and then cultivated spots, presenting on the whole a very rugged and wild appearance. This tract is bounded on the north by Arapahoe Creek and on the south by Pedlar Creek, inclosing an area of about 3 miles in width by 6 in length, extending from southwest to northeast. Over this section the cloud passed harmlessly and without attracting much attention.

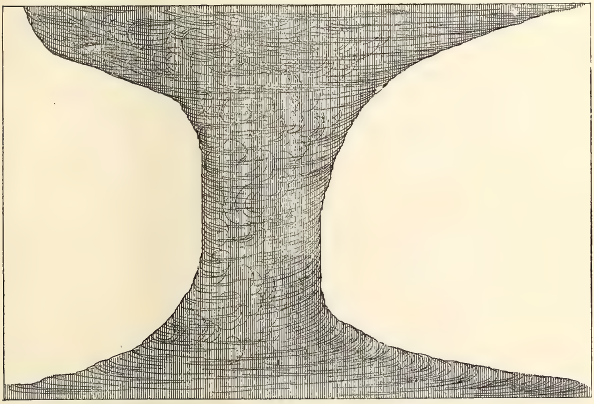
Mr. William De Bord, living east of Parker about 2 miles, saw the cloud (time about 4 p. m.) as it passed by him to the south. It was several hundred feet above the ground, and very small and narrow, resembling an elephant's trunk; no damage was committed. A light storm of rain and hail had preceded its appearance about 15 minutes, wind from the northwest, but as soon as it came in sight the wind changed suddenly to the southwest, blowing quite strong. The weather had been very sultry and threatening most of the day, with a southerly wind. The ground was very dry, and vegetation had suffered for want of rain, which had not fallen for several weeks. A short distance to the northeast the funnel approached the ground on the farm of Mr. Jackson Smith, passing about 250 yards south of his house, but doing no damage to speak of. A few lengths of fence were displaced, and scattering rubbish thrown about over a width of 60 to 80 feet. The first decided manifestation of the tornado's power was on the farm of Mr. Dudley Messick, about 2 miles northeast of Mr. Smith's. Mr.

Messick's house is situated upon a slight rise of ground just across Arapahoe Creek, to the north, and 30 rods west of the storm's center. As the funnel reached the creek it descended for the first time into the heavy timber lining its banks, smashing it up terribly for a width of nearly 300 yards. Elm and hickory were twisted into ropes, while oak and cottonwood were broken off near the stump, or divested of limbs and shattered throughout the trunk. Trees thus destroyed varied in diameter from 6 inches up to 3 feet. As the cloud approached the timber on its southern line, only the tops of the highest trees were destroyed at first, gradually descending, until they were torn from the ground. It followed along the creek to the eastward for about one-fourth of a mile, when it turned to the northeast, passing up a gradual elevation of about 60 feet, to the rolling prairie. The tornado passed the house of Mr. Messick about 4 p. m., he judging of the time somewhat, by the fact that his children were just entering the front yard on their return from school, which was regularly dismissed at 3.30 p. m. Half an hour before the storm there was witnessed several miles to the southwest an unusual commotion in the threatening clouds, which were low down in the western horizon, and seemed to be rushing toward a common center from every direction. These clouds looked like smoke and caused Mr. Messick to remark that a heavy windstorm was approaching; in the northwest there was a totally different cloud, to all appearances presenting a dark, heavy, smooth mass, not in commotion, but looking as if it might pour down torrents of rain; lightning was also seen in this cloud, but none in the former. It had been very sultry and threatening all day, with a southerly wind. The storm cloud was first seen coming up over the timber along the creek, but no danger was apprehended until, with the quickness of a flash of lightning (the cloud yet distant about 300 yards), a cow-pen covered with straw, standing southwest of the house, was whirled into the air, scattering the *débris* in every direction. The wind blew from the southwest very strong for about two minutes, bending the trees in the yard to the ground, and causing the house to creak and tremble from garret to cellar. Five trees in the orchard south of the house were blown down to the northeast. East of the house 15 rods, and down in a hollow, stood a hay stack containing about 2 tons, which was completely turned over to the west, bottom side up, not being blown entirely away, but scattered in a semi-circle from right to left. The current of air which did this work also threw down an east and west rail fence to the south, and a north and south rail fence to the east, south of the storm's center; but north of the storm's center the fence was thrown to the west. The current then passed completely around an inclosure of about 50 feet square, containing a large hay and cattle scale, without doing injury to it or the fence about. (Diagram No. 1.) From this point the funnel passed northeastward over the hill before referred to, giving Mr. Messick an excellent opportunity to view its form, who stated that it looked to be about 200 feet across near the bottom, and but very little larger at its upper extremity. It had the appearance of dark smoke issuing from a locomotive, and the cylindrical column gyrated continually in a direction contrary to the movement of the hands of a watch.



No. 1.

(Diagram No. 2.) Out of the top of the cloud rolled and tumbled in a frightful manner dark masses of smoke, accompanied with a roar that was almost deafening. Mr. Messick saw no lightning in the cloud at any time, and did not distinguish any sulphurous smell in the atmosphere. A few minutes after its passage rain and hail came with a very violent southwest wind, lasting about ten minutes, but not by any means as strong as that accompanying the tornado. The hailstones were scattering, but unusually large, some of them being the size of a man's fist. Then again about dark (three hours later) a very heavy thunder storm set in, without hail, continuing all night, with the wind changing to the northwest, and turning quite cool. Mr. J. T. Beason, living on the property of John Harvey, 1 mile north and 1½ miles west of the storm's center, experienced no strong wind from the passing tornado, but could see it distinctly in all its angry contortions.



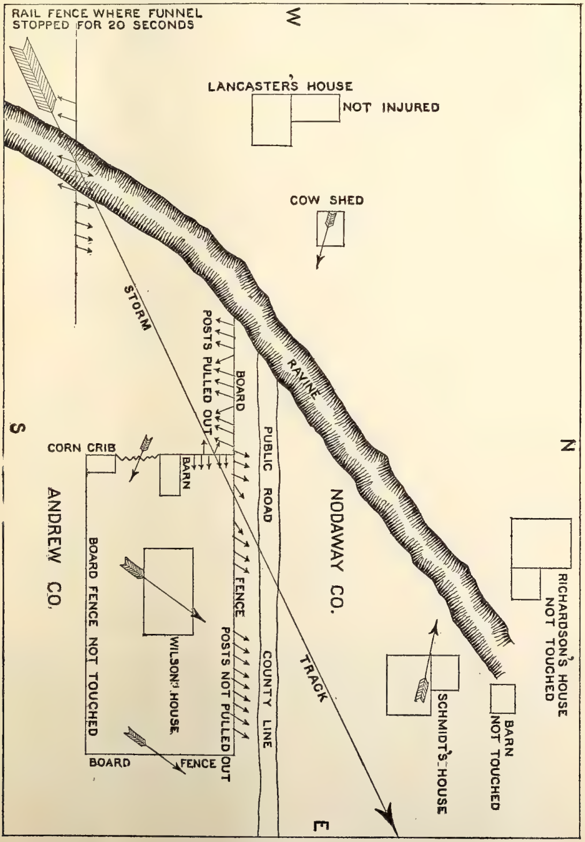
No. 2.

Mr. Chancy Alkive, 2½ miles north of the storm's center, experienced a gentle wind from the north during the passage of the tornado. Rain and hail accompanied the wind, the latter exceedingly large, and ceasing to fall in about ten minutes, as the wind changed to the west. Mr. A. J. Sutton, 2 miles southeast of Mr. Messick's, and 1 mile east of the storm's center, stated that the cloud did not appear to whirl at all, or in fact to develop into a tornado until it reached Mr. Messick's. There was no strong wind at his house, but rain and hail fell just after the storm passed. I very much doubt the reliability of Mr. Sutton's statement regarding the first appearance of the tornado. The cloud, as he viewed it, was high in the air at the distance of several miles to the southwest, and most of the time a clear observation was obstructed by belts of intervening timber. It would be rather difficult to discern the whirl of the vortex under these circumstances; however, the peculiar form of the cloud which then existed would determine its character. Mr. Perry Messick, living half a mile east of Mr. Dudley Messick's, and about the same distance east of the storm's center, felt no effects from the tornado. He would not have known that it was passing had not his attention been accidentally called to it.

From Mr. Dudley Messick's the tornado passed to the farm of Mr. David Maginnis, three-fourths of a mile to the northeast, where it demolished a lumber wagon, carrying the ruins along the track, but not injuring the buildings, which were several rods to the west of the storm's center. It then passed over the farm of Mr. James Wade, tearing down fences for a width of 250 yards, throwing the rails in north and south fences to east, south of the storm's center, and to the west, north of the storm's center. The rails in east and west fences were thrown to the north on the east side of the storm's center, and to the south on the west side. At the house of Mr. Lancaster, northeast of Mr. Maginnis's and 200 rods west of the storm's center (while the doors and windows were open), the dishes on the supper table were blown off, and part of them carried out on the ground. The stock-sheds, 15 rods east of the house, were blown down and the *debris* scattered for a quarter of a mile to the southeast.

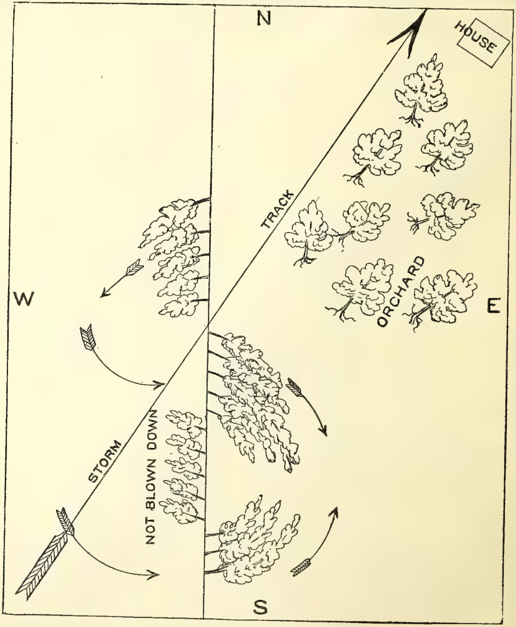
Between the houses of Messrs. Maginnis, Wade, and Lancaster, to the west, and Messrs. Wilson, Schmidt, and Richardson, to the east, courses a deep ravine, 40 to 60 rods wide, running from WSW. to ENE. The tornado after passing Messrs. Wade and Maginnis's, crossed the south portion of the ravine, at a point about half a mile southwest of Mr. Wilson's, where it tore out 20 rods of rail fence in the bottom of the ravine. Here the funnel-shaped cloud, which could be distinctly seen by Mr. Wilson, seemed to halt for about 20 seconds, but whirling constantly with increasing rapidity, as if gathering force for the onslaught to come. As it finally darted forward it passed over the east bank of the ravine (not following it, though right at its mouth and running in the usual course of the storm), toward the former's house. The building stood just south of the Nodaway County line, in the northeast corner of the northeast quarter of Clay Township, range 61 N., 36 W., Andrew County, and east of the storm's center about 100 feet; size 16½ by 32 feet, standing east and west, and 1½ stories high. The storm struck a few minutes past 4 p. m. Mr. Wilson and family, numbering six, were within the house at the time, where they received the first intimation of the storm's presence by the bursting in of the south door. Mr. Wilson ran to shut it, hallooing to his son three times in quick succession to close the north door; but before the latter could even start to fulfill the command, the house was lifted from the earth, turned over on its north side, and torn to pieces, the storm passing on to Mr. Schmidt's. It was all over in about two seconds. Upon the lifting of the house from the earth, the lower floor with the family upon it, except the father, fell to the ground, while the upper portion passed over it, but not seriously injuring the mother and children. Mr. Wilson, who held to the door with all his strength, caught hold of the casing as the floor fell, and hung by one arm until he had attained, as he thought, a height of about 16 feet, and a distance of 50 feet northeast of the foundation, when the building went to pieces and he fell to the ground, escaping with slight injuries. Almost the entire *débris* was carried to the northeast. His son, who started to shut the north door, was carried to the north 40 feet, and lodged against a fence, to which he clung with a tenacity that perhaps saved his life, though he was surrounded and partially covered with *débris* of all kinds. The barn, 60 feet west of the house, with the south door left open, was not injured in the slightest. A corn-crib 20 feet south of the barn, and standing on a foundation of loose stones, was not moved or injured, while the fence connecting the barn and crib was carried to the southeast. A light board fence south of the house, the west end adjoining the crib, had not a board taken off; but the fence north of the house and running to the west a distance of 30 rods, and across the storm's center, was completely carried away. East of the storm's center, the posts were stripped of their boards and bent over to the north, some broken off, while west of the center they were pulled out of the ground, with the exception of a few on the extreme edge of the track, which were partially broken off or bent over to the south.

Mr. Schmidt's house, which stood 60 rods NNE of Mr. Wilson's, was next visited. The main part was 16 feet square, with a kitchen on the north side 12 by 16 feet; the east side was first crushed in, allowing the roof to fall through upon the lower floor, a portion of which struck Mrs. Schmidt upon the back of her neck, holding her down until released by her lady companion; she was very severly injured. The *débris* of the house was carried to the northwest for from 60 to 80 rods. A small stable standing 4 rods north of the house was not touched. The house of Mr. Robert Richardson, half a mile north of Mr. Wilson's, was not damaged; did not even feel a strong wind while the cloud was passing. The relative positions and comparative effects of the storm at the houses of Messrs. Lancaster, Wilson, Schmidt, and Richardson are approximately given in the accompanying diagram. (Diagram No. 3.) Arrows indicate the direction in which the *debris* was carried. The house of Mr. John Kimble, 40 rods east of Mr. Wilson's, and about 70 east of the storm's center, had chimney blown off, and all loose articles about the building carried away to the northeast. The wind was not strong enough to blow down trees. Mr. A. Davis, 100 rods ENE. of Mr. Wilson's, and 60 rods east of the storm's center, experienced the wind so strong from the southwest that he could not get from his blacksmith shop to the house, a distance of 7 rods to the south. No particular damage was done to property. From this locality on to the Sixteen-Mile House, a distance of one mile, no damage was done except to fences, the cloud passing over the open rolling prairie. The building stood upon a considerable elevation sloping to the south and east, three-fourths of a mile north of the Andrew Co. line and about the same distance west of White Cloud Creek; size, main part, 16 by 32 feet, one story high, with an L to the north 16 by 19 feet. The house was occupied by Mr. John W. Phelps and family, and stood 75 feet south of the storm's center. Mr. Phelps stated that about thirty minutes before the tornado struck the house he noticed a huge dark cloud in the northwest, with indications of a violent rain storm, but the cloud bore slowly to the north without any precipitation. During the day the air had been very sultry, with a southwest wind, and at about 1 p. m. there was a slight fall of rain and hail (latter very small), wind from the south, and lasting for five minutes. This storm was much more severe at Rosendale, about 6 miles south, where dark and heavy clouds were seen in the west in unusual commotion. The entire family stood out near the house as the tornado came up, which appeared to be traveling about 30 miles per hour, although at times it seemed to spurt forward at a much more rapid pace. It could be seen to the southwest, at a distance of about 3 miles, whirling in fearful contortions and throwing out at its top black masses of smoke and every variety of *débris*, while it appeared to be suspended by some mysterious force in a partially clear atmosphere. The width at the lower part appeared to be about 200 yards, and half a mile at the upper, while the attendant roaring fairly made the earth tremble.



No. 3.

As it drew near to the house, its way lay through a tall willow hedge, which it whipped into strings for a width of 45 rods, twisting the body of the trees around each other like the strands of a rope. (Diagram No. 4.) It then entered the orchard, blowing down and uprooting 17 trees, carrying their tops to the north and northeast.

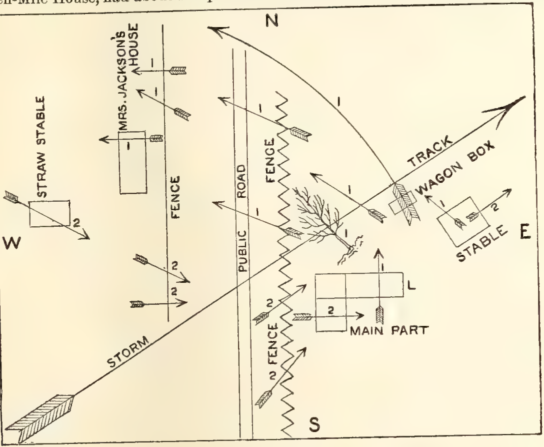


No. 4.

Crossing the north and south road just beyond, it struck the L part of the house first, carrying it to the north; then in the return of the whirl, a few seconds after, the main part was carried to the east. Both parts were now completely demolished and scattered over some 40 acres of ground. This house was the most completely wrecked of any of the buildings previously visited by the tornado. Stoves, bedsteads, chairs, clothing, in fact every article of household furniture, shared a common fate; nothing was left in a serviceable condition. Two of the house-sills 8 by 10 inches and 16 feet long were carried 100 yards to the northeast. A cottonwood tree 2½ feet in diameter, which stood 15 feet north of the L part, was broken off near the ground and carried to the northwest. Eight lengths of fence west of the house and south of the storm's center, were carried away to the northeast; while north of the storm's center 80 yards of fence was carried to the northwest. Mr. Phelps and family, upon the approach of the tornado, secreted themselves under a hedge fence, at a point 75 yards south of the house, where they remained throughout the whole storm without receiving an injury or feeling a strong wind. A loose rail fence 30 feet east of their position had not a rail removed or shaken. A stable standing northeast of the house 40 feet was unroofed when the L part of the former was destroyed, and its *débris* carried to the northwest. The body of the stable was afterwards carried away to the northeast by the return current, that destroyed the main part of the house. (Diagram No. 5.) All parts of the diagram marked with the figure (1) indicate the resulting action of the first whirl of the cloud vortex, and all parts marked with the figure (2) the action of the return current.

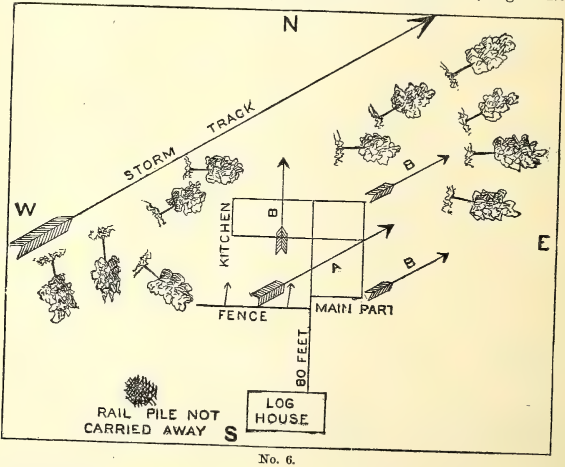
A wagon-box a few yards northwest of the stable was carried to the northwest one quarter of a mile and partially destroyed. A vest belonging to Mr. Phelps was found

6 miles to the northeast unharmed; also a bonnet, the property of his wife, was found 5 miles in the same direction and condition. The width of the storm's track at this place was found to be about 98 yards. Mrs. Jackson, who lived 20 rods northwest of the Sixteen-Mile House, had about 12 square feet of the northwest corner of the roof of her residence torn off and carried to the west. All of the window sash were blown out by an easterly wind; those on the east side were found lying within upon the floor, nearly across to the west side of the house, while those on the west side were carried out on the ground to the west. The floors were covered several inches deep with dirt, leaves, twigs of trees, splinters, &c. All of the dishes and kitchen utensils were blown out of the house some of which had never been found. A picket fence running north and east of the house was carried away to the northwest and west, while south of the house a board fence for a distance of 20 rods was carried to the east and southeast. Six cherry trees standing along this fence, and from 6 to 8 inches in diameter, were found twisted around from east to west. The straw roof of a stable 10 rods west of the house was carried to the southeast.



No. 5.

Mr. Adolphus Mason, living 400 yards southwest of the Sixteen-Mile House, and 80 rods east of the storm's center (in a considerable hollow), experienced a brisk southwest wind as the tornado passed, and some limbs were torn from the trees in the front yard, but the house was not damaged in the least, although very rickety. Mr. E. M. Litts, living three-fourths of a mile south of the Sixteen-Mile House, and upon a high elevation, experienced a strong wind from the south as the tornado passed. Ten rods of north and south rail fence, half a mile northwest of the house, was blown to the east, but no damage committed at the house. After leaving the house of Mr. Phelps the tornado crossed White Cloud Creek, three-quarters of a mile to the east, where it cut a path through the heavy timber 125 yards wide, passing on to the house of Mr. A. J Turner, 1¼ miles beyond, situated upon a rise of ground sloping to the south and east. This was a new structure and barely finished. The main part was 14 by 32 feet, and 1½ stories high, running north and south, with a kitchen on the west side of the north end 14 feet square and of the same height. The building stood southeast of the storm's center about 80 feet. It was first struck by the wind from the southwest, between the kitchen and the main part. The latter was separated from the former, the south end being moved 33 feet to the northeast, and the north end 12 feet in the same direction. The main part was then lifted in the air and turned bottom side up, falling upon its ridge and breaking to pieces. The kitchen was carried to the north and completely torn into bits; most of the *debris* in both cases was carried along the storm track to the northeast. One sill 6 by 8 inches, and 16 feet long, was carried 75 yards to the southeast, and found actually twisted in two. Apple trees in the orchard northwest of the house were torn up by the roots and carried to the east and south, while those northeast of the house were blown over to the northeast. A high pile of stone 25 feet west of the house was leveled to the ground. A hedge fence 25 rods southwest of the house was whipped to pieces and the leaves looked as if scalded. A rail fence 30 feet south of the house, and running east and west, was carried to the north. The log house in which the family safely secreted themselves during the storm, and which stood 80 feet south of the new building, was not damaged save the chimney. An old rail pile, loosely thrown together, 40 feet southwest of the new house remained intact. The barn and stables, situated 150 yards southeast of the house were not injured. (Diagram No. 6.)



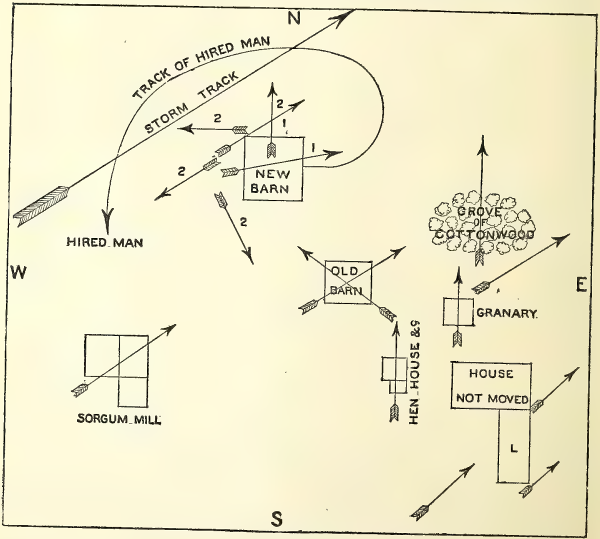
No. 6.

Two miles of fence were completely torn down; north and south fences were carried to the east and northeast, and those running east and west were carried to the south. In speaking of the atmospheric conditions preceding the storm, Mr. Turner stated that the weather was threatening, with a variable wind, during the day. About noon there was a slight sprinkle, with a brisk south wind. At 2 p. m. another rain came, accompanied with hail, the latter scattering but very large; the wind blew very violently from the south for a few moments. The weather was so excessively hot during the middle of the day and early afternoon that both Mr. Turner and his wife watched the clouds, being apprehensive of some terrible storm. About 3 p. m. two clouds were seen rising, one in the northwest and the other in the southwest, entirely different in form and appearance. The former was the darkest, heaviest, and broadest, having a clear, smooth surface, but intensely dark, and indicating heavy rain, while the latter was of a lighter cast, presenting the appearance of huge columns of smoke belching forth from a monster furnace, and suggesting the approach of a heavy wind-storm. These two clouds continually approached each other until columns of smoke appeared to ascend immediately between them.

The wind at this time was strong from the south and the heat suffocating. In a few minutes the funnel-shaped cloud appeared in the exact place where the column of smoke had before been seen ascending. The wind now changed to the southwest and the roaring was distinctly heard. Of course the funnel was well developed before they saw it, as their horizon was somewhat shortened by intervening hills and the apple orchard to the west. When the column of smoke was seen ascending, it was no doubt the effect of the rolling and whirling motion of the upper part of the funnel, for they judged its distance to be about 5 miles, which, under the circumstances, would necessitate a change of their horizon so as to shut out the lower portion of the funnel. When the cloud was distant about half a mile, all kinds of *debris* could be distinguished flying around in it in the most frightful manner, nearly paralyzing the anxious watchers with terror. It passed the house between 4 and 5 p. m., and as the southwest current struck the latter, the concussion and noise was as if a heavy cannon had been discharged near the building. During the destruction, which was almost momentary, the buildings and everything about them were enveloped in dark, whirling masses of smoke, so thick that it seemed as if they "could have been cut with a knife." The roar of the storm was deafening and drowned the noise from every other source; not even the crashing and grinding of the timbers of the new house could be heard, or the falling of a large tree against the south end of the log house, in which, as I have before stated, the family had resorted for safety, and where they were at that moment crouching in anxious expectation of a terrible fate. Said Mr. Turner, "No pen could possibly portray the awful scene or depict the indescribable terror and complete prostration of our physical powers during the short passage of the storm, but which seemed to us an age." The funnel now crossed the highway, and entered upon the premises of Mr. Henry M. Harman. His buildings stood about 40 rods northeast of Mr. Turner's, and just south of the storm's center. The house was a large frame one, standing 100 yards southeast of the storm's center, and on ground about 20 feet lower than the large barn. Its size was 24 by 26 feet, and 1½ stories high with an L attached to the south side, running north and south, 16 by 30 feet, and of same height. The L part was struck on the west side, the south end moving 15 feet to the northeast, and the north end 6 feet, before touching the ground. The west side and roof was then torn off and carried some 80 feet beyond the house and lodged in the orchard. The main part was not moved or injured, but a large stone chimney on the west end was cracked. The barn, the largest and strongest in the vicinity, 48 by 63 feet, 16-foot posts, with nearly all of its timbers 8 inches square, stood 30 yards southeast of the storm's center, and 70 northwest of the house. The entire building was moved on its foundation 4 inches to the east. It contained about 15 tons of hay and grain, besides a large number of heavy farming implements. The roof was completely torn off, apparently by piecemeal, and scattered along the storm's path for a distance of three or four miles. A heavy stone wall, forming the basement and the foundation upon which the barn rested, was cracked half an inch wide from top to bottom on the west side. A granary, which stood 50 feet north of the house, was carried due north and torn in two, the eastern half being scattered along the track to the northeast. In a grove of cottonwoods which stood 80 feet northwest of the house, the trees were broken or twisted off from 12 to 20 feet above the ground, and their tops carried to the north. An old barn, standing half way between the house and the large barn, 36 by 32 feet, and 12-foot posts, was entirely taken away down to the floor, and the *débris* carried to the northeast and northwest. The principal part of the *débris* of both barns went to the northeast, but some portions were found to the NW., W. SW., and SE. A hen-house and tool-shop 60 feet southeast of the old barn was swept clean from the ground and the *débris* carried to the north. A sorghum mill, which was situated 20 rods SSW., of the large barn was entirely destroyed and the *débris* carried to the northeast. Mr. Harman's hired man, James Baker, weighing 160 pounds, ran out of the large barn on the east side, as the storm struck it. After leaving the barn he was caught up by the wind and carried around the building by the north to the southwest, a distance of 125 yards, and landed unhurt but very dizzy.

When Mr. Harman came out of the house as the storm went by, to call the hired man, he noticed with considerable surprise, that Mr. Baker was coming toward him from the direction of Mr. Turner's. Upon questioning him as to his whereabouts and experience, Mr. Baker recollected of coming out of the barn, of being caught up and then set down again, but nothing whatever during the interval. (Diagram No. 7.) Two of Mr. Harman's sons were in a field 50 rods southeast of the barn as the storm approached, coming up hurriedly with a team and lumber wagon. After reaching nearly half way they unhitched the team and turned them loose, secreting themselves as best they could. The horses moved to the north, nearing the path of the storm, and when it passed both were stripped of their harness, which was literally torn to pieces. One of them was instantly killed and the other bled to death from ugly wounds received from the flying *débris*. A scantling 4 inches square and 10 feet long was found imbedded in the ground a depth of 3½ feet, at a distance of 45 rods northeast of the house. The soil was a black loam and rather easily penetrated after the tough sod had been cut through for 2 inches. A large red board taken from the barn, 16 feet long and 1 foot wide, was found 2 miles to the northeast, not broken or split, and the nails still in it. Regarding the time at which the storm passed, Mr. Harman stated that he called his sons from the field at exactly 4 p. m., because of the unusual appearance of the clouds in the west, but the tornado, which appeared to be about 2 miles away, came on so rapidly that the latter could not reach the house, as before stated. After all was quiet following the storm, Mr. Harman found that his clock had stopped at 4.05 p. m. Mr. John J. Swartz, living 1½ miles south of the storm's center, did not feel any strong wind, but while the tornado was passing it blew gently from the southwest. After the storm a very strong westerly wind, accompanied with rain and hail, prevailed for a few moments. Toward sundown the wind changed to the north, accompanied with heavy rain, which lasted nearly all night. Mr. G. K. Montgomery, 1¾ miles south of the storm's center, experienced a gentle wind from the southwest before the tornado passed, quieting down to a calm by the time it was nearly opposite him to the north.

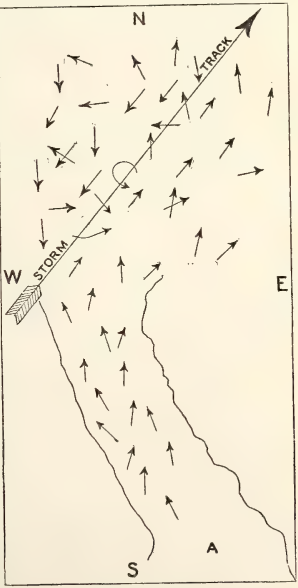
After leaving Mr. Harman's the funnel reached One Hundred and Two River, three-fourths of a mile to the northeast, up which it passed for 1½ miles, changing its course about 10° to the north. At the edge of the heavy timber lining the banks of the river, and 200 feet east of the storm's center, stood the house of Mr. J. H. Benson. The earth about the walls, which had been mixed with broken stone and pounded down solid, was blown out so as to form trenches several inches deep along the south end and west side. The house was not injured except by the branch of a tree, which was thrown through the west window. The barn stood west of the house and nearer the storm's center, but was not entirely destroyed, being moved off the foundation to the northeast, a distance of 8 feet. The two doors on the east side were torn off and carried to the north 150 feet. The timber north and west of the house was terribly broken up for a width of over 250 feet; trees from a few inches to 3 feet in diameter were uprooted, broken off close to the ground, or twisted into splinters. The prostrations on the east side of the storm's center lay pointing to the north and east, and on the west side to the west, northwest, and south. In crossing the river, which had very low banks on the west, but little raised above the bed of the stream and coinciding with the general level of the valley for one-fourth of a mile westward, the path of destruction widened out from 200 yards to one-fourth of a mile. The width of the forest along the river where the passage was made was from a mile to a mile and a half, the timber consisting of walnut, hickory, oak, elm, sycamore, and cottonwood. Trees from 6 inches to 2 and 3 feet in diameter were broken off like pipe-stems; where they were too tough to break easily they were twisted, always in a direction from right to left, until the trunk was splintered. On the outer edges of the path of destruction only the tops of the trees were broken off, and occasionally instances occurred where only the limbs on the inner half of the tree were taken; that is, the half nearest the storm's center. In many cases limbs 5 or 6 inches in diameter, and smaller were found wound around the bodies of the trees, always in the same direction, from right to left. The west side of the storm's path was narrower and more regular on its outermost edge than the east side, which was quite irregular, due to the presence



No. 7.

of swathes cut in toward the storm's center from the southwest and southeast, varying in width from 30 to 50 feet, and separated by intervals of from 200 feet to 40 rods. The east side varied from 80 to 180 rods in width, while the west side was at no place over 70 rods, and often as narrow as 25 rods. (Diagram No. 8.)

When the storm cloud reached within 1¼ miles of Barnard to the northward, which is situated on a considerable eminence east of the river, it turned to the northeast again, passing about 80 yards northwest of the house of Mrs. Sarah Goforth. The house was not much injured, although the wind blew very hard from the southwest. The barn, which stood 200 feet south of the house, had the south doors blown in, and otherwise considerably damaged. Several trees in the orchard north of the house were blown to the west. A north and south fence crossing the storm's track east of the house was thrown inward toward the center. From this point the storm passed through the timber for three-fourths of a mile up a gradual ascent to the northeast, and before passing the house of Mr. Francis Conlin, 1½ miles east of Barnard, it descended into a deep and heavily wooded ravine. In passing through this ravine the storm's center approached within 300 yards of Mr. Conlin's house, which was situated on the high ground to the southeast. The house was new and hardly yet finished; size 16 by 30 feet, and 1½ stories high. The wind first struck it at the southwest corner and moved it from its foundation 15 feet to the east, wrenching it out of plumb about 3 feet; the south end was thrown to the east and the north end to the west. The fact of its being constructed of heavy oak timber, and the cloud some distance to the northwest in the ravine, no doubt saved the house from total destruction. A granary 300 feet northeast of the house, but nearer the storm's center, containing 260 bushels of wheat, was completely torn to pieces, and all but 50 bushels scattered to the winds. Wheat was found the next day scattered along the storm's path for a distance of 2 miles, and over a width of from 30 to 60 feet. A corn crib standing near by, and containing 800 bushels of corn in the ear, was also demolished. The roof had not been found, and only 200 bushels of the grain were left upon the ground, the rest being carried along with the wheat. Between 200 and 300 chickens were carried away, only 9 of them returning after an expiration of fifteen days. The bodies of dead fowls were found about the fields and along the storm's center for a distance of 2 miles or more, stripped of their feathers and badly mangled. Several were found hanging by their heads in the tops of trees, and others were blown into the hedge fences. A large government wagon-box, covered with about 200 pounds of iron in the way of fastenings, was carried away from near the corn-house, and no portion of it afterwards discovered. Two sulky cultivators, weighing between 400 and 500 pounds each, were broken into pieces and portions carried to the east for a distance of one-fourth of a mile. An old log-house, 24 feet square, and standing 60 feet ENE. of the house, was only unroofed, the *débris* being carried to the northeast. A north and south hedge fence, east of the house 40 feet, was completely interwoven on its west side only, with *débris*. Mr. Bowman's log-house, 25 rods SSW. of Mr. Conlin's, and 250 yards east the storm's center, had its roof carried off to the northeast. An east and west hedge fence near the house was filled with *débris* on the south side only. Before proceeding further with the storm track, I will give the statements of several gentlemen living in or near the town of Barnard concerning their experience and observations upon the passage of the tornado.



No. 8.

The opportunities for making quiet and reliable observations upon the atmospheric conditions of the approaching storm were much better where the observer was removed a mile or so from the storm's path than where he was within the immediate influence of the furious monster, as under the latter condition he would be compelled to seek a place of safety for his life and property, and could not thereby observe the storm's effects with accuracy. The town of Barnard was removed from all danger of the storm, being situated upon the divide between One Hundred and Two River and Long Branch Creek, 1¼ miles north, and about the same distance east of the storm's center. It offered an excellent opportunity for observation, because from its elevation the storm cloud could be watched for miles before and after its passage. Dr. A. W. Bear stated that the 29th was a day of unusual warmth; the air in the forenoon was clear and the wind quite brisk from the south, from which point it had been blowing for several days. About 2 p. m. it began to cloud up in the west, wind still from the south, and the air growing more close. At 3 p. m. a very dark and heavy cloud was seen looming up from the northwest horizon, looking as if it might bring in a short time torrents of rain, while at the same time a decidedly different cloud was observed rising in the southwest, like smoke from a burning building, or, more nearly, some large straw-stack. The latter cloud rose much more rapidly than the former one, and was continually in commotion. By the time the two clouds had, to all appearances, reached each other (and at the same time moved nearer the city) the column of smoke proved to be a well developed tornado, having the form of a waterspout at sea. As it drew nearer, all kinds of *débris* were seen to be playing about in the whirl cloud, and a terrible roaring accompanied it. There seemed to be four well developed motions to the cloud, viz, upward through the center, downward on the sides, a twisting motion contrary to the hands of a watch, and a long wave-like motion from side to side. The latter motion was not as oft-repeated as the others, but at intervals of from two to three minutes. The large cloud in the northwest after the formation of the funnel was left in the rear, causing the rain and hail which it brought, to occur a few minutes later at each point than the time of the passage of the tornado. At the distance of 5 miles the funnel appeared to be 50 feet across at the top, 20 feet at the bottom, and 250 or 300 feet high, not perpendicular, but the lower part thrown forward at an angle of about 45° with the horizontal. Whenever it commenced to destroy objects upon the ground, the lower part spread out, sometimes as wide as the top and even wider, especially when it entered a belt of timber, where it had more of an opportunity to reach out and be drawn from one tree to another, and less chance for its dimensions to be wholly controlled by the opposing currents of air which formed the cloud. There was no rain or hail during the day until the occurrence of that which immediately followed the tornado, and which came with a northwest wind from the cloud previously referred to. It did not rain hard, but the hailstones were unusually large and scattering. About two hours after this precipitation, which lasted ten minutes, a very heavy rain followed, mingled with small hail; wind still from the northwest.

Dr. John S. McAdow, who resided at Barnard, but was, upon the day of the storm 8 miles northeast of the city, and about the same distance northwest of the storm's center, attending a patient, near Platte River, stated that at 2 p. m. the weather was exceedingly sultry, hardly any air stirring. At 3 p. m. dark clouds were seen appearing in the southwest and northwest, with the wind southerly at the surface. In about 20 minutes thereafter the wind changed to the northwest, coming with a dash that made the house tremble, and so cold as to cause every one to shiver, and endanger the life of his patient. In from two to five minutes rain and hail fell, the latter scattering and of unusual size; some of the hailstones could not be placed in a pint measure. The rain-drops were also very large and scattering. After precipitation ceased, alternate gusts of hot and cold air were felt from the south and northwest, and the whole horizon seemed to be lined with dark, heavy, threatening masses, but breaking away before the funnel appeared. In about twenty minutes after the black cloud had passed, which caused the first rain and hail, the funnel appeared by itself surrounded by almost a clear sky, which caused many to wonder at the unusual scene. Then in a few minutes a second but smaller funnel appeared about a mile in rear of the former, and moving parallel with it, but soon disappeared from view. The large funnel seemed to be bounding along, first rising, then falling; could easily distinguish that it whirled contrary to the sun, and as it drew nearer flying *debris* was apparent in the upper part of the funnel. For about an hour after it passed to the east, there was no prevailing wind, but a constant interchange of hot and cold currents, after which there came up a strong wind from the southwest, bringing heavy clouds attended by rain and hail. The fall of rain was exceedingly heavy, and the hail small but very thick. In half an hour it appeared to be clearing up, and the doctor started home. He had not gone far before he encountered a second storm, attended by the most terrific display of lightning and the heaviest peals of thunder that he had ever heard of or witnessed. The whole heavens were, at times, one sheet of flame, and then again traversed by a labyrinth of darting tongues of fire. Now and then, while urging his horse along at the highest speed, he would pass through a stratum of air so hot that it would nearly burn his face, and then again through a stratum that would make him shiver and draw his coat more closely about him. The storm lasted about three-quarters of an hour.

Dr. James W. Heath, of Barnard, watched the storm from his residence, which stood on about the highest ground in the town, and from which the surrounding country could be viewed for miles. Thursday morning, the day of the storm, opened bright and clear with a southerly wind, but the air close, as if heavily ladened with moisture. Early in the afternoon it began to cloud up in the southwest and northwest, with wind from the southwest, and very hot. The cloud in the southwest looked like smoke ascending from a burning building, the rising column vibrating from side to side. In a few minutes this vibrating column, as it drew nearer, proved to be funnel-shaped, after the pattern of a waterspout. This was beween 3 and 4 p. m., and the wind southerly; a few miles west of Barnard it was from the north. The tornado passed the town at 4 p. m.; could hear heavy roaring for a distance of 4 miles, and see the funnel rise and fall. As it came down to the ground it would spread out on the surface to a width of several rods, remain quivering and twisting for a moment or two, then rise and contract to a diameter of about 4 feet, not lifting itself directly up, but slowly gliding upward in a wavy motion from right to left, consequent upon the inrushing of warm air from the south. There was no rain or hail before the tornado, but it fell about ten minutes thereafter, with a westerld-wind. The hail was very large and scattering, some of them the size of a man's fist. They were also strangely shaped, some oblong, some flat like a saucer, and some nearly round and covered with cone-shaped crystals half an inch long. The doctor stated that a smaller funnel was seen to accompany the larger one in what appeared to be a parallel path but situated about two miles to the north of it and beyond the divide between One Hundred and Two River and White Cloud Creek. It continued in view for only a short distance, when it was lost in the timber. About dark a second storm of rain, and small, thick hail set in, continuing for an hour.

Mr. Jos. H. Blagg, 3½ miles southeast of Barnard, and 1 mile east of storm's center, stated that the tornado passed his house a little after 4 p. m. Before it came, he saw clouds in the southwest and northwest, but entirely different in appearance; the former were dusty and smoky, and in great commotion, while the latter were smooth, dark, and heavy. The wind at this time was in the southwest, and in about ten minutes, as the clouds approached nearer, currents of air were distinguished moving from the northwest and southwest. The southwest clouds were the highest and moved the most rapidly. After the funnel formed it was noticed that no objects were drawn into it from the northwest, but only from the south or southwest. Preceding and during the passage of the tornado, only southerly winds were experienced, but afterward had a westerly wind with rain and hail. Did not see any lightning in the funnel, or hear any thunder during its passage. There was a severe thunder-storm between 2 and 3 p. m., three miles northeast of Barnard; team killed by lightning.

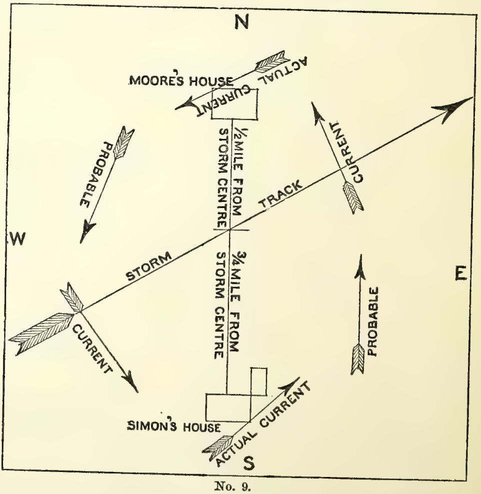
Mr. Alfred Ulman, 1 mile west of the storm's center, and 2½ miles west-southwest of Barnard, stated that before the tornado had a hot wind from the southwest, changing to south as the funnel passed, followed in about ten minutes by very large hail and large scattering drops of rain; wind northwest. It slacked up soon, and became almost calm, continuing so for half an hour, when there came up a dash of wind from the southwest. Mr. Ulman was out in the field plowing, when his attention was drawn to a startling appearance in the southwest, unlike any cloud formation he had ever seen, and in direct contrast to the northwest cloud, which looked like all storm clouds previously seen. The former resembled a column of smoke in great commotion, dusty masses tumbling about in the greatest confusion. The cloud above the funnel was light and fleecy, and looked as if the sun was shining throughout it.

Mr. William Barringer, 3½ miles southeast of Barnard, and three-quarters of a mile east of the storm's center, could easily distinguish that the funnel revolved contrary to the hands of a watch. While the tornado was passing, the wind from the southwest blew sufficiently strong to prostrate trees and fences, all of which were carried to the northeast. After the storm, there was rain with a southwest wind, but no hail. Two miles east of his place, the southwest wind was still strong enough to demolish fences.

Mr. G. W. Campbell, 2 miles south of Barnard, and half a mile southeast of the storm's center, stated that a strong southwest wind, which prevailed during the tornado, blew down one-fourth of a mile of north and south fences to the east. A piece of boxing 8 feet long was found near his house, carried from Mr. Harman's, 2½ miles to the southwest.

Mr. George Simons, 2½ miles east-southeast of Barnard, and three-quarters of a mile south of the storm's center, was first attracted to the presence of the storm by shingles, broken pieces of timber, limbs of trees, clothing, and leaves falling down in circles in his yard, there being at the time a gentle wind from the southwest. It did not rain or hail during the day, but was very threatening in the west the entire afternoon, which was followed during the evening by a light shower of rain, with the wind from the south.

Mr. George H. Moore, 3 miles east-northeast of Barnard, and half a mile north of the storm's center, stated that while the tornado was passing he felt a strong wind from the northeast. It did not appear to come direct, but moved in a circle, carrying *débris* of all kinds, and dropping it in his yard in eddying whirls. There was no damage done at this place. Before the tornado the wind was so strong from the southwest that Mr. Moore thought his house would blow over, and therefore directed his family to go into the cellar. Half an hour after the funnel passed, rain and hail fell, with a southwest wind. It is of importance to draw a comparison between the falling of *débris* at this place, half a mile north and west of the storm's center, and at the house of George Simons (previously mentioned), three-quarters of a mile south of the storm's center. At the former place the *débris* fell with a northeast wind, moving in a circle, and at the latter it fell with a southwest wind, in whirls. One place was 3 miles east-northeast of Barnard, while the other was 2½ miles east-southeast, on opposite sides, of the track, and, as the effects prove, were under the influence of the same whirl from right to left, one on the northern and the other on the southern edge of it, making the diameter of the whirl at this point 1¼ miles, and the south side of the track one-fourth of a mile wider than the north, as shown in the following diagram. (Diagram No. 9.)



No. 9.

Mr. Andrew Baker, one-fourth of a mile north of Barnard, and three-fourths of a mile west of the storm's center, reported a light wind from the southwest while the tornado was passing; when opposite him to the northeast rain and hail fell.

Mr. W. H. McGuire, three-quarters of a mile northeast of Barnard, and half a mile west of the storm's center, reported that the wind was from the south before the storm, but while it was passing seemed to blow from every direction. After the tornado the wind changed to the west. About 3 p. m. a black cloud was seen to rise in the southwest and move around to the northwest, bringing the first rain and hail and attended by thunder and lightning. Then a smoky-looking cloud arose in the southwest, which proved to be the funnel, but was not accompanied by lightning.

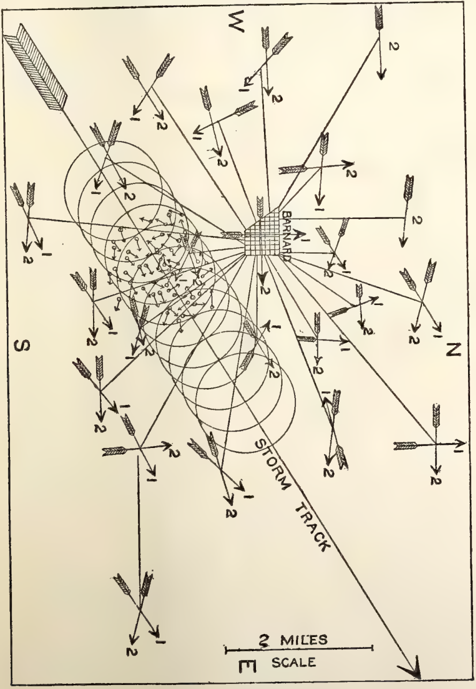
Capt. James A. Forrest, a merchant of Barnard, stated that he saw distinctly a second and smaller funnel accompanying the larger one, and while the latter passed Barnard on the south the former passed it 4 miles to the north, but did not at any of the time appear to reach the ground. The larger one passed Barnard first, and as it approached the Platte River, 5 miles to the east, it appeared to halt for an instant, many persons feeling certain that it was coming back to the town. While in this position the smaller funnel was seen to deviate from its course and bend towards the larger one, which immediately moved up to meet it, when the smaller funnel instantly disappeared from view, drawing up its tail into the surrounding clouds and mingling its whirl with the larger one.

Mr. Thomas M. Jobe, 3½ miles northeast of Barnard, experienced a strong wind from the southwest while the tornado was passing. There was no damage done. Very large hail fell a few minutes after the funnel passed. Roaring was distinctly heard.

Mr. James Trother, 2 miles north of Barnard, did not feel the influence of the storm. Heard the roaring and could see the funnel, about 4 miles distant, the *débris* flying about in it. Had rain and hail with a northwest wind after the tornado passed.

Mr. P. G. Briggs, 2½ miles southeast of Barnard and half a mile east of the storm's center, had six apple trees blown down to the east and southeast and a quarter of a mile of north and south fence carried in the same direction.

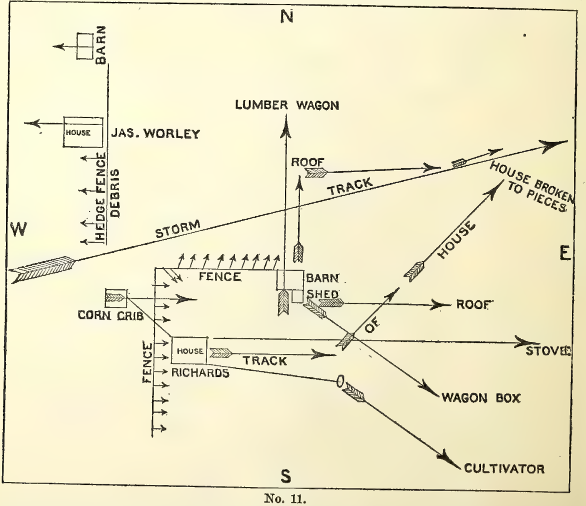
Mr. W. H. Elliott, photographer at Barnard saw from his gallery window the funnel when about 2 miles to the south. It was very regular in shape, and of the form of a balloon, gyrating contrary to the hands of a watch and filled with flying *débris*, which seemed to be thrown out only at the top. While the tornado was passing the air was quite still, now and then large hailstones falling to the ground. One near the flour-mill weighed seven ounces and several were picked up in the street weighing from three to four ounces. They were in appearance quite smooth and flattened at both ends like an apple. After the tornado passed the wind blew very strong from the southeast, and in about one hour a very heavy storm of wind, rain and hail came from the west which continued far into the night.



No. 10.

In connection with giving in writing the positions, observations and effects of the storm at many places in the vicinity of Barnard, I have prepared a map showing more distinctly than by words the directions of the wind during and after the storm at the several places. The arrows show the direction of the movement of the wind and the figures indicate the time at which the direction was observed, No. 1 during the storm, and No. 2 after it had passed. The large arrow shows the center of the storm's track, and the circles about it the path of greatest destruction, which represents a section of the latter through the heavy timber lining the banks of One Hundred and Two River, south and east of Barnard. The small arrows within the circles indicate the direction in which the trees were thrown. (Diagram No. 10.)

Resuming the description of the course of the funnel from Mr. Conlins, we pass on to the house of Mr. C. C. Robinson, but occupied at the time by Mr. Guilford Richards. The building stood on high ground, above the edge of the timber overlooking Long Branch Creek to the east, and 750 yards south of the center of the storm. Size, 16 by 26 feet, and 1½ stories high. The storm struck the west side of the house first, between the hours of 4 and 5 p. m. It lifted it bodily from the foundation, and carried it first 20 feet to the east, then 40 feet to the northeast, then again 30 feet further in the same direction, when it broke to pieces and was scattered along the track through the timber for a distance of about 3 miles. The barn, 100 yards north-northeast of the house, had its roof carried to the north 60 yards, broken to pieces and scattered along the track. The northeast corner of the building was moved 1 foot to the north. A hay roof upon a shed attached to the south side of the barn was carried off to the east. A corn-crib made of poles, and standing northwest of the house 50 yards was half torn down and carried to the east. A north and south fence northwest of the house was blown down to the east, and an east and west fence northeast of the house was blown down to the north. A sulky cultivator, weighing between 400 and 500 pounds and standing east-southeast of the house 50 yards, was carried one-fourth of a mile to the southeast and broken to pieces. A stove was carried out of the house 40 rods to the east and destroyed. A lumber-wagon standing in the shed attached to the barn was carried 75 yards to the north with very little injury, while the box upon it was carried 60 rods to the southeast and torn to pieces. Two heavy iron-bound trunks filled with clothing were carried one-fourth of a mile east into the woods, completely torn to pieces, the clothing torn in shreds and scattered among the branches of the trees; some of the garments were carried 2 miles east to the Platte River. One sill of the house, 10 inches square and 16 feet long, was carried 40 rods to the east. Several school books were found near the Platte River, 2 miles east. (Diagram No. 11.) A bed



No. 11.

was found slightly injured a half mile to the east, and a dog was carried 1 mile in the same direction without apparent injury. Mr. Richards stated that he saw the cloud when about 1 mile distant to the west, its top being filled with flying *débris*, but near the bottom it was so intensely black that he could not distinguish any objects within. The cloud had the appearance of an elephant's trunk, looked to be about 100 yards wide at the top and 30 yards at the bottom. Could easily discern that it was whirling and that the movement was against the sun. There was no lightning in the funnel, but the roaring was terrible, almost shaking the earth. Some rain and hail fell as the tornado passed, but the largest quantity fell some minutes later. The wind was blowing towards the funnel as it came up and for a few minutes thereafter, when it changed to the northwest, with rain and hail, cooling the atmosphere considerably. The width of the path of greatest destruction was 125 yards, but damage was committed upon trees and fences one-fourth of a mile to the south of the storm's center, and about 40 rods north.

Mr. James Worley, 250 yards northwest of Mr. Richards's and 75 yards north of the storm's center occupied a house 16 feet square, with an L on the north end 8 by 10 feet. The latter was moved 2 inches to the west. A hedge running north and south along the road and to the south of the house was filled with *débris* on its west side only. A corn-crib and hay-roof barn, 60 feet north of the house, were partly blown down to the west, but only the hay was carried away. Several oak trees southeast of the house had some of the limbs twisted about their trunks in a circle from the east by north to the west.

At Mr. J. W. Thompson's, 1 mile east of Mr. Richards's and south of the storm's center, a smoke-house and a few fruit trees were blown down to the east. This occurred while the funnel was nearly 100 feet above the ground.

Mr. Sanford Rhodes, one-fourth of a mile northeast of Mr. Richards's and west of the storm's center, whose house stood considerably below the latter's, in the heavy timber of Long Branch Creek and three-fourths of a mile west of the creek, had the roof taken off from the kitchen which was attached to the west end of the house, and the *débris* carried to the northeast. All of the fencing about the house was carried in the same direction.

Mr. Richards's house was the last one destroyed by the tornado, it lifting from the ground immediately thereafter, sweeping through the tops of the dense timber lining the wide ravine of Long Branch Creek. The funnel cloud passed south of Mr. Rhodes's house about 20 rods, and tore down the timber for a width of 110 yards in the worst of its path, but some trees were prostrated over a width of one-fourth of a mile. It was plainly evident, from the manner of the destruction, that the funnel did not reach the surface while in the timber, for the trees were generally broken off or twisted at a height of from 10 to 30 feet above the ground. Many had only their tops whipped off, or limbs twisted about their body. A few were pulled up by the roots. This destruction was only continued for about half a mile, when the funnel rose entirely above the timber in the deepest part of the ravine (150 feet below Mr. Richards's in a gradual descent), passing over the houses of Messrs. Kinsey and Mercer without doing the least damage, and over a succession of densely wooded ravines to the Platte River, a distance of 1¾ miles.

Mr. David Freeman, half a mile east of the Platte River, stated that the funnel passed above the ground to the south of him, doing no damage except prostrating a few trees in his orchard. The wind was strong from the southwest.

Mr. James Groves, 2½ miles east of the Platte River and 2 miles northeast of Guilford, on the high prairie, stated that the tornado passed over his house with a terrible roaring, rushing noise, but it was so high that it did no damage, although the wind blew very strong from the southwest in the wake of the cloud. Could distinguish *débris* flying about in it, but the cloud had not a well defined funnel form, as it appeared to be losing its identity in the dark masses of overhanging clouds. Mr. Groves's position upon the high prairie was such that he could see a distance of 10 miles, and after the tornado had passed him he watched it until it was lost from view, during which time it did not descend to the ground or make any dips downward, nor had he heard of its doing so beyond that point. The funnel after leaving Mr. Conlins turned due east to Mr. Richards's, where after lifting from the ground it gradually resumed its northeast course, passing 1½ miles northwest of Guilford.

Mr. W. H. Stevens, of Guilford, stated that the storm passed his place about 5 p. m. Could see that the cloud was funnel-shaped, and heard the roaring distinctly. During its passage there was a strong wind from the southwest which blew down some fences and the tops from several trees, but did not endanger the buildings. After the funnel had passed about five minutes, rain and hail fell with a westerly wind, lasting for twenty minutes. The precipitation was not heavy, but the hail was unusually large, and like rough chunks of ice.

Mr. H. Craig, 1½ miles north of Guilford, stated that the funnel passed along above the ground, a short distance north of him. Twenty small shade and fruit trees near the house were blown down by a strong southwest wind, but no damage was done to the house. One mile of fence was prostrated; that which ran north and south was carried to the east, while that running east and west was blown to the north. The heaviest wind lasted about fifteen minutes. The storm cloud did not seem to be moving very rapidly, nor was its funnel shape very well defined, but the roaring was exceedingly heavy.

Mr. James O'Donnell, 2 miles southwest of Conception, 3½ miles north-northeast of Guilford, and 1¼ miles north of the course of the tornado, stated that a rain and hail storm, with a strong north wind, prevailed at his house about 5 p. m., the rain continuing at intervals for one and a half hours. The hail was unusually large and broke all of the windows on the north exposure. Did not see any funnel-shaped cloud, or hear of any destruction in his vicinity, but at Conception there was a heavy storm of rain and hail from the north, soon after 5 p. m.

This completes the investigation of the Barnard tornado, which lost its identity as such after passing Mr. James Groves's, situated half way between Guilford and Conception, who watched it, as before stated, for a distance of 10 miles to the east of him. It gradually disappeared in the clouds, losing its funnel form, but the rain and hail, with which it first made its appearance, still continued, which fact would carry the storm about 5 miles into the northwestern corner of Gentry County and possibly into the southern portion of Worth County.

The distance traversed by the tornado from the Nodaway River, between Andrew and Holt Counties, to the northwestern corner of Gentry County, including some irregularities in its course, was about 36 miles. The time occupied in making this distance could not easily be determined, as many persons in the course of the storm had no clocks, and those who had considered the time of no importance, or were so frightened that they were at their wits' end to provide means of safety for life and property. Throughout the whole track of the storm, as far as obtaining information was concerned, the people knew the least of anything with reference to the important element of time. However, placing the time of the funnel's starting at Nodaway River at 3.30 p. m. (which by reference to the reports in that vicinity it will be seen can be considered a safe judgment), and the time of reaching the Gentry County line at 5.10 p. m., the velocity of progression would be 1 mile in 2.8 minutes, or about 21 miles per hour. The course of the storm from the Nodaway River to the northern boundary of Andrew County was due northeast; here it turned to the east for about 1 mile, resuming again its northeastern course until it reached One Hundred and Two River, when it turned to the north-northeast for three fourths of a mile, then east again 1 mile to near Long Branch Creek, continuing thereafter without deviation to the northeast throughout the remainder of its course.

GENTRY COUNTY TORNADO.

This storm, which proved to be very destructive for a short distance, did not come under my notice until I had completed every preparation, even to purchasing a ticket, to leave the northern counties of Missouri. Although I had made diligent inquiry during my stay at Barnard and vicinity respecting the occurrence of storms in the neighboring counties, no intimation of this disturbance came to hand. I had received considerable information while investigating the "Barnard tornado" concerning a severe storm of wind, rain and hail during the 30th, between 9 and 10 p. m., which passed through portions of Nodaway and Andrew Counties from the northwest, causing a large destruction of property. All people spoke of it as a straight wind, and did not mention, or leave room for inference, that it had developed into a tornado in Gentry County to the east. My first definite information was received from Mr. E. V. Leonard, of Island City, Gentry County, who drove into Barnard just as I was leaving. Hearing of his arrival, and hoping that he might give me some valuable facts from that section, I hastened to confer with him, and found, to my surprise, that a so-called tornado had commenced its ravages near the headwaters of Island Creek, about 4 miles west of Island City. Taking this fact in connection with the many reports of a heavy storm of wind and rain between Island City and Barnard that I had received, the development of the tornado seemed much more clearly defined and I therefore made preparations to obtain the best information available.

Mr. W. H. Elliah, of Barnard, stated that on the eve of the 30th, between 9 and 10 o'clock, the town was visited by a very hard rain and some hail from the northwest. Wind was very strong, but did no damage within city limits.

Dr. Joseph Heath, of Barnard, stated, on May 30th, the day of the Kansas storms, it was very hot but clear during the forenoon, with a southerly wind. After dinner it began clouding up in the west, and about 9.30 p. m. an exceedingly heavy wind and rain storm came from the northwest, continuing all night, washing away bridges, flooding fields, and doing great damage to property. The wind blew violently from the northwest for about 20 minutes, during which time much of the destruction oc-

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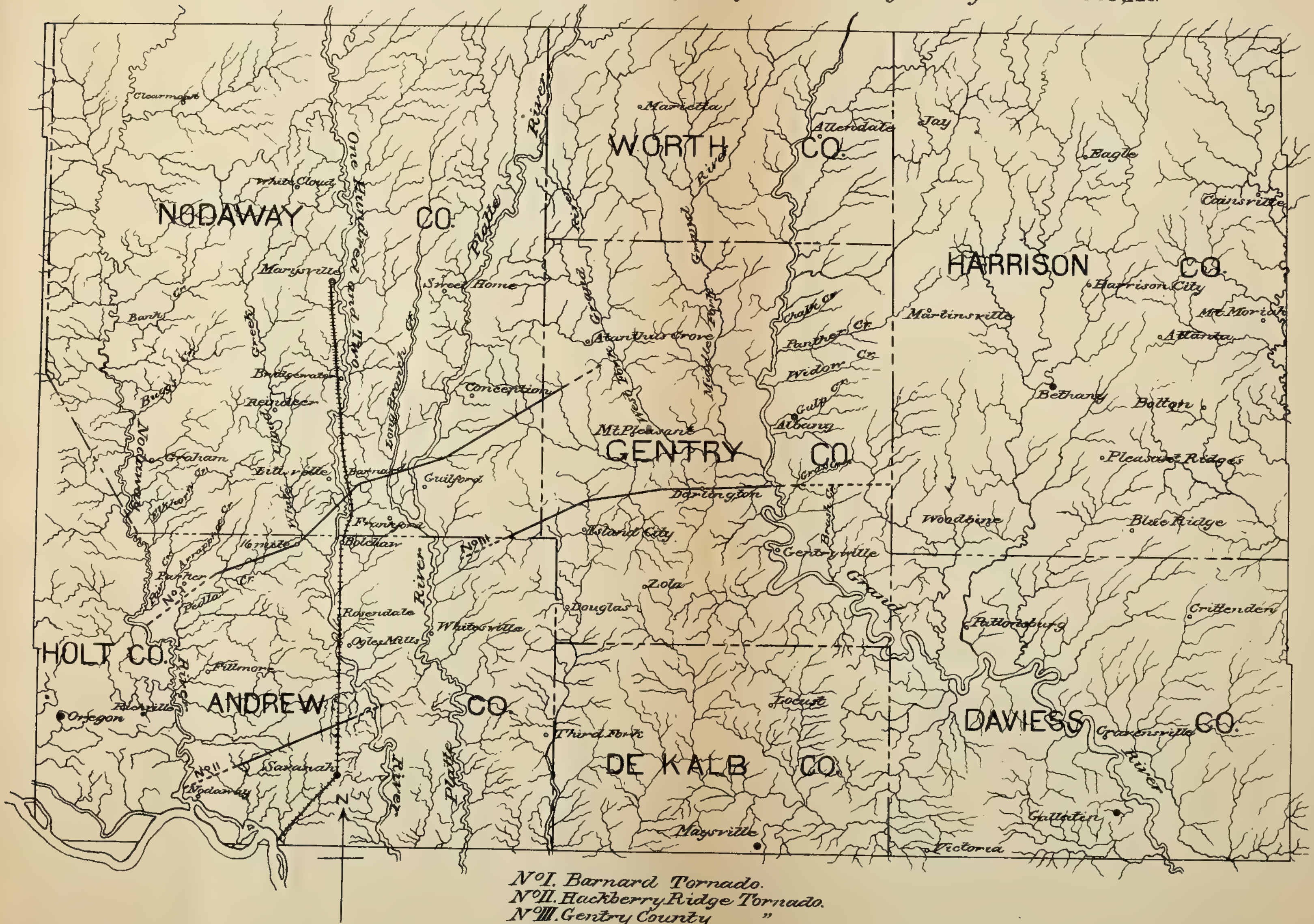
Exhibit A.

Map of the Track of the Barnard, Hackberry Ridge and Gentry County Tornadoes, Mo.



N^o^I. Barnard Tornado.
N^o^II. Hackberry Ridge Tornado.
N^o^III. Gentry County "

curred. The hail was large in size and quantity, and struck like rocks against the houses, breaking all the windows on the north and west exposures.

Mr. H. Craig, 1½ miles north of Guilford and 7½ northeast of Island City, reported occasional showers nearly all day, but no heavy wind or rain.

Mr. John H. Moore, 3 miles ENE. of Barnard and 11 miles northwest of Island City, experienced a heavy rain and hail storm between 8 and 9 p. m. from the WNW., continuing for about one hour. Considerable timber was blown down and much damage done to fences. The hail was in larger quantities than on the 29th, but much smaller.

Mr. Thomas M. Jobe, 3½ miles northeast of Barnard, experienced a very heavy storm of wind and rain about 9 p. m. from the northwest. It blew down some fencing, but three-fourths of a mile to the southeast, on Long Branch Creek, the timber was fearfully demolished.

Mr. James Protten, 2 miles north of Barnard, stated that about 9 p. m. there fell the heaviest rain for many years, considerable hail, but small. The wind blew exceedingly strong, first from the west and then from the northwest. Storm continued for five hours. Five trees in the southeast corner of his orchard were torn up by the roots and carried for several rods to the southeast.

Rev. Samuel Huffman, of Savannah, Andrew County, stated that it rained during the morning, but cleared off in the afternoon and remained pleasant. No storm in the evening, but warm southerly winds.

Mr. William Kaucher, at Oregon, Holt County, reported strong southerly winds during the forenoon, with light rains at 10 a. m., and a very heavy thunder storm, wind changing to west from 7.30 to 9.30 p. m. Hail commenced at 8 p. m. and ended at 8.20 p. m.; precipitation during last storm, 1.51 inches.

Mr. Joseph O'Donnell, 3 miles west of Conception, in Nodaway County, experienced a heavy rain storm from the northwest, but no hail; wind very strong, but no damage done.

These reports furnish indubitable evidence, that preceding the tornado formation and for a distance westward to the Missouri River, there prevailed an unusual storm of wind, rain and hail. In the neighborhood of the towns of Guilford, Barnard, Maryville and Mahan, north of Andrew County, it came from the northwest and was the heaviest, while at the towns of Forrest City, Oregon, and Fillimon to the southward, the storm was not so heavy, and came more from the WSW. and SW. At Savannah and Saint Jo, still further south, no rain fell at the hours previously mentioned, but the weather was fair and warm; southerly winds prevailed. At Saint Jo a very heavy storm of rain and hail from the west occurred during the middle of the day, but it cleared away before evening, wind changing to the south. With these peculiar and characteristic conditions north and south and just westward of Island City, we may safely connect the subsequent development of the tornado in question, which first appeared near the source of the western branch of Island Creek, and passed ENE., crossing the northern branch 2½ miles north of Island City, demolishing the small house of a herder on the open prairie and uprooting several apple trees on the farm of Elliott Rose, half a mile further east. No lightning attended the cloud here, or was reported as seen at any other point in its course. Rain and hail fell a few minutes after it passed. From this locality the storm left no evidence of its course upon the high open prairie for a distance of 2 miles, when it encountered heavy timber upon the numerous southern branches of Wild Cat Creek, and commenced, for the first time, to display its terrific power. The largest trees were twisted off near the ground, uprooted, or broken off, and lay with their tops pointing in a circular direction from right to left within the central path of greatest destruction. Those on the south side of the center were pointing to the east and northeast, and even northwest when very near the center. On the north side they were pointing northwest,-west, southwest, and southeast.

Mr. Pravers, correspondent of the Kansas City Journal, who was ordered to report upon the storm to that paper, and Mr. Leonard, of Island City, both positively assured me that the cloud in all instances whirled from right to left, that it was funnel-shaped, and in every respect a complete tornado. The latter stated that the roaring could be heard for several miles, and sounded like an approaching train of cars. The noise seemed to greatly increase in intensity upon entering the timber, and somewhat diminish when reaching the open prairie. In this portion of the county there was presented a constant alternation of open prairie and heavy timber, which conditions continued for a distance of 5½ miles, until the town of Darlington, consisting of three houses and one blacksmith shop, was reached, distant 5 miles southwest of Albany, the county seat of Gentry County. All of the buildings were demolished except one, the small land office of Captain Pomeroy. The tornado continued to encounter high prairie and timber for a distance of 4 miles farther eastward, when it struck the house of Lewis Campbell, on the western side of Grand River, and north of the storm's center, lifting it from its foundation and carrying it 20 feet to the southeast. In crossing the river at Greenwell Ford, 4 miles south of Albany and 4½ miles east of Darlington, it lifted the new iron bridge, of 160 feet span and weighing 120 tons, from the stone pier upon which it rested, carrying it into the bed of the river without overturning. The structure was strongly bolted to the abutment at one end, while the other end rested on rollers at the opposite abutment to allow for the expansion and contraction of the iron stringers. The bridge had just been completed at a cost of $4,200 and was still in possession of the contractor, waiting for a small portion to be painted. It was damaged to the extent of about $1,500. As the tornado struck, its oak timbers, 14 inches square, were broken asunder, the whole structure lifted bodily and deposited as above stated. The tornado now crossed the heads of Grass and Brush Creeks, meeting with but a few small outbuildings, some hay-stacks, and fences, disappearing from the high rolling prairie towards the southeast corner of Harrison County, having traveled a distance of about 22 miles. The course of the tornado was due northeast until it reached the north branch of Island Creek, when it became ENE. for a distance of 6 miles, turning directly east at Darlington, and continuing in that direction until it reached Grand River, after which it resumed the ENE. course again.

I could obtain no data from which to ascertain the velocity of progression. The storm began, as reported from the vicinity of Barnard and Guilford, about 9 p. m., and some time before 10 p. m., or what was called the early evening, it had reached Darlington, a distance of 21 miles. In all probability it traveled about 20 miles per hour. In its path it traversed alternately hills and valleys, doing similar damage in both, and maintaining a perfect disregard of topography in order to preserve its characteristic course. That its course was more easterly than many of its companions was due, not to the peculiar features of the surface over which it traveled, but to the fact that the formation of the tornado cloud was preceded by a very heavy northwest wind, which, on meeting the southerly current, overcame to an unusual degree its northerly tendency, causing the tornado to pursue a course the resultant of the two forces. Not one of the other tornadoes came up with as great a contrast between the force of the movements of the warm and cold currents, or, in other words, the northwest and southwest clouds.

HACKBERRY RIDGE TORNADO.

This storm traversed a region of country known as Hackberry Ridge, taking its name from a species of North American tree of considerable height and great beauty, also called sugar berry, nettle tree, and hoop ash. The Ridge covers a tract some 7 miles in width and 12 miles in length, forming a succession of small depressions and elevations in the central portion of Andrew County, between the Nodaway and Missouri Rivers on the east and south, and One Hundred and Two River on the west. It rises considerably above the general level of the immediate surroundings, and is therefore called a ridge, yet it is not considered by the inhabitants thereabout as a "divide," which latter rises more abruptly and is generally free from timber, its surface forming a high prairie. The tornado appeared as a well developed funnel-shaped cloud on the afternoon of May 29th, coexistant with and pursuing a path parallel to the Barnard tornado, but about twelve miles farther south. It very probably originated from the severe thunder and hail storm that prevailed to the south of Oregon, Holt County, on that afternoon, as reported by Mr. Kaucher, Voluntary Observer Signal Service U. S. A., who also reported a second hail storm to the north of the same place, but not covering so wide a track and occurring little later in the day. This reference to its origin is rendered even more probable from the fact that the region over which the hail storm began its depredations lies directly west of the commencement of the tornado path. The funnel clouds crossed the Kansas City, Saint Jo and Council Bluffs Railroad between Savannah to the south and Rosendale to the north, 2 miles north of the former and 6 miles south of the latter. The timber on both sides of the track was considerably damaged, although it was evident from the tree tops, which were only broken off or twisted about the body of the trees, that the funnel did not reach the ground. A large branch from one of the trees was carried upon the track, delaying for some time the 4 p. m. southern-bound mail train.

Mr. C. S. Pickett, 3 miles east of Savannah and about the same distance south of the track, stated that during the day up to 3.30 p. m. it was very sultry, with a southerly wind. At 4 p. m. the wind changed to west and then northwest, and black clouds arose in the southwest and northwest, whereupon it began to rain and hail with a northwest wind; the stones were unusually large and scattering. After continuing for about ten minutes the wind changed to southwest and the tornado appeared, moving at a considerable height above the ground. The roaring could be plainly heard, sounding like an approaching train of cars. The cloud was intensely black and resembled an elephant's trunk, but greatly magnified. Considerable timber was blown down north of Mr. Pickett's, the path of greatest destruction being 150 yards in width; no buildings were injured.

Rev. Samuel Huffman, Methodist minister, at Savannah, stated that at about 4 p. m., it rained and hailed with a northwest wind on the afternoon of the 29th, lasting about fifteen minutes. Heavy and unusually threatening clouds were observed in the northwest and southwest just before the rain, after which the wind changed to southwest, when a terrible roaring was heard in that direction. Did not go out to see the tornado. The wind continued high from the southwest for about 25 minutes. It was excessively warm during the day with a southerly wind, which conditions, amounting almost to a drought, had continued for several weeks. Farmers in every direction were complaining that their crops were dying for want of rain, and that the ground was so dry that it could not be cultivated.

Mr. Dudley Messick, over whose farm the Barnard tornado passed, also saw this funnel cloud to the south of his place about 10 miles, as he judged, he at the time saying that it must be passing along Hackberry Ridge, which statement he afterwards corroborated by a personal examination of the track. There were no buildings injured, the storm pursuing a path entirely confined to the timber, which it did not destroy as savagely as did its companion to the north. Mr. Messick saw the one on Hackberry Ridge first, and had been watching it for several minutes when the Barnard storm came into view. Heard the roaring of each storm distinctly, but considered the one to the south of him the smaller and less severe, which it proved to be.

Mr. Jackson Smith, who lives 2 miles southwest of Mr. Messick's, also witnessed a funnel-shaped cloud passing to the south of him in the direction of Hackberry Ridge. It seemed to be above the ground most of the time, did no damage except in the timber, and remained in sight but a short time, when it disappeared in the overhanging clouds.

Dr. Heath and Captain Forrest, of Barnard, also witnessed this funnel cloud in connection with the Barnard tornado, both of which moved in paths parallel to each other, and with the same apparent velocity of progression; but the latter was considerably the larger and manifested more power, even when judging of its force at a distance of 5 miles. The course of the Hackberry Ridge tornado was from southwest to northeast, extending a distance of over 10 miles. It commenced its destruction in the timber and on high ground, ending under similar conditions. I could not ascertain the velocity of progression, as reliable time, or, in fact, any time, could not be obtained, very few people taking any notice of it, the funnel cloud being much smaller and less destructive than its companion.

THE TORNADO TRACKS.

It may be well, for the purpose of avoiding any misapprehension or doubt concerning the identity of the several tornadoes, to state briefly, in connection with the data presented on the several topographical maps, their relative positions and times of appearance and disappearance.

Commencing in the extreme western portion of the region traversed by these storms, we find the first manifestations of the "Lincoln County tornado" as given at 2.30 p. m. of May 30th, ending at 3.30 p. m. At no point in its course was it less than from 12 to 14 miles from its nearest companion.

"Buffalo Creek tornado": Track, 30 miles north of the "Lincoln County tornado" and 18 miles northwest of the terminus of the "Delphos tornado"; commenced about 3 p. m., ended about 3.30 p. m.

"Delphos tornado": Track, 12 to 18 miles east of the "Lincoln County tornado"; began at 3 p. m., ended at 4.25 p. m.

"Pipe Creek tornado": Track, 8 to 10 miles east of the "Delphos tornado"; began at 4 p. m., ended at 4.30 p. m.

"Wakefield tornado": Track, 36 miles east of the "Delphos tornado," 12 miles south of the "Irving tornado," and 15 miles northwest of the "Stockdale tornado"; time of beginning and ending, between 5 and 6 p. m.

"Stockdale tornado": Track, 14 miles southeast of the "Irving tornado"; time of beginning and ending, between 6 and 7 p. m.

"Waterville tornado": Track, 12 miles northwest of the "Irving tornado"; time of beginning and ending, 6 to 6.30 p. m.

"Irving tornado": Began at 4.15 p. m., ended at 7.10 p. m.

"Clarinda tornado": Track, 40 miles east of the terminus of the "Irving tornado," and about 30 miles north of the "Barnard tornado"; time of beginning and ending between 2 and 2.30 p. m.

"Gentry County tornado": Commencement of track 12 miles southeast of the "Barnard tornado" and 14 miles north-northeast of the terminus of the "Hackberry Ridge tornado"; time of beginning and ending between 9 and 10 p. m.

"Lee's Summit tornado": Terminus of track 50 miles south-southeast of the "Gentry County tornado"; began at 5.30 p. m., ended at 7.30 p. m.

MAY 29.

"Barnard tornado": Track, 12 miles north of the "Hackberry Ridge tornado"; began at 3.30 p. m., ended at 5.10 p. m.

"Hackberry Ridge tornado": Track, 12 miles south of the "Barnard tornado"; time of beginning and ending between 3 and 4 p. m.

Considering these facts in connection with others which appear throughout all of the storm descriptions previously given, limiting the tornado's influence from one-half to three miles outside the immediate path of the central cloud, it will not be difficult to comprehend the individuality of each tornado.

THE VELOCITY AND FORCE OF THE WINDS.

In trying to obtain factors upon which to base calculations respecting the pressure and velocity of the wind's action upon heavy objects, many difficulties were encountered. Buildings that had been partially destroyed or moved from their foundations were found to have been rebuilt or straightened up, and the *débris* so removed and changed about from its position as the storm left it, that it required unusual precaution in conducting any investigation, which at best would not give sufficiently reliable data.

It was always of prime importance to ascertain definitely, which side or end of a structure or object was first struck by the wind, in order to determine the configuration and inclination of the exposed surface, but such examination was rendered next to impossible by the celerity with which the devastated districts had recovered from the shock of the storm and the lateness at which I arrived at the different storm tracks.

Objects that were reported to have been carried certain distances, could rarely be satisfactorily examined on account of their removal or change in form and position since the storm.

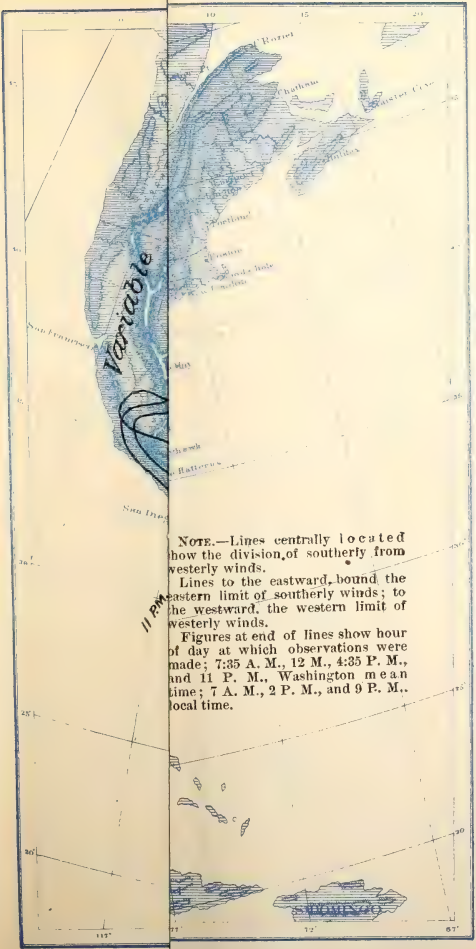
Not one of the cases which I could enumerate, satisfactorily expresses a near approximation to the actual wind velocity manifested in its destruction, and particularly the force exerted within the vortex of the whirling cloud. The center of the storm cloud as near as I could ascertain, very rarely, if ever, came directly in contact with large objects except the timber in forests, where its manifestations could be studied with any important results. Some very interesting and valuable conclusions might in all probability be reached regarding this question by a special examination into particular cases of twisted or broken trees.

Because of the untoward circumstances above enumerated, I have thought it inexpedient to present even a few of the calculations I have made, giving a velocity of from 80 to 150 miles per hour, from a fear of misleading rather than aiding a comprehension of the tornado's power.

Quite as satisfactory and even a better idea can be secured from a perusal of the several storm descriptions, where considerable care has been taken to give correct dimensions and distances.

WIDTH OF THE PATH OF DESTRUCTION.

This varied constantly at different points in the storm's track, ranging from 60 feet to 90 rods, which estimate does not include the boundaries within which anything, however small or weak was blown down, but the path immediately described by the storm cloud. The violent whirl of the air about the cloud as it progressed forward, diminishing in force as distance from the center increased, would throw down fences, break off the tops of trees, or unroof small buildings at a distance of from 1 to 2 miles. The funnel-cloud corresponded very closely in its dimensions with the path of greatest destruction. Whenever it descended to the ground its base broadened to a variable width, and with it the path of violence, which again contracted proportionate to the height of the cloud above the ground. The apparent height and comparative width of the top and bottom of the funnel-cloud were variously estimated by the different observers, their results depending upon their relative positions respecting the cloud and their consequent angle of vision. For their statements reference will be made to the various storm descriptions. Very few who were directly within the storm's path could intelligently observe the various effects, as their whole attention was directed to efforts for protection and many were paralyzed with fear. The comparative width of the sides of the storm track was a matter very often brought to my attention. The left or west side was always the narrowest, and, unless within the limits of the path of greatest destruction, the force manifested was always the weakest on this side. I inquired repeatedly if any one experienced strong inward rushing currents on this side which were often mentioned as occurring on the opposite side, but always received a negative answer. The west side was generally from one-third to one-half as wide as the east or right-hand side. On the latter side only, the funnel cloud received its unfailing supply of energy from the warm, moist, southerly current, which often rushed with great force towards the funnel, increasing in velocity as its distance from the funnel cloud diminished. The velocity of the southwest current was, no doubt, from



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"Hackberry Ridge tornado": Track, 12 miles south of the "Barnard tornado"; time of beginning and ending between 3 and 4 p. m.

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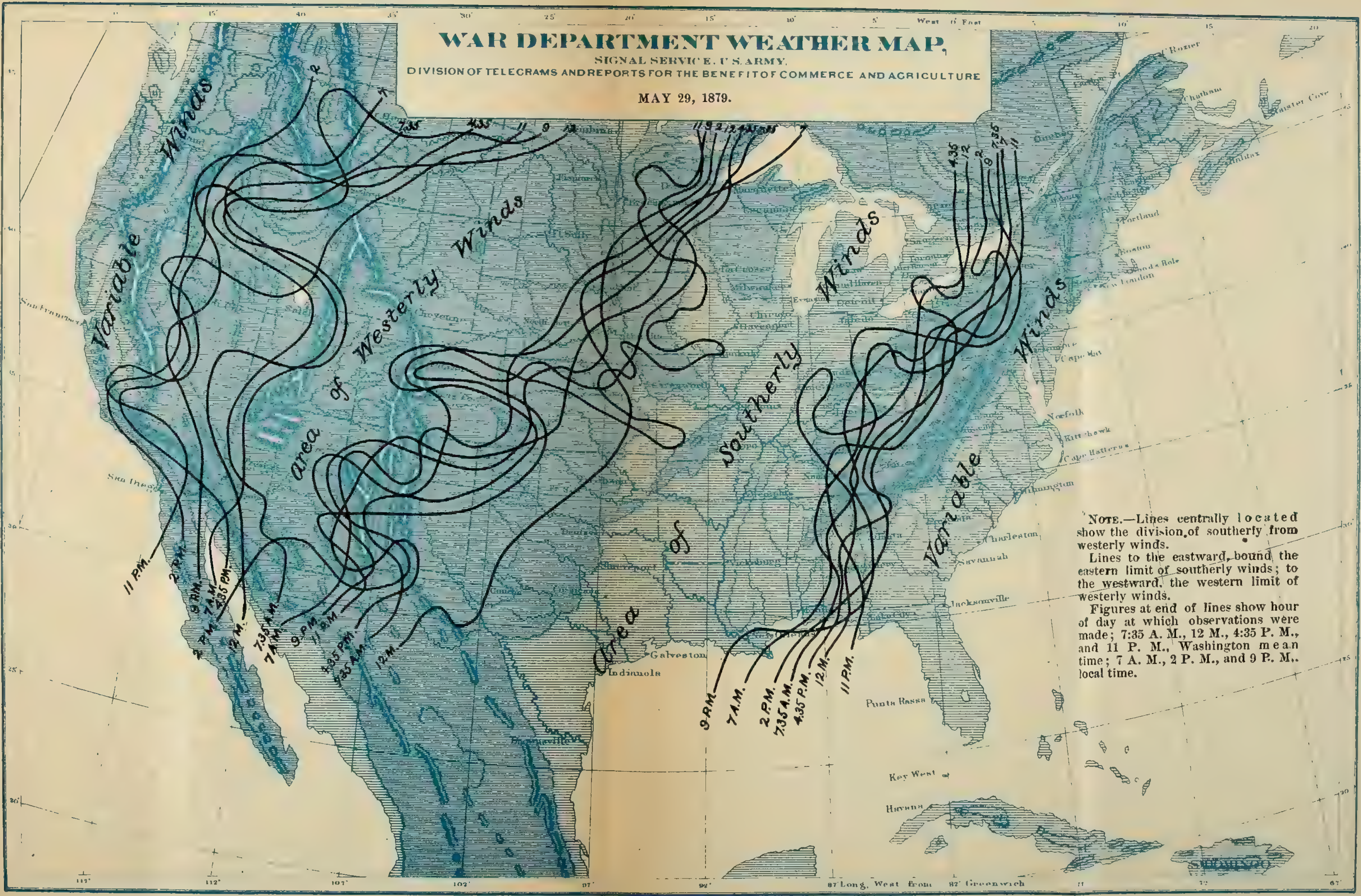


WAR DEPARTMENT WEATHER MAP,

SIGNAL SERVICE, U. S. ARMY,

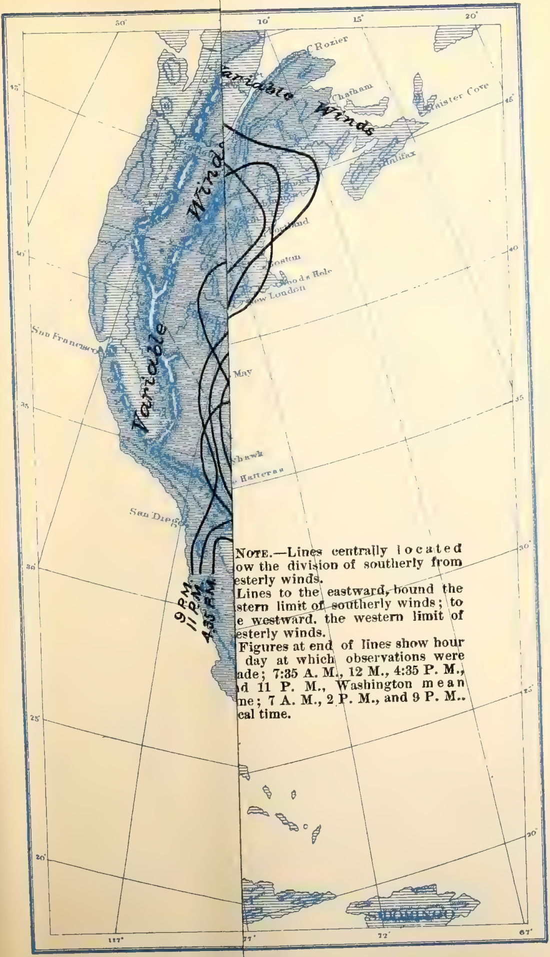
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE

MAY 29, 1879.

NOTE.—Lines centrally located show the division of southerly from westerly winds.

Lines to the eastward, bound the eastern limit of southerly winds; to the westward, the western limit of westerly winds.

Figures at end of lines show hour of day at which observations were made; 7:35 A. M., 12 M., 4:35 P. M., and 11 P. M., Washington mean time; 7 A. M., 2 P. M., and 9 P. M., local time.



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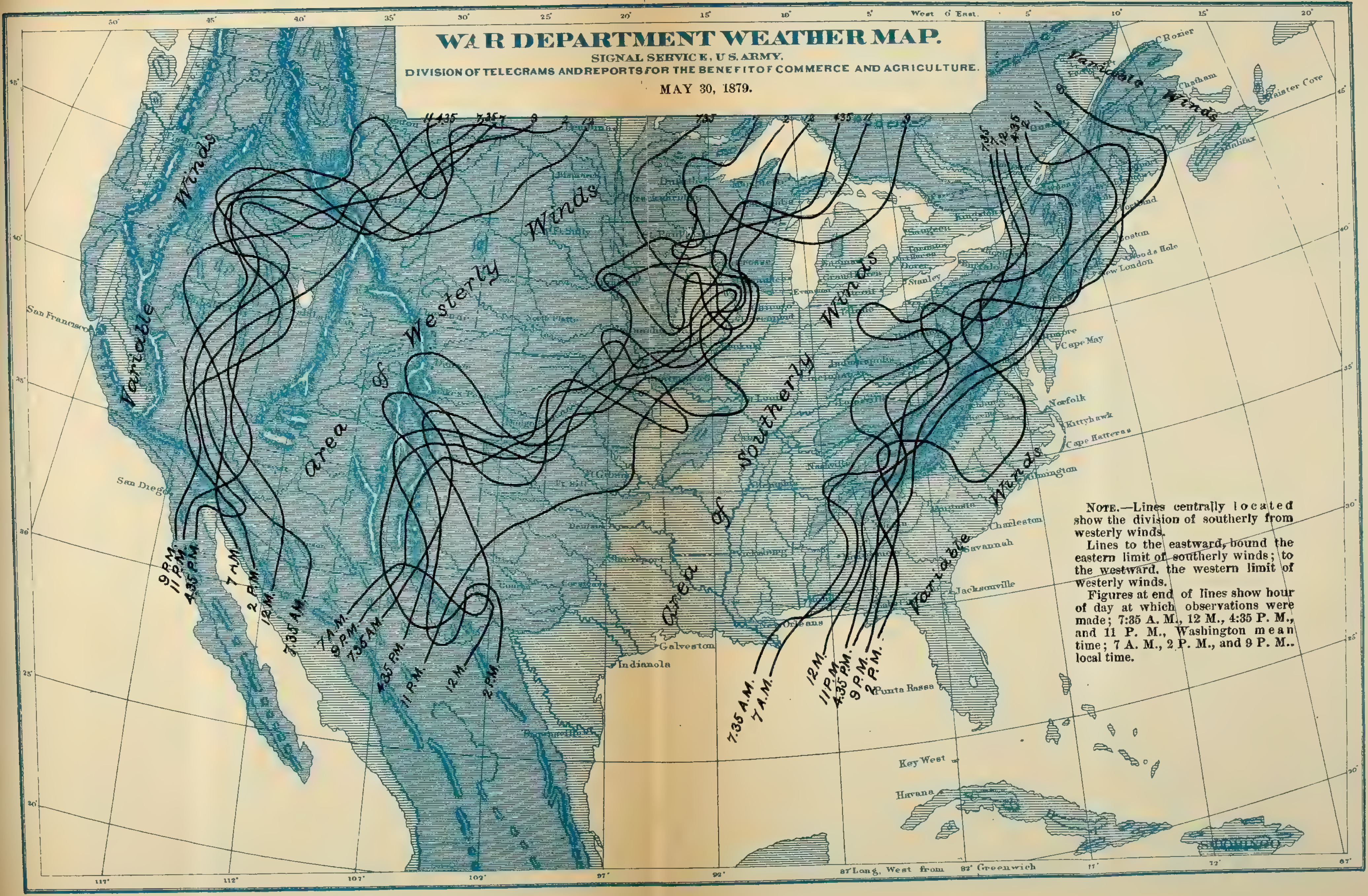

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

MAY 30, 1879.

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50 to 70 miles per hour, and at times perhaps greater. This was the straight wind before it arrived within the compass of the whirling cloud, when its velocity was more than doubled by the attending circumstances. The contrast in the width of the opposite sides of the storm's track was noticed by many persons, and was the cause of considerable inquiry. Several persons who were intelligent and careful in their observations, reported that they did not feel a straight but always a circular movement of the air on the west side, whereas on the right side, people would often say "the wind came straight from the southwest"; still the whirl was as often felt on the right side, particularly when near the storm's center. It is a combination of the straight wind with the whirling current from right to left that creates a distinction between the air currents on the right and left sides of the storm track. The comparative width of the two sides is no doubt influenced to a certain degree by the progressive movement of the cloud, which coincides with the direction of wind on the right side, thus increasing its velocity and its power of destruction.

ELECTRICITY.

Characteristically absent from the funnel cloud, it invariably accompanied its incipient stages in the formation of the massive cloud from which the funnel depended. The rain and hail preceding the tornado were not always but generally attended by lightning, not a violent manifestation, but occasional flashes. The most terrific displays were reported during the heavy precipitation which sometimes occurred after the tornado had passed some ten or fifteen minutes. Very often its darting flash was observed as the dark clouds began to rise above the western horizon, an hour or more before the storm. Even while the funnel cloud was whirling over the earth, flashes were noticed in the distance to the southwest and northwest. Every person was utterly at a loss to account for the absence of this element in the funnel cloud, and it caused many anxious inquiries, because all observers who had in the least attempted to philosophize upon the terrible manifestation of power presented to them by the destructive effects, were determined to assign it to some mysterious interference of electrical force. Wherever a piece of iron was bent, broken, or twisted, a huge tree torn up by its roots, or clothing snatched from the body, it was attributed to electricity. The fact that it did not appear in the cloud by a flash was explained away by supposing that its subtle presence produced powerful effects through some incomprehensible modification of its usual character. There was a dogmatic predisposition to attribute everything, the result of unusual power, to this one member of the group of physical forces. Of course, it was the easiest way to get rid of a difficult problem. It being generally accepted that little is yet known of the peculiar nature of electricity, there would be comparative safety in assigning the cause of a strange atmospherical disturbance to its wonderful range of power, feeling satisfied that, for a considerable time at least, there would be no probability of a decided advance into the analysis of such a relation. The funnel cloud is a mere collection of clouds of the same rarity as the mass whence they are drawn. Their descent is evidently the mechanical effect of the whirlwind. The latter is caused by the disturbed equilibrium of the warm and cold currents, which, creating a high degree of rarefaction, extending between the clouds and the earth, cause them to descend within the rarified area by their gravity, or by the pressure of the surrounding clouds and of the air. The contortions of the descending mass of vapor, and the violent whirlwind felt at the earth, as well as the appearance of the commencement, increase and decrease of the mass, all demonstrate the whirl of the air to be the mechanical cause. The same vortex, whirl or eddy of the air which occasions the cloud to descend, determines the character and rapidity of ascent of the loose bodies on the earth. If the surface upon which the funnel descends is water, the same mechanical power raises a body of foam, vapor, or water to the clouds, and the cylindrical mass becomes a waterspout. There is not the slightest difference between this and a tornado, the contrast only exists in the material acted upon. As soon as the vortex or whirl exhausts itself, the phenomena terminates by the fall to the earth of the light bodies or water, and by the ascent of the cloud. The degree of the mechanical power manifested depends upon the size of the vortex, moisture of the warm current, the rapidity of its ascent, and the contrast of temperature between it and its opponent, the cold current. As the warm current passes into the vortex, its rapidity of ascent is contributed to by the degree of the cold of expansion and the latent heat liberated by condensation, which together assist in the formation of a high degree of rarefaction, necessary to the violent rush and whirl of the air. It is plainly evident that the movement of a current of air at the rate of 200 or 300 miles per hour is sufficient to demolish the strongest building, and it is equally evident that a high degree of rarefaction between the clouds and the earth, produced within the limits of a few hundred yards, is the competent agent of such a force. Even if electricity was present there is no need of its intervention to produce the force required. Whatever its cause or function in the thunder storm, there is no faithful evidence of its existence in the tornado.

UPWARD AND DOWNWARD CURRENTS.

Numerous instances were given in evidence of the existence of a remarkable degree of force exerted upon bodies of considerable weight, carrying them to unusual heights and with great velocity. Several cases are referred to in the descriptions of the storms, where persons were carried out through the tops of buildings, after the roofs had been removed. Also where even a more powerful force was exhibited, as in the case of Mr. Condray's house, in the Stockdale tornado, where the roof was lifted to a height of nearly 300 feet. Again in the Irving storm, where Mr. Robert Patterson reported the upward pressure at the center of the cloud, extending its influence even to the extreme edges, as illustrated by its effects upon a man's weight, and upon lighter articles like straws, shavings, &c., moving upward without any apparent action of the wind. Almost every person who watched the cloud for any length of time had occasion to mention the presence of *debris* in the funnel, and of its being drawn upward through the center of the cloud and thrown outward at the top. Wherever the center of the cloud was seen to pass directly over loose objects (when not too heavy), they would shoot upward with lightning rapidity. The presence of downward currents was not by any means so well apparent. I obtained no well authenticated instance of any object being thrown to the ground by the individual effort of a downward current. Small clouds were seen to dart down the outer sides of the funnel whenever they floated in close proximity; but their motion was indirectly the result of a strong upward movement in the vortex of the cloud, exerting a violent centripetal action extending some distance from its circumference and increasing in intensity from the top downward. From the very nature of this peculiar combination of opposing currents and consequent cloud formation no downward current can be expected to form. The funnel is formed, fed and maintained by the rapid ascent of continued warm and moist currents whose moisture is condensed by the cold of expansion and elevation, liberating latent heat and thereby accelerating the powerful upward movement, which constitutes the principal current of the tornado. There are several motions to the storm cloud resulting directly or indirectly from the action of this current, particularly the rising and falling motion which is caused by the violent in-rushing and upward movement of the warm current, which, as a natural effect, would cause the light cylindrical cloud to shoot upward or sway from side to side. Several cases occurred where objects and animals were dashed to the ground with great violence, but nearly always at an angle of from 30° to 40°, showing that they had first been lifted from the ground by the upward current, and thrown forward by the progressive velocity of the storm, or a violent outward movement of the whirl. Where objects were broken to pieces in falling or by being driven into the ground, or animals had their bones broken, it indicated no greater force than could be attributed to gravity. A person may be very easily misled into the conclusion of the existence of a strong downward current, because of the violence with which objects raised to a considerable distance in the air, strike the earth, particularly if the circumstance is but casually noticed; while closer examination will reveal the fact that its movement is the result of the violent inrushing current or the progressive velocity of the storm.

DIRECTION OF THE WHIRL.

Without a dissenting voice the various observers united in declaring the motion to be from right to left. The relative position of the fallen trees and the scattered *debris* on the opposite sides of the storm's track bear indisputable testimony to the truth of their observations. There were instances among the prostrated trees, especially near the storm's center, where the direction of their tops would form an exception to this characteristic direction, but the accompanying circumstances were sufficiently cogent to explain the anomaly. Trees falling from the influence of the violent whirl near the center would necessarily mingle in such confusion as to prevent the possibility of their downward movement coinciding with the direction of the wind. The greater the distance from the center, up to a certain degree, the more regularly were the trees prostrated, and consequently their more faithful correspondence with the direction of the revolving current of air. In the case of buildings there was no difficulty in observing the distinct and invariable direction of the whirl, because, unlike the trees they presented but a single object to be acted upon within the area of disturbance. The second Irving storm presents peculiarities in this respect and in several others, which cause it to differ materially from the first Irving storm or any of its companions. To my mind the second storm was not a completely developed tornado, otherwise it would have asserted undeniable characteristics and not remained isolated in nearly every respect but its destructive power. Its complete history is given under the head of the "Irving tornado," where a study of its manifestations can be made.

RAIN AND HAIL STORMS.

In referring to the several storm descriptions, it will be found that rain and hail invariably preceded the tornado cloud from ten to thirty minutes, nearly always attended by a southerly wind. The rain was light but in large drops, and the hail presented the same peculiarity, with this addition, that most of it seemed to fall on the north or left-hand side of the storm's center, probably due to the fact of the strong southerly current carrying the stones, as they dropped from the hail cloud, beyond it to the north. It was seldom that hail followed the passage of the tornado cloud with a change of the wind to the west, but rain did so with scarcely an exception and often very heavy. If hail did follow, it was always very small, but in large quantities and covering a much wider path than that left by the tornado. It is especially important to note that every one of the several tornadoes were preceded by a precipitation of hail, and when the funnel cloud lost its identity the hail storm still continued, evidencing the truth of what has been surmised, that a tornado is a hail-storm cloud of unusual intensity, reaching the surface of the earth. There may be a violent opposition of warm and cold currents above the surface of the earth, forming the hail cloud, producing a whirling movement and a cylindrical cloud, within which similar manifestations of a variety of forces obtain, as in the true tornado cloud. An important lesson can be drawn from the comparative size of the hail stones that fell before and after the passage of the funnel cloud, illustrating the relative power of the centripetal current and the rapidity of condensation as performed within the cloud vortex. It will also be noticed that the first precipitation of hail embraced a much narrower path, being coincident with the path of greatest destruction, while the second precipitation was generally from 3 to 5 miles in width. This seems to plainly indicate that the formation of the largest hail stones accompany the manifestation of the greatest centripetal power, and also that the funnel cloud does not necessarily, because of its transformation, include the entire breadth and capacity of the hail cloud. This idea would again seem to be substantiated by the fact that several persons saw more than one funnel at a time depend from the same circumscribed cloud, but eventually combining in one. There were instances where no hail but only rain fell after the funnel passed, which would seem to indicate that here the tornado and the hail cloud occupied the same area. There were no well authenticated cases where all precipitation did not cease at every locality immediately preceding the passage of the funnel cloud. Everything gave way to the boundless power and velocity of the dark cloud.

EXPLOSIVE EFFECTS.

I made diligent inquiries respecting the occurrence of any manifestations of this character, but failed to elicit any evidence in proof of its existence. Those buildings situated directly within the center of the storm's path were of course torn to pieces almost instantly, while those on either side, where such effects might be expected, generally had the doors and windows all open because of the intense heat, and succeeded in shutting but a portion of them before the storm began its work of destruction. Had buildings been closed, which in all probability would have been the case in cooler weather, opportunity would then have been afforded for the sudden displacement of the surrounding air. Under these conditions the building quickly relieved about its exterior from the support of an equally distributed body of air would, through the resulting action of the inclosed mass of the same material, seeking to restore the disturbed equilibrium, be thrown violently apart, the sides and top going in various directions. Again, throughout all of the storm tracks, the most of the *débris* was gathered up in piles about the foundation, or entirely carried away, so that it was impossible to pass judgment upon the character of the destruction. This was a great hindrance to rapid and complete work, and one of the chief difficulties encountered in my investigation.

DURATION OF TORNADO.

The time of passing any point was variously estimated from five seconds to two minutes. "Quicker than thought," was an expression often used as conveying the observer's idea of the rapidity of destruction. Estimating the average diameter of the cloud at 150 feet, and its average velocity at a mile in two minutes, we have its mean duration at any one point, about ten and a half seconds. There were times in the passage of the cloud when it appeared to remain almost stationary, whirling upon its narrow base like a top; again it was reported as moving no faster than a horse gently galloping, but only for half a mile or so, when it would make up for lost time by dashing forward at a rate of 50 or 60 miles per hour, and then gradually working down to its accustomed velocity of about 30 miles per hour.

TOPOGRAPHY.

In accordance with instructions, I have prepared a series of maps, giving, as well as the time and material at my disposal would permit, a general idea of that region of country over which the several storm tracks are located. Each map embraces from 6 to 10 square miles of territory on either side of the immediate storm center, so as to afford a fair opportunity to comprehend the prevailing character of the surface. It will be observed that there is a marked similarity of general features presented, not only among the several Kansas storm tracks, but in one State as compared with another, and the lesson to be drawn from this peculiarity is two-fold. In the first place, such maps of limited superficial areas do not and cannot present points of topography adequate to a clear and faithful investigation of any supposed connection between the *origin* of this class of storms and the contour of the surface. Bear in mind that I refer to the *origin* and not to the manner in which the tornado cloud already formed, may be influenced by the irregularities of the surface. A map prepared to show the entire topography of that portion of the United States included within the meridians of 89° and 101° would plainly illustrate an important truth in the tornado problem, viz, that there is not another section of our vast domain wherein there exists opportunities so unlimited for the unobstructed mingling and opposition of warm and cold currents and currents highly contrasted in humidity. As an area of low barometer (not necessarily a storm area) advances to the Lower Missouri valley warm and cold currents set in towards it from the north and south respectively, which, if the low pressure continues about stationary for some time, ultimately emanate from the warm and moist regions of the Gulf and the cold and comparatively dry regions of the British Possessions. Here lies the key to the marked contrasts of temperature and moisture, invariably foretelling an atmospheric disturbance of unusual violence, for which this region is peculiarly fitted by nature, and in apparent recognition of which it has received the euphonious title of the "battle-ground of tornadoes." It cannot be disputed that, so far as the history of tornadoes is concerned, the majority have occurred over this region, and why? Because of its peculiar topography. From the Gulf northward to the central portion of the Lower Missouri valley, and from the British Possessions southward to the same locality, there is permitted an entirely free movement of the air; nothing in the shape of earth or water exists to modify its character, except, perhaps, to intensify the contrast of attributes. That this is a fact, I need only to recall my own experience and the united testimony of the inhabitants as to the monsoon character of the winds in Kansas and Western Missouri. Over Texas, Louisiana, Arkansas, and Indian Territory occurs a broad expanse of rolling surface; sometimes abruptly hilly, but on the whole presenting a sameness of outline to a marked degree. Similarly conditioned are the States of Minnesota, Iowa, Nebraska, and the eastern half of Dakota Territory. West of the 101st meridian we find a rugged and abrupt country, traversed by great mountain chains, which deflect the course and modify the temperature and moisture of passing currents. On the east side of the 89th meridian, the Great Lakes introduce an equally important factor into the modification of passing currents. The second lesson (a positive one) is that these small maps perform the important function of portraying the actual relation existing between direction of movement, as contrasted with place of origin of the tornado cloud. In this connection it will be seen that the funnel preserved its characteristic northeast course at the expense of every other accompanying circumstance. The cloud might and did in several instances change its course, apparently through the influence of intervening elevations, as in crossing the Blue River at Irving; but whether this change in its course was due to the interception of the Bluffs, or that at that moment the elastically suspended funnel received a fresh influx of warm and violently inrushing air from the south, is a question which can only be settled by actual observation. The funnel was several times noticed to change its course on the highest ground, and perhaps did so as often as in the ravine. I made particular inquiries and examination into such cases where it was possible, and found that almost without an exception I was able to obtain some and, in a few cases, indubitable evidence that the change of direction followed a violent inrushing movement from the south. Houses were destroyed with as great violence and completeness upon high land as upon low land, but the largest number were wrecked in ravines, because it is the prevailing custom of this region of country to select building spots along the low bottoms of a stream for convenience to water and timber, and for protection from the continued heavy winds that break over the open prairie. In several instances the funnel cloud passed from one ridge to another, doing damage on both, but skipping the intervening depression; then again it would follow a high "divide" for several miles. The ridges and valleys were almost always crossed at right angles, as their courses were generally from northwest to southeast. As to the formation of gaps in the storm track, comparatively few occurred, and those that did, as many times included valleys as ridges. The ascent or descent of the tornado cloud was always gradual and in a long, swinging, swaying motion, as if caused not so much by the influence of the configuration of the earth's surface as perhaps the current of air from the south, acting singly or combined with the conflicting movement of the currents within the vortex. Several times when rising over high ridges the cloud, after reaching the top, would remain above the ground a few minutes before descending, when again its work of destruction would commence. The region over which the tornadoes occurred both in Kansas and Missouri is thickly traversed by creeks, with generally quite abrupt boundaries or ridges from 75 to 300 feet in height, and bottoms varying from one-fourth of a mile to 2½ miles in width, to which I have called special attention in the description of each storm. In Kansas the storm tracks were, without an exception, confined to what is known as the 2,000-foot level, coinciding with the "middle rain belt" as determined by the State Meteorological Bureau. This belt receives a yearly precipitation next to the heaviest or "eastern rain belt," but for the month of June, 1879, considerably the largest as compared with the eastern and western rain belts, corresponding respectively with the 1,000 and 3,000 foot levels. In reference to the relation between topography and the storm track in Jackson County, Missouri, I produce a portion of a letter in reply to inquiries addressed by me to Maj. E. A. Hickman of Independence: "As far as is known, all of the tornadoes that have entered our county came from one of the water divides that head up on that great water-shed east of the Rocky Mountains and west of the Missouri River. These smaller divides and their streams head up and out on other divides, and they in turn head on the high water-shed that begins on the top of Pike's Peak and winds on to the Missouri River, north of Independence, shedding first its mountain waters into the Platte River on the northeast, and the Arkansas river on the southwest; then as it comes nearer it continues to divide the streams that head on it into those that run northeast and southwest." The tornadoes both north and south of the Missouri River, as a general rule, followed the "divides" between the streams, not so much, perhaps, because they were elevations as that their course was from southwest to northeast, and thereby necessarily coincided with the characteristic course of the tornado; while in Kansas, the course of the "divides" being from northwest to southeast, they were crossed at right angles.

CASUALTIES AND LOSSES.

I found it a subject of no little difficulty to ascertain what might be considered a fair estimate in this matter. Newspaper reports were frequently very much exaggerated, and the statements of individuals were affected with a certain degree of indefiniteness that made them unreliable. However, I have endeavored to combine the results of my own inquiries with the reports of relief committees, newspapers, and individuals, so as to arrive at a close approximation to the truth. The total number of persons killed number 42, and the wounded 185. This result comprises only the work attendant upon the destructive agency of the tornadoes. The severe local storms which occurred preceding and following the tornadoes would not add more than three or four to the list of killed, but it would increase the number of wounded to upwards of 250. The loss of property, including timber, crops, buildings, farming implements, furniture, &c., embracing that caused by the local storms as well as the tornadoes, will reach nearly $1,000,000. I estimated 262 houses as destroyed, which if changed to the word "buildings," would more than double the number. These numbers may appear comparatively small when considered with the large number of tornadoes reported, or as compared with the disastrous results of smaller tornadoes that have occurred at various times in the Eastern States. It must be remembered that these storms, especially in Kansas, passed over very new and thinly settled districts, and that only in one instance was a town actually entered by a storm track, which town contained but 300 inhabitants. Many towns were passed, but nearly all were within a safe distance. Even this loss is a terrible calamity to befall young and feeble communities struggling for a foothold in the vast prairie wilderness. The effect upon the people was pitiful in the extreme. Night after night (particularly in Kansas) hundreds of people never went to bed, but remained dressed and with their lanterns trimmed, watching for a fresh onslaught which they expected momentarily Every dark cloud or sudden increase in the velocity of the wind seemed to them filled with evil forebodings which could not be allayed until every vestige of supposed danger had vanished. The terror depicted upon the countenances of the bravest men, at the sight of a dark cloud above the horizon, was something beyond description or realization, except by those who could witness their excitement. Persons were preparing to quit the country; business of every kind succumbed for a season, except that of generously supplying the wants of the sufferers by well organized relief committees. Many acts of devotion and self-sacrifice redound to the glory and honor of Kansas people. It was a matter of the most serious consideration, and of oft-repeated inquiry, whether or not this region was particularly subject to this class of storms, and the frequency with which they might and would occur. Could the question be settled? Would it be settled by the Signal Service Bureau? Does the Signal Service Bureau pay particular attention to this class of storms, so intimately affecting our welfare? Will the Bureau be able to forewarn us next spring and summer? These and similar questions were earnestly propounded by the active business men of every community, both within and outside of the storm's path. Permit me to suggest that it would be advisable, and without doubt practicable, to station a special observer during the months of May, June, and July at Kansas City, a point easily communicated with from any part of the Lower Missouri Valley, who shall receive special reports and instructions from Washington regarding atmospheric disturbances, and report the same to various telegraphic stations throughout the valley, and on the occurrence of a tornado or other violent local storm, be able to visit the storm track within the shortest possible time after its passage. Although having a meteorological bureau of its own, Kansas recognizes the truth that it is only one of the factors, of which the Signal Service Bureau is the composite head, and that to properly investigate and prepare for these storms it is absolutely necessary that a study of the atmospheric conditions of the entire country should be prosecuted in order to protect the vast agricultural interests of one of the most productive and promising States in the Union. Here is an opportunity for the Signal Service Bureau, with the aid of its efficient Chief, to enter upon a field of inquiry as grand in its possibilities (because of its great utility) as any effort of the kind yet meditated.

A plan contemplating the furnishing of reports to the cotton districts of the South, giving the proprietors of that great industry the earliest information as to the probable occurrence of frost, would be a great and beneficial undertaking, but not more so than a well directed attempt to meet the needs of that great section of the West, the Lower Missouri valley. The frost will come in spite of the prediction, so will the tornado, but to get the right information to the proper point before the occurrence of the dangerous phenomenon, thereby affording opportunity to provide against its ravages, is the great desideratum. It can be done.

OTHER STORMS OF MAY 29 AND 30.

In connection with the distinctive tornadoes very violent storms of wind, rain, and hail visited portions of Kansas, Missouri, Nebraska, and Iowa.

On the 29th, in central Kansas, clear or fair weather generally prevailed; but the eastern portion of the States of Nebraska, Iowa, and Missouri, lying adjacent to the Missouri River, were visited by severe local storms and tornadoes between 3 and 6 p. m.

On the 30th rain commenced falling as early as 10 a. m. in central and northwestern Kansas, resulting in severe hail and wind storms between 1 and 2 p. m., and tornadoes between 4 and 6.30 p. m. In southeastern Kansas and western Missouri rain commenced early in the day, followed by tornadoes and several local storms between 3 and 5 p. m. In northwestern Missouri and the adjacent territory of Kansas, Nebraska, and Iowa, the heaviest storms, occurred from 6.30 to 9.30 p. m. A heavy storm was reported in southeastern Iowa between 2 and 3 p. m.

Beloit, Mitchell County, Kansas, 30th.—Storm struck town about 2.30 p. m. Several houses were blown down or unroofed. Large trees on the banks of the Solomon were twisted or wrenched in two. Hail of unusual size fell during the passage of the storm, which seemed to be the most violent to the westward.

At Cawker City.—The Cawker City Free Press described the storm as the "most destructive ever known here. Seven buildings were totally wrecked and several persons injured." Hail fell measuring 8 to 10 inches in circumference.

Scandia, Republic County, Kansas, 30th.—Storm broke out at 4 p. m. Every house in town was shaken, the cellars flooded, and much damage committed. Several miles southeast of the town severe destruction to property occurred in the country. Storm came up with a heavy northwest wind and lasted about three hours. Track about 3 miles wide, following the Republican river, from northwest to southeast.

Centralia, Nemaha County, Kansas, 30th.—Heaviest rain and wind storm for several years passed over this town about 8 p. m., tearing down fences, barns, houses, trees, and everything in its path. Course of storm from west to east.

AT CENTRALIA.

To the Editor of the Champion: CENTRALIA, *May* 31, 1879.

A frightful storm of wind and rain passed over this village last evening, doing serious damage to property. About 6 o'clock a very black cloud appeared in the southwest. At first we thought the storm would go to the north, but by 7 it was evident that a gale was upon us. At 7.30 p. m. its violence culminated, and at our house, a mile northeast of the village, large limbs were flying from the cottonwoods and every movable thing was upon the whirl.

A chicken coop was taken from the northwest side of the house, and this morning we found it several hundred feet to the southeast of it. But the storm seems to have spent its violence on the farm of Mr. A. W. Slater, which is being cultivated by Mr. Nightengale. The house in which Mr. N. resided was in a moment made a complete wreck. Every window, save one, was broken in; a part of the roof was blown off, and torrents of rain came rushing in. A child, dangerously sick, was taken over to the nearest neighbors in the midst of the storm. The barn was blown down with the sheds, and the flying timbers hurled among a herd of cattle in the yard, breaking off the horns of several cows and maiming others seriously. One hog had his fore shoulder broken. The farm wagon was turned bottom side up, and completely smashed.

The grove of fruit trees and cottonwoods, one of the oldest and most beautiful in the country, is ruined. Large trees were twisted off as though they had been twigs, and many fine bearing apple trees and others were torn up by the roots. All the wood fence in the neighborhood is demolished. Indeed, the whole place is a complete wreck, causing serious loss to all concerned.

Upon the place occupied by Mr. Griffiths, and owned by Mr. Peter Clipinger, the barn was very badly damaged. The roof was blown off, and the entire building is a wreck. A large amount of fencing upon this farm is destroyed, as is also upon the home farm of Mr. Clipinger. Fortunately, so far as heard, no lives have been lost. Rumors reach us of serious damage elsewhere, but we have no details. The storm continues but without the violence of last night.

Yours,

GEO. B. LINCOLN.

Rev. G. W. Goodale, pastor of the Presbyterian church, Pawnee City, Pawnee County, Nebraska, reports, on May 30th, a very severe storm of wind, rain, and hail from the northwest at 7 p. m.; heaviest wind lasting about fifteen minutes. Several houses were blown down in the city and also in the adjoining country to the southeast.

It will be of interest and importance to call attention to some peculiarities that developed themselves in connection with a study of the character and position of the local rain and hail storms. On the 29th they were confined, as before stated, to eastern Kansas and western Missouri; their invariable direction was from southwest to northeast, averaging about 6 miles in width and from 18 to 25 in length. I was able to carefully locate no less than nine of these storms from numerous letters received in answer to inquiries directed to postmasters and others upon the subject. The several tracks were separated by distances varying from 5 to 18 miles, except one instance of 35 miles. On the 30th the hail storms, rather more numerous and of greater width and length, came invariably from the WNW. and passed to the ESE. In this connection, and as a means of explaining the different directions pursued by the hail storms on the two days, it will be of importance to consider the relative position of the area of low barometer as presented by the Signal Service weather maps on those days at the hour of 4.35 p. m. On the 29th the low area occupied the northern portions of Nebraska and Iowa, and the southern portions of Dakota and Minnesota, drawing over Kansas and Missouri warm southwesterly winds. Without an exception, every report concerning a hail storm stated that the cloud first appeared in the southwest, preceded from one-half to two hours by a southwest wind. In some cases it had been the prevailing wind for the day. One person remarked that he had never before seen a hail storm come from the southwest; always supposed them inseparably connected with a northwest wind.

On the 30th a second low area had formed to the southeast over Indian Territory, Texas, and Arkansas, while the first area had moved to the Upper Lake region; thus on that afternoon cold northwesterly currents had taken the place of the warm southwesterly currents on the day previous. The first hailstorms were formed by the opposition of cold northwesterly and warm southwesterly currents, causing them to pursue a northeasterly course, while the second were formed by cold northwesterly and warm southeasterly, producing an ESE. course. This would seem to illustrate the truth that the course of these peculiar atmospheric disturbances, which arise from the opposition of warm and cold currents, depends upon the relative position of the warm current. From this we might conclude the reason of the characteristic northeast course of a tornado. It is an exception to find them pursuing an E. or ESE. course, because their movements are controlled by the energy-supplying force, the warm moist current which prevails from the southwest between north latitudes 30 and 64. While these prodigious storms (tornadoes and hail storms) were devastating nearly the entire Lower Missouri valley, a protracted and severe drought obtained in the southwestern part of Kansas, embracing a territory of 130 square miles, and having a general altitude of 3,000 feet. Such serious proportions had the effects of drought assumed, that a proposition to convene the legislature was considered by a convention of organized committees. This section forms a part of what is termed by the Kansas Meteorological Bureau as the "third or western rain belt," whose mean annual rainfall is 19.48 inches, about 41 inches less than the combined mean of the central and eastern belts, which are respectively 23.61 and 37.07. Nearly the entire region forms a portion of the unorganized counties of the State. As compared with the middle and eastern divisions it is but poorly watered, having but one main stream, the Arkansas River, which has a very limited number of tributaries until it reaches the 98th meridian.

OTHER TORNADOES.

Mr. T. B. Hanna, of Raymore, Cass County, Missouri, kindly furnished me considerable information and assistance in obtaining some of the following data:

July 16th, 1878, about 2 p. m., course from southwest to northeast, passing along one of the branches of Grand river, 3 miles north of Raymore. Track from 80 to 100 feet wide, and about 7 miles long. A funnel-shaped cloud whirling rapidly and sweeping everything before it.

July 20th, 1876, about 4 p. m., a tornado passed 2½ miles south of Raymore, over the ridges and across the valleys, destroying several buildings. One house was blown down, and the inmates thrown in several different directions from 100 to 150 feet, killing one lady and badly injuring another. Another house had its sides thrown outward as if by an explosion, and the ground floor left with a stove standing in the center. Still another house was destroyed, killing a child in its mother's arms, and distributing the ruins of the building in every direction, over several acres. Width of track about one-fourth of a mile, and course from west to east.

June 28, 1873, about 3 p. m., through the northern portion of Cloud County, Kansas; course, west to east.

June 12th, 1877, in the afternoon, through the northwestern portion of Cloud County, Kansas; course, northwest to southeast.

July 4, 1860, about 5 p. m., in Doniphan County, during the year of the great drought in Kansas, destroying a great deal of timber along the Missouri river.

November 8th, 1870, a cone-shaped cloud, accompanied by a loud, roaring noise, and great tumult in the clouds, crossed the Republican River near the mouth of Buffalo Creek, and passed northeastward over Republic County, Kansas, into Nebraska, doing great damage, especially in the latter State.

Mr. John Flagg, a resident of Manhattan, Kans., but who at the time was at Salina, Saline County, reported to me as follows:

June 6, 1876, at 3.30 p. m., a tornado passed over the northern portion of Saline County, commencing in the eastern portion of Ellsworth county; course, from southwest to northeast, and length about 40 miles. Eleven persons were killed, many wounded, and $30,000 worth of property destroyed. The cloud did not follow any ravine, but crossed depressions and elevations alike. It passed at a considerable height over the town of Salina, letting down a large quantity of *débris*. Three other tornadoes were experienced on the same afternoon in different portions of Saline County, at points from 8 to 10 miles apart. No. 1 passed along the "divide," between Smoky River, and Gypsum Creek; course, from south-southwest to north-northeast; length, 12 miles. No. 2 took a northeastly course along Dry Creek for about 10 miles. No. 3 crossed Mulberry Creek, near the town of Mulberry, in Pleasant Valley Township. Previous to the occurrence of these storms there had been a continued dry period for several weeks, with warm southerly winds, which became very strong the last three days.

June 20, 1859, p. m., a tornado crossed the Solomon River in the southern portion of Ottawa County; course, from southwest to northeast.

June 14, 1866, 4 p. m., a tornado passed, from southwest to northeast, over the central portion of Page County, Iowa.

August 18, 1858, p. m., a tornado passed over Iowa City, Iowa, from southwest to northeast.

June 16, 1863, p. m., a tornado, following the course of Wolf River, in Doniphan County, Kansas, crossed the Missouri River, and passed northeastward through the southern portion of Holt County, Missouri. The southwest wind was the most powerful and damaging, and the worst destruction was committed in the lowest places.

Maj. E. A. Hickman, of Independence, Mo., very kindly furnished me with the following report of two tornadoes in Jackson County, Missouri.

October 25, 1844, 6.30 p. m., a violent tornado passed through the northern portion of Jackson County, along a ridge south of the Missouri River, 450 feet above the water, in a course north 56° east, from southwest to northeast. It entered the State about 1 mile south of the small town of Westport, and passed over the town of Blue Mills, on the Missouri River, 10½ miles distant. For two months previous to the storm the weather had been exceedingly dry, with monotonous southerly winds. Within a few days of its approach the southerly wind grew warmer and stronger, with a haziness in the air, casting a pale, sickly light upon every object around. The sun looked like a vast ball of fire hung in the air. During the day, until about 5 p. m., the atmosphere was very quiet, at times intensely calm. At 5 p. m. a breeze sprung up from the south, followed by the rapid appearance of a dark portentous cloud in the west. The greatest destruction was found on the highest places, it seeming to pass over valleys without descending. All of the *debris* on the east side of the track lay to the north-east and north, and on the west side to northwest, west, and south, as though the destroying agent moved in a spiral course from right to left.

No. 2 was reported by the Indians to have occurred during the spring of 1814. Its destructive path through the timber was easily identified twenty-five years afterward. In 1826 the first government survey of the Territory of Missouri records the position as follows: "10 chains west from town 49 north, range 32 west, and 30 chains north from northwest corner of same town, pursuing a course north 30° east." The storm passed along the high divide, between the waters of the Big and Little Blue, crossing the path of tornado No. 1, near Wayne City, striking the Missouri River at Blue Mills.

May 18th, 1877, p. m., a tornado passed from west to east along the line between Ottawa and Saline Counties, Kansas, destroying a great amount of property.

February 23, 1875, 3.40 p. m., a tornado passed over the town of Houstonia, Pettis County, Missouri, demolishing it, lifting freight-cars from the railroad tracks, and causing considerable loss of life; course, from southwest to northeast; breadth of track, 300 yards. A large amount of timber was destroyed north of the town on Black River.

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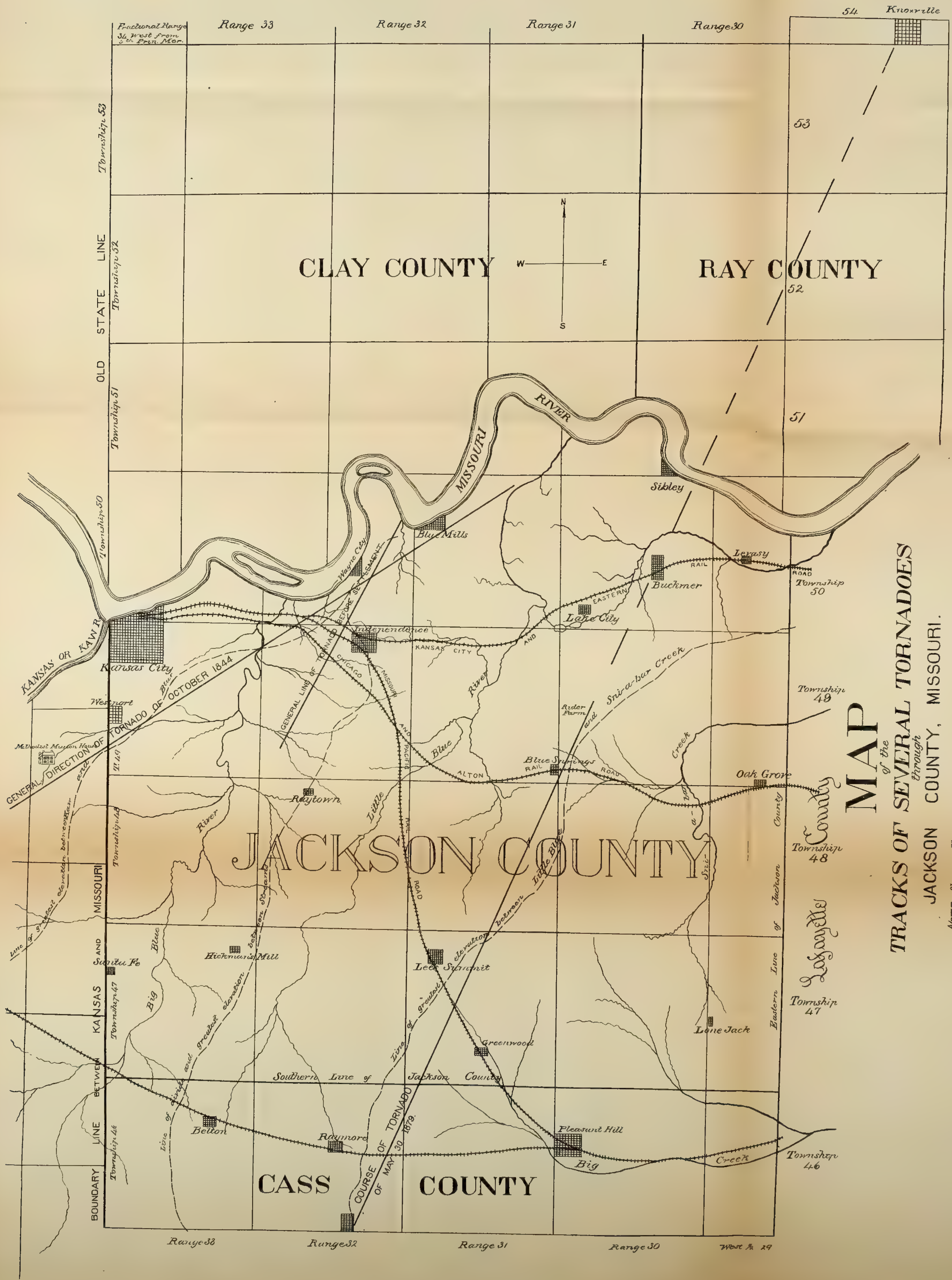


MAP of the TRACKS OF SEVERAL TORNADOES through JACKSON COUNTY, MISSOURI.

NOTE.— Showing their positions relative to lines of greatest elevation.

June 26th, 1874, p. m., a severe tornado passed near Coffeyville, Montgomery County, Kansas, committing considerable damage; course, from southwest to northeast.

June 22d, 1874, p. m., a tornado passed near the town of Towanda, Butler County, Kansas; course, from southwest to northeast.

The following communication from Mr. Wiesbard, of Irving, Kansas, is full of interest:

"On July 31st, 1860, at 3.30 p. m., with the thermometer at 102°, and a medium strong current from the south, a dark cloud suddenly developed in the northwest, which, in a few minutes, changed into a dark gray cylindrical mass of vapor, which swept with terrible force and velocity down the valley of the Blue River, north of Marysville, in Marshall County, Kansas, unroofing houses, uprooting trees, carrying away fences and all vegetable products from the fields. When it struck the town of Marysville it filled the air with dust and a dark mass of clouds, until it seemed like midnight. The first crash burst in the front door of my store, and then carried the roof off. I went out the back door to save my trunk, when the wind hurled me south, towards my stable, where I grasped an elm post, around which I was several times whipped, but managed to hold on until the storm was over. A gentleman now living in Chicago was taken from my side and carried several hundred feet over the ruins of a house and deposited in Spring Creek valley. On the prairies, in the center of the storm track, the grass was completely stripped, as in winter after the prairie fires. There were seven houses destroyed in the town, and two persons seriously injured. Succeeding the passage of the dark cloud, a violent gale set in from the northwest, accompanied by heavy rain and hail, lasting about 40 minutes, and chilling the atmosphere to a painful degree."

June 3, 1860, p. m., a most remarkable tornado passed from near the center of Iowa, eastward, to the Mississippi River, destroying the cities of Comanche and New Albany. It passed thence more than half way across the State of Illinois, exhausting its energies on a rocky ridge near the town of Paw Paw, in De Kalb County. As it ascended the elevation, it is reported that heavy bowlders, weighing from 10 to 20 tons, supposed to have lain there since the glacial period, were turned out of their beds and rolled up the ridge several rods.

On June 9 and 10, 1879, while pursuing my investigations of the storms of May 29 and 30, 1879, a series of violent storms visited central and eastern Kansas and western Missouri, doing a large amount of damage to property, killing several persons, and injuring a large number. Small tornadoes were reported in several portions of central Kansas during the afternoons of the 9th and 10th, but the heaviest and most destructive disturbance occurred on the evening of the 10th, between 8 and 10 p. m., as a terrific storm of rain and hail from the northwest, moving to the southeast in narrow belts of from 6 to 10 miles in width, over a territory 340 miles long by 260 miles broad. In this storm fell the ill-fated town of Delphos, in Ottawa County, Kansas. Thirty-seven buildings were torn to pieces, and those remaining were moved from their foundations or twisted out of shape. People who had succeeded in partially recovering from the devastating fury of the first storm (May 30) were again desolated. No one was killed, but sixteen persons were seriously injured, and $30,000 worth of property destroyed. The storm was particularly severe at Cawker City, Beloit, Onaga, Topeka, Wichita, Emporia, Ottawa, Seneca, Lawrence, and Leavenworth, in Kansas, at Kansas City, and in the northwestern counties of Missouri. The destruction caused by the hail was especially severe, as the stones were of remarkable size. Most of them were as large as hens' eggs, many were picked up weighing from 12 to 14 ounces, and some were reported to have been found the size of bricks, which, judging from the large holes made through the sides of frame buildings, through tinned roofs, and the heavy canvass covers of stage coaches, were not exaggerated in dimensions.

TECHNICAL NAMES.

It is a matter of no little importance that distinct and well defined terms, closely adhered to, should be applied to the several kinds of atmospheric disturbances collectively called storms but individually designated as cyclones, tornadoes, whirlwinds, water-spouts, hailstorms, and thunder storms. It may be thought hasty and ill-advised to insist upon an arbitrary nomenclature in regard to storms when their peculiar characteristics and their more intimate nature have but for a short time been open to scientific inquiry. Yet enough is already known to justify resort to a well defined name quite as reasonable and exact as those applied to the several cloud formations. Two or more storms may combine so as to act to all appearances as one, yet as well may two or more kinds of clouds exist in the same manner, but the whole is invariably considered by a separation of its parts. It is not that we lack the coinage of suitable terms, but that having them we fail to insist upon their absolute use for the undeniable advantage of clearness and rapidity in investigation. It cannot be denied that the class of storms which I have been ordered to investigate, are *tornadoes* and nothing else, their unfailing accompaniments being quite fully exposed in this report, as well as in others of earlier date. That they are not cyclones, whirlwinds, or waterspouts is evidenced by the manner of investigation and the results of the labors of this office.

I refer here to various cyclones properly so called which from time to time have been, to a certain degree, carefully analyzed in the publications of the office of the Chief Signal Officer. I was repeatedly asked to define the nature of a cyclone and a tornado, and to state why it was that the two terms, which apparently indicated different atmospheric disturbances, were constantly interchanged in their use. It was considered very strange that two apparently distinct classes of storms could be the same whenever any one chose to make them so by a mere effort of the tongue. The people naturally look to this Office for the decisive settlement of all such questions, and invariably manifest the utmost confidence in and reliance upon the labors of the Chief Signal Officer, pointing with pride to the zeal and ability with which meteorological knowledge of practical value has been disseminated. As indicative of this sincere appreciation and interest in the work of the Office, I take pleasure in acknowledging the receipt of the most uniform courtesy and hospitality during the progress of my work. Assistance of importance was willingly rendered me by many persons, which space will not permit me to make mention of here. Especial note should be made of the exceptional kindness of Mr. John A. Martin, editor of the Atchison Champion; Maj. E. A. Hickman, United States land office, Independence, Mo.; Mr. J. A. Shaw, attorney at law and land agent, Lee's Summit, Jackson County, Mo.; Dr. F. A. Ballard, Independence, Mo.; Colonel Van Horn and Colonel Case, Kansas City, and Sergeant S. W. Rhodes, United States signal office, Leavenworth, Kans.

JOHN P. FINLEY,
First Class Private, Signal Corps, U. S. A.

PAPER 50.

CHRONOLOGICAL LIST OF AURORAS OBSERVED FROM AUGUST 1, 1873, TO DECEMBER 31, 1875, WHICH HAVE BEEN REPORTED TO THE CHIEF SIGNAL OFFICER OF THE ARMY BY THE POST SURGEONS, U. S. A., VOLUNTARY OBSERVERS, AND SIGNAL SERVICE OBSERVERS.

[Compiled by First Lieut. A. W. GREELY, Fifth Cavalry, Acting Signal Officer and Assistant.]

PREFATORY NOTE.

Dates and times given are local. Aurora notes recorded at the moments of simultaneous meteorological observations are here credited to the corresponding local times. The hour of commencement and end of the display is given when practicable. All "p. m." displays (including 12 p. m.) occurred after sunset, and all "a. m." before sunrise on the date given. These abbreviations are also used where the observer has given no hour, but simply said evening or morning. In cases where cloudiness prevented further observation, the hour of its obscuration is prefixed by the word "obscured." Where the disappearance of the aurora was not observed, the last hour noted by the observer is given, preceded by "after." Where grave doubts exist as to the light having been auroral, the name of the station is bracketed, and an interrogation point (?) is *prefixed.*

AUGUST, 1873.

2.—*Dakota:* Pembina, 10 p. m.

3.—*Dakota:* Pembina, 10 p. m. *Minnesota:* Saint Paul.

5.—*Maine:* Gardiner, 9 till after 11.59 p. m. *Massachusetts:* Boston. *New Hampshire:* Mount Washington, 9 to 11 p. m.

7.—FULL MOON.

8.—*Michigan:* Alpena, 10 till after 10.34 p. m.

10.—*Dakota:* Pembina, 9.50 to 11.30 p. m.

12.—*Illinois:* Chicago, 9 to 11 p. m. *Iowa:* Dubuque, 10 to 11 p. m. *Maine:* Gardiner, 9 till after 11.59 p. m. *Michigan:* Alpena, 9.30 p. m. *Montana:* Fort Benton. *Nebraska:* Omaha, 9 to 9.30 p. m. *Pennsylvania:* Erie, 12 p. m. to 1 a. m., 13th. *Wisconsin:* Milwaukee.

13.—*Dakota:* Pembina, 10.20 p. m. *Maine:* Gardiner.

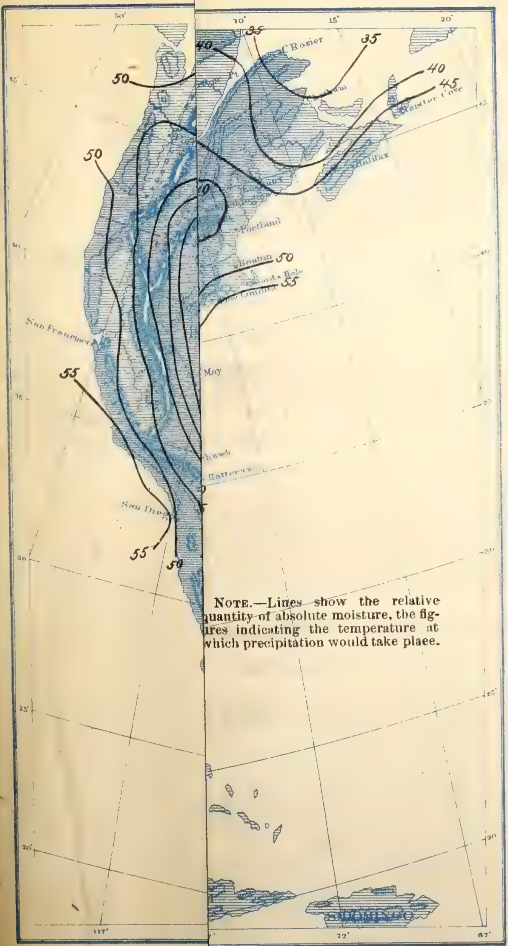
16.—*Michigan:* Alpena, 9.30 to 11 p. m. *Nebraska:* Omaha, 11 p. m. to 1 a. m.

17.—*Maine:* Gardiner, 9.30 p. m. till after 1 a. m. *Michigan:* Alpena, 9 till after 10 p. m. *Minnesota:* Breckinridge; Duluth, 8.30 to 8.50 p. m. *New York:* Oswego, 11 to 11.20 p. m.; Rochester, 8.15 to 9.40 p. m. *Wisconsin:* La Crosse, 8.40 to 9.30 p. m.

18.—*Dakota:* Pembina, 8.50 to 10 p. m.

19.—*New York:* Rochester, 8.40 p. m.

20.—*Michigan:* Alpena, 10 p. m.



Note.—Lines show the relative quantity of absolute moisture, the figures indicating the temperature at which precipitation would take place.

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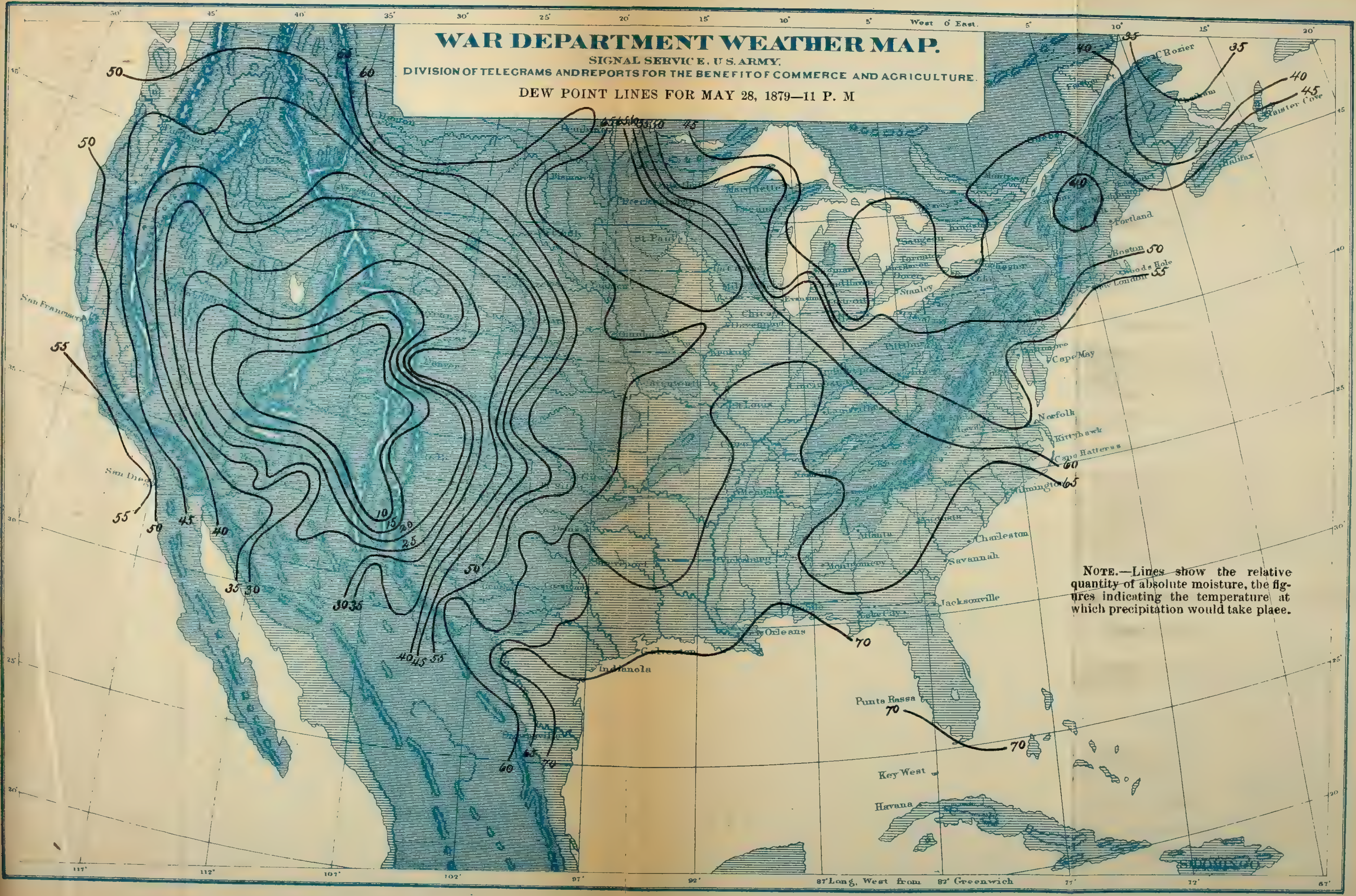


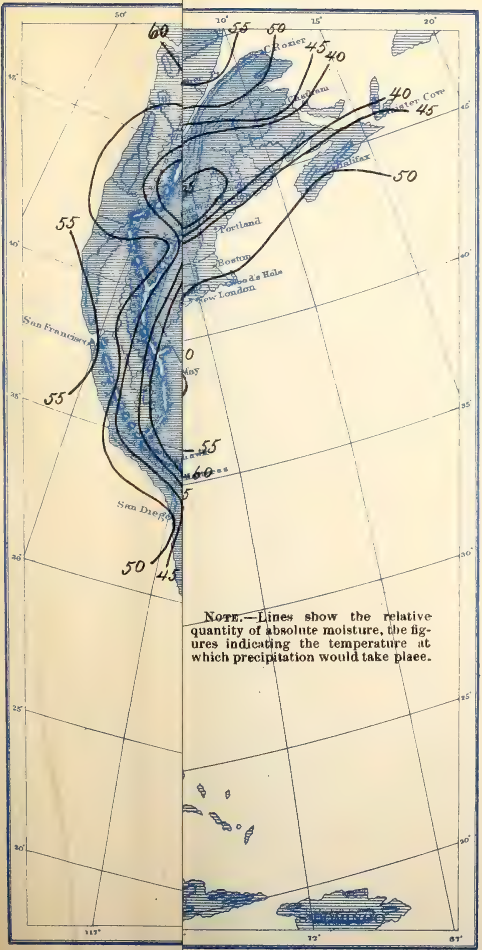
WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

DEW POINT LINES FOR MAY 28, 1879—11 P. M.

Note.—Lines show the relative quantity of absolute moisture, the figures indicating the temperature at which precipitation would take place.



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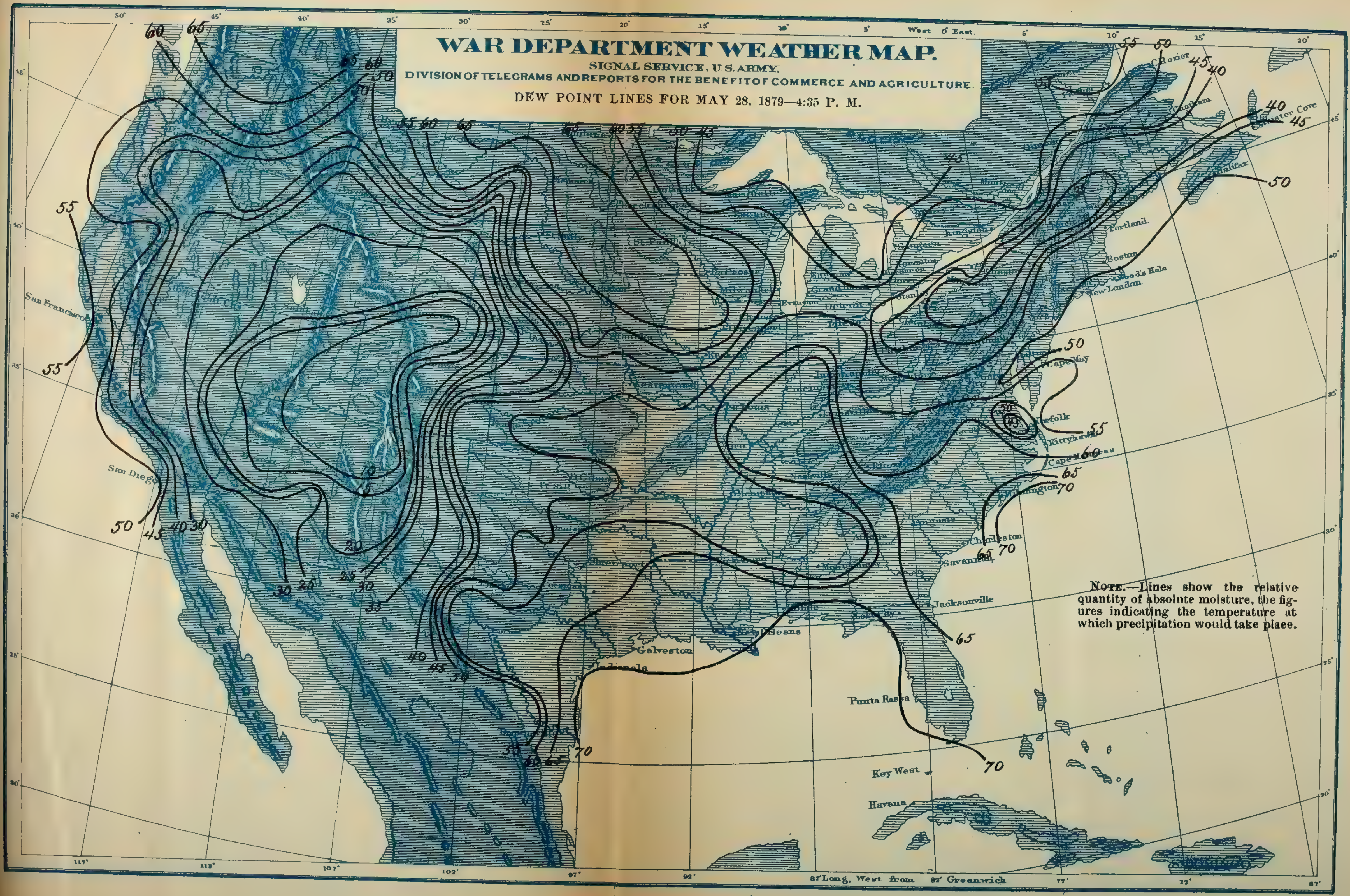

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

DEW POINT LINES FOR MAY 28, 1879—4:35 P. M.

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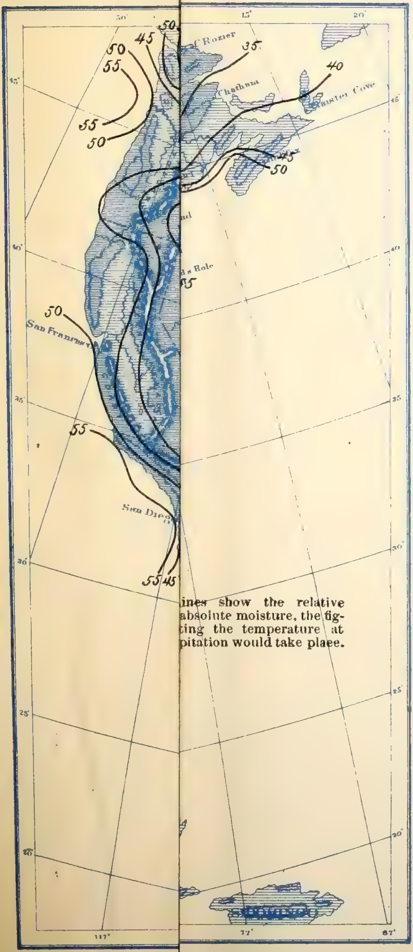

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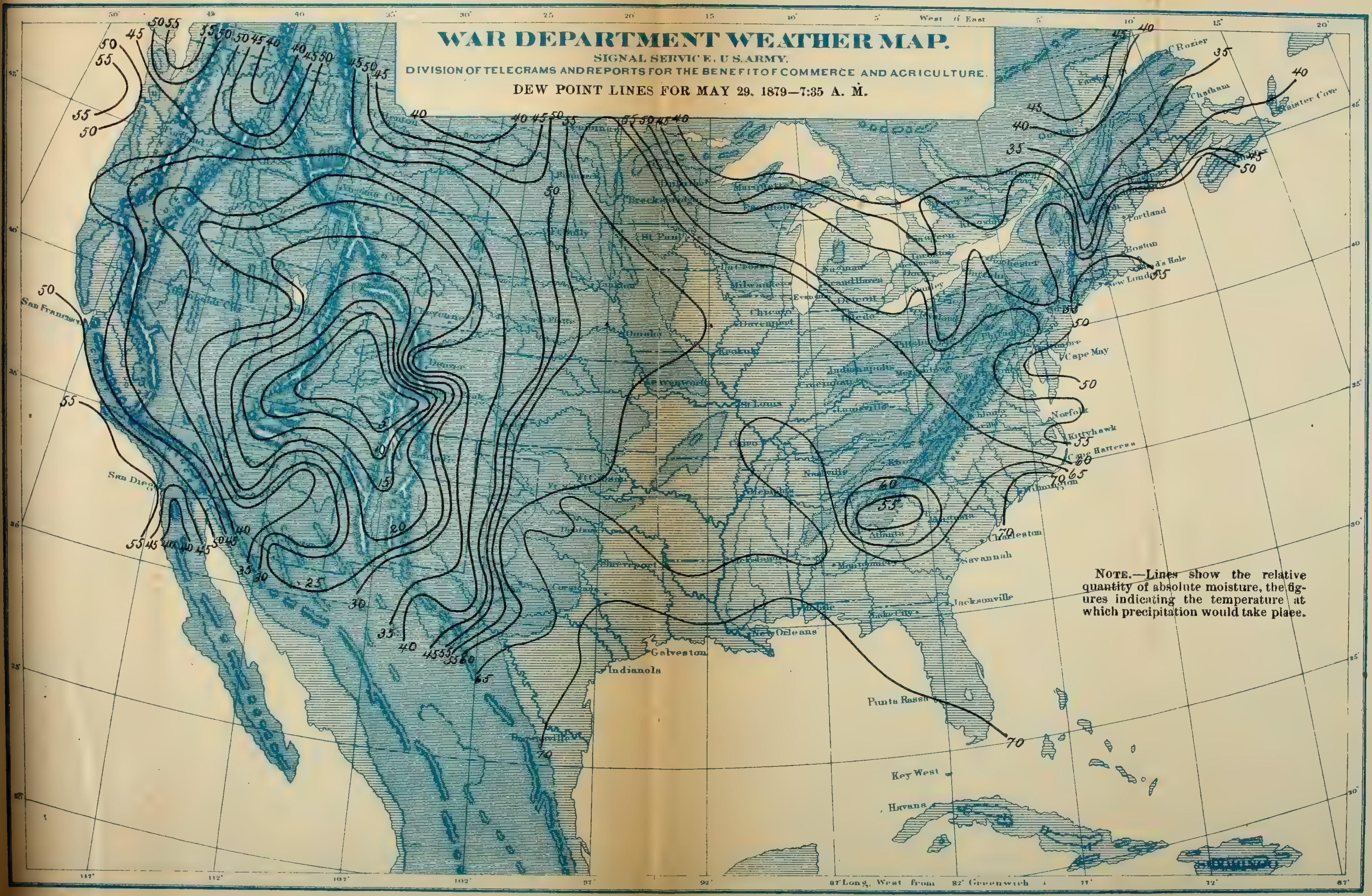

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

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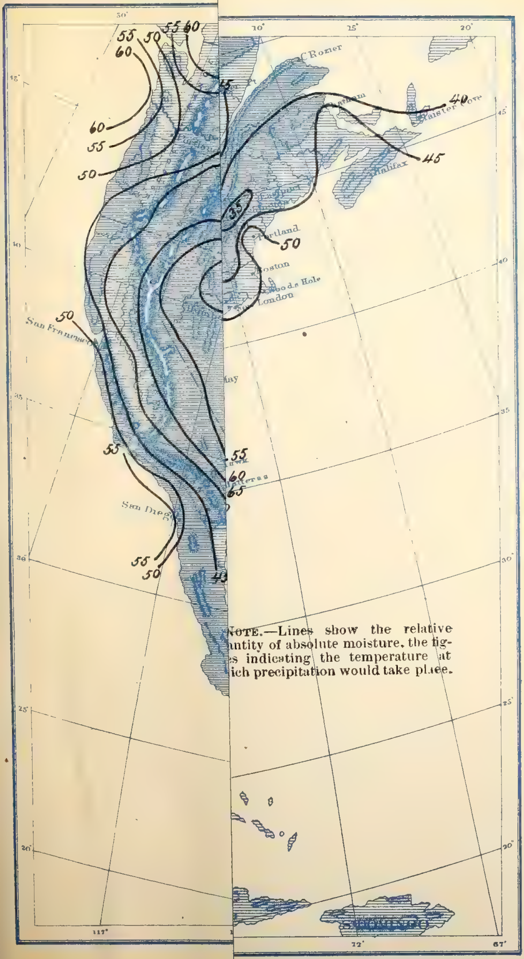

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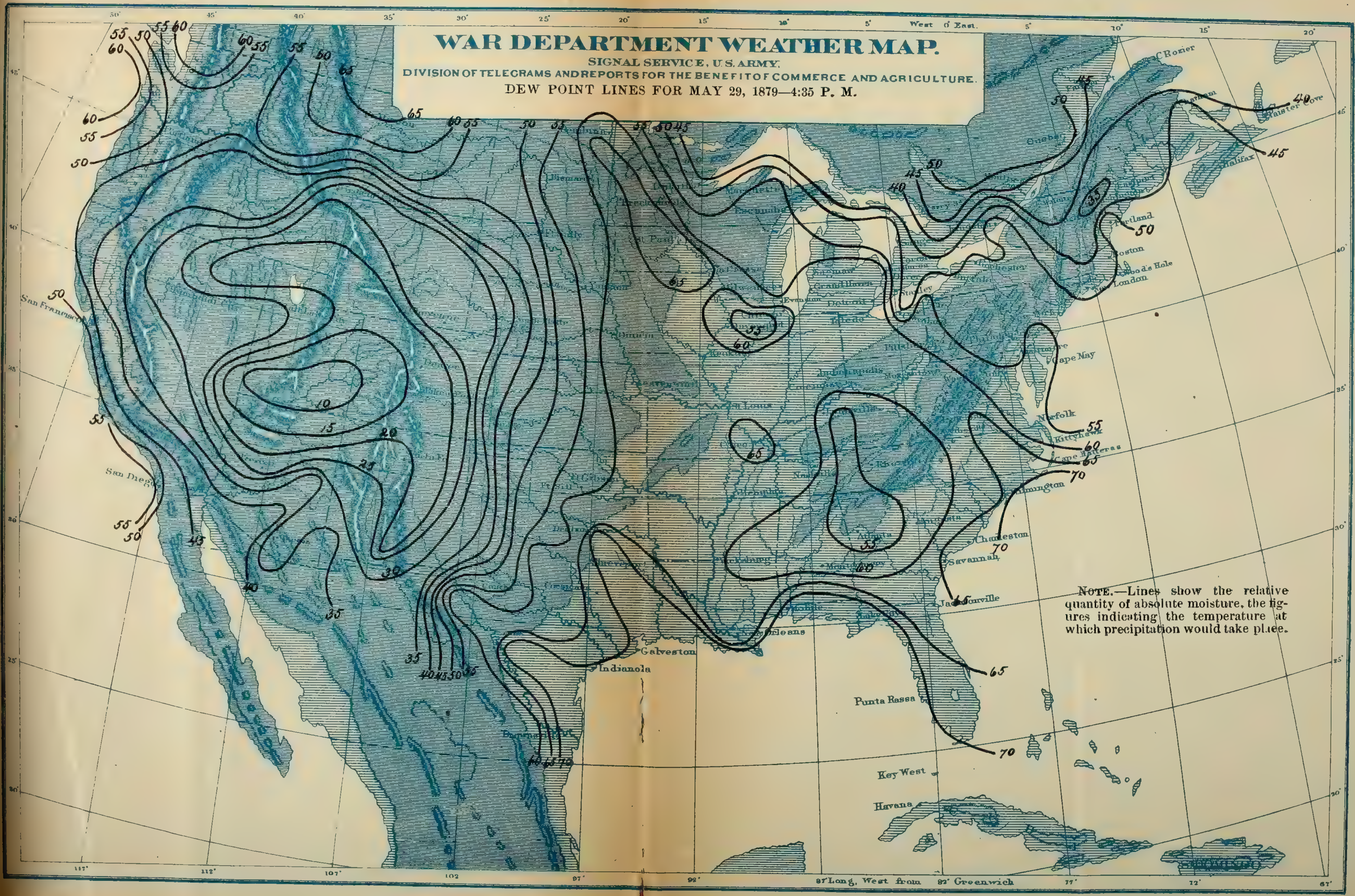

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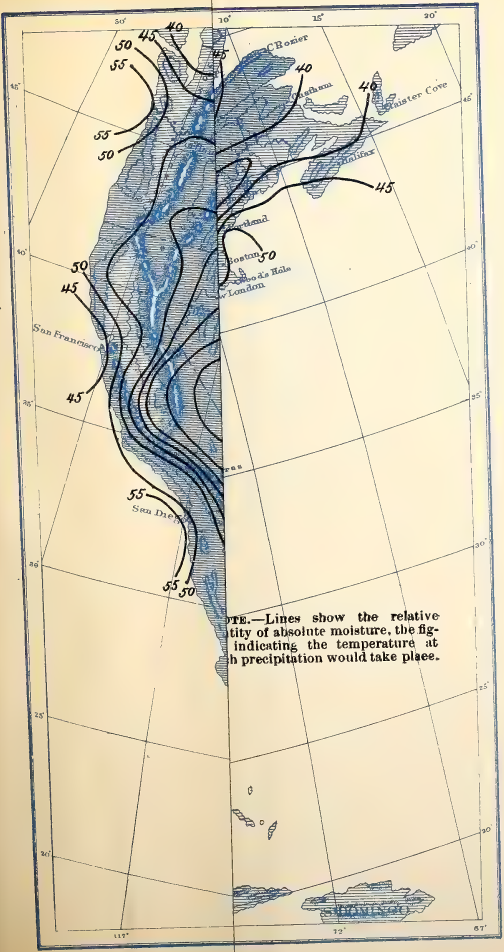

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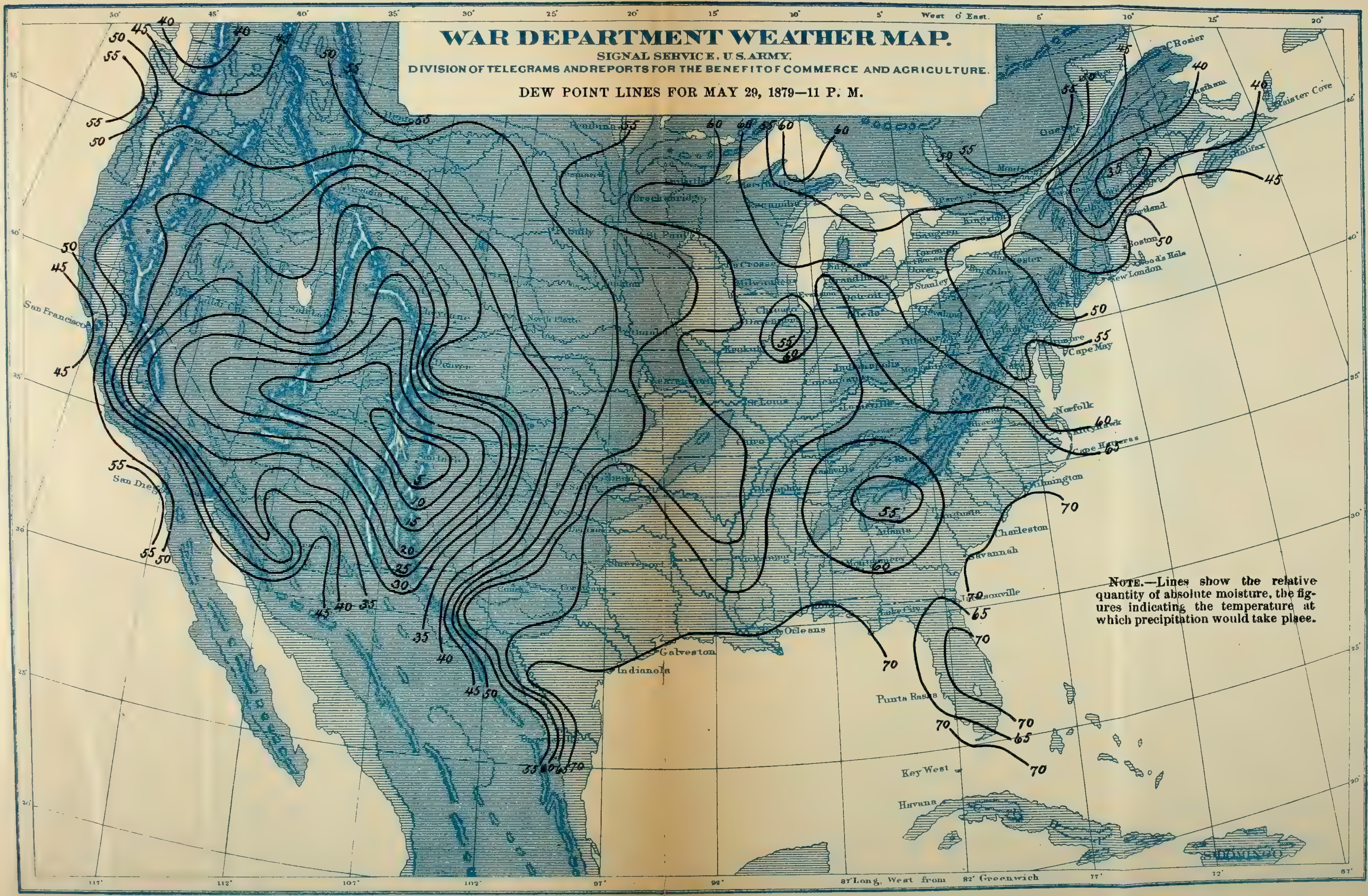

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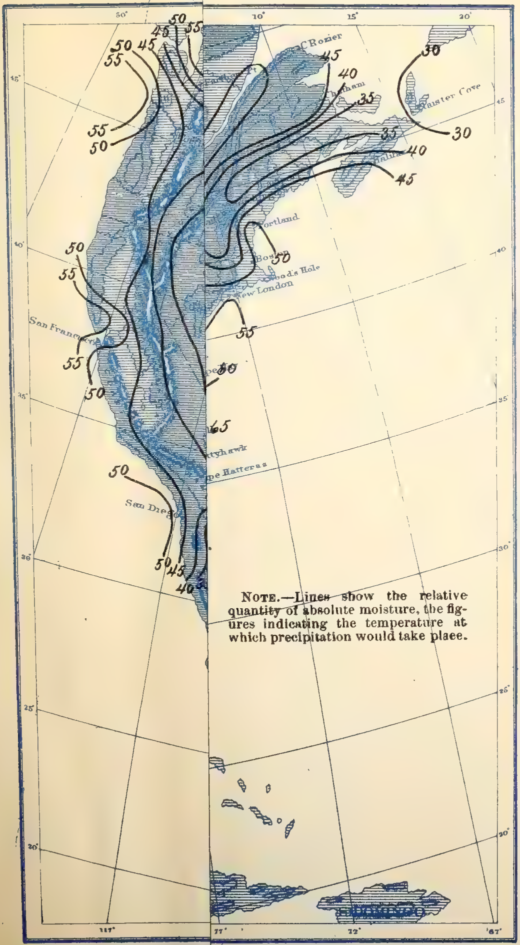

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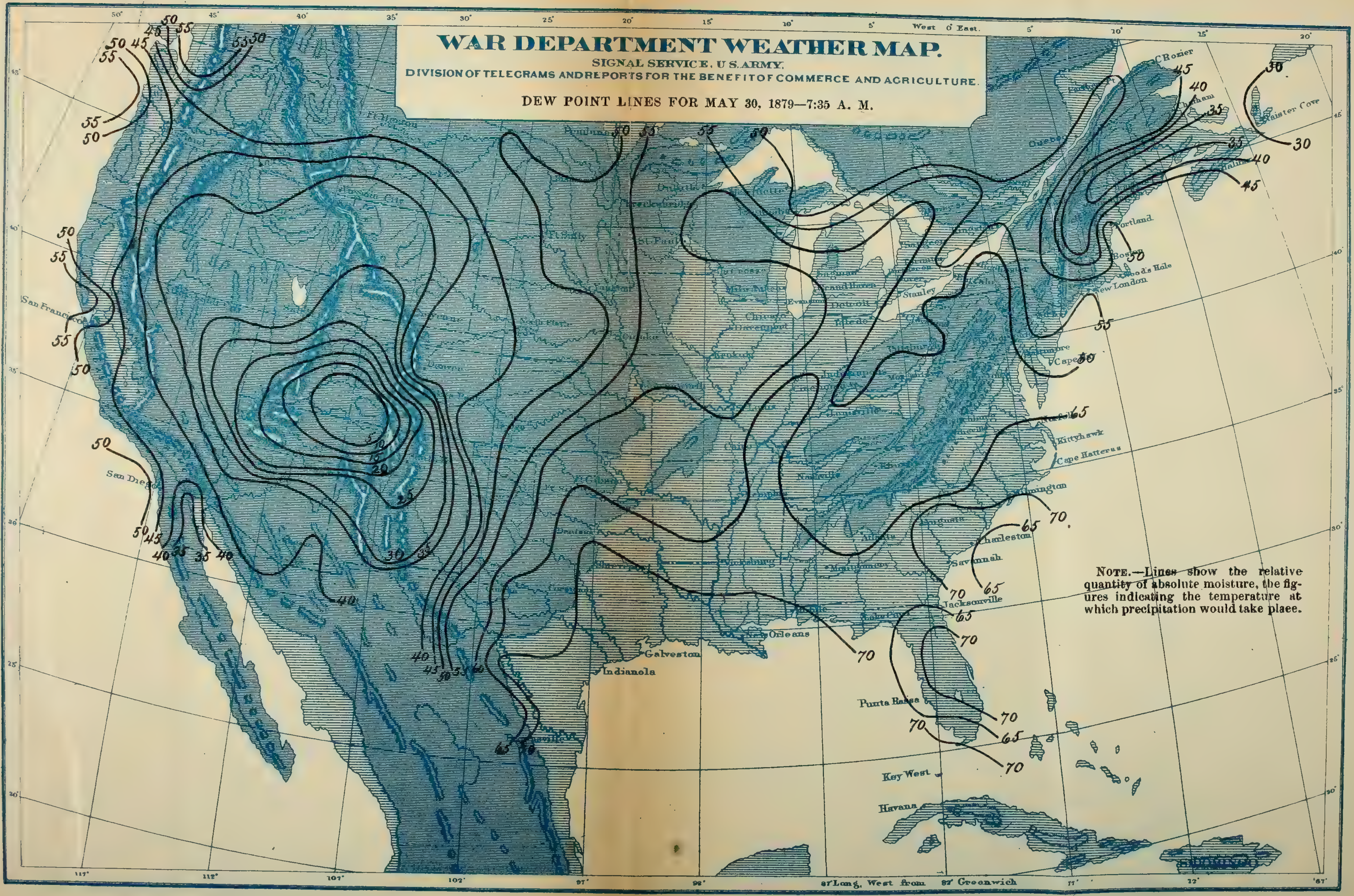

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SIGNAL SERVICE, U. S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

DEW POINT LINES FOR MAY 30, 1879—7:35 A. M.

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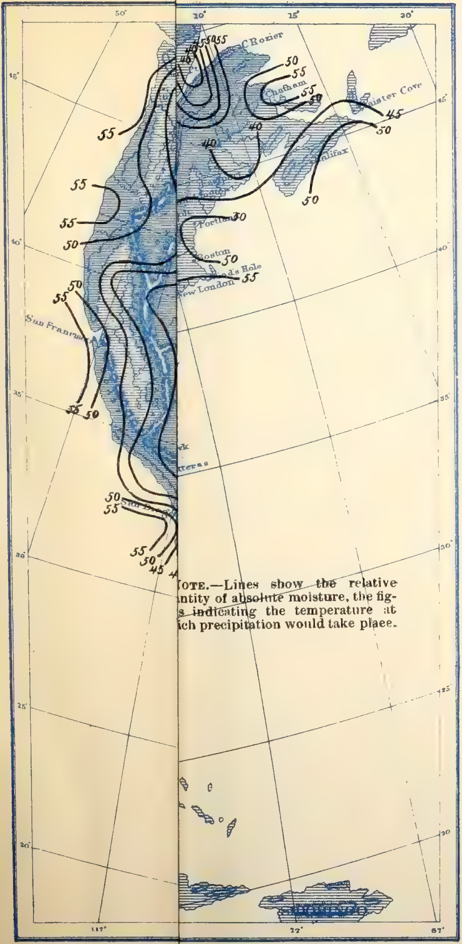

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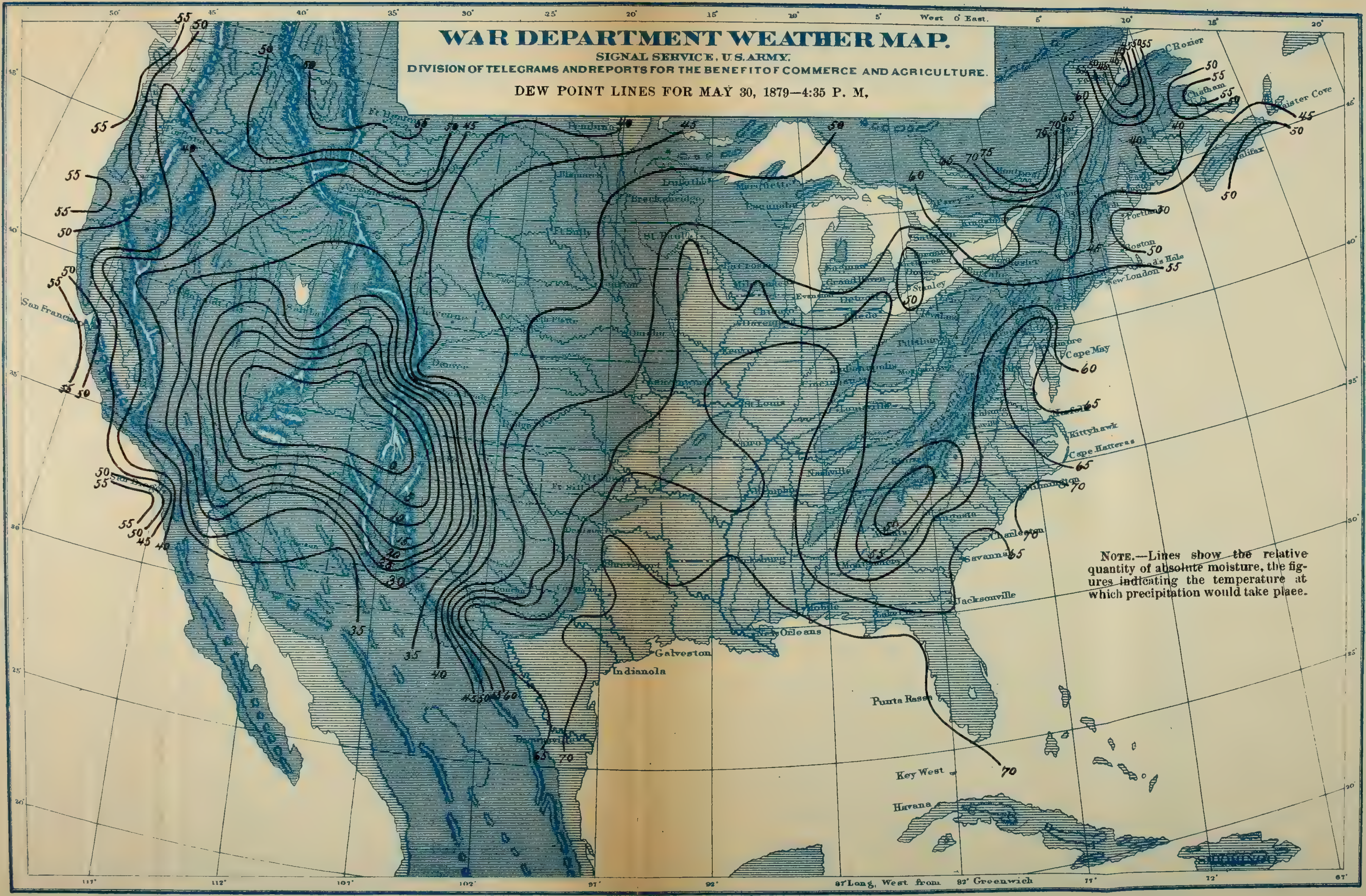

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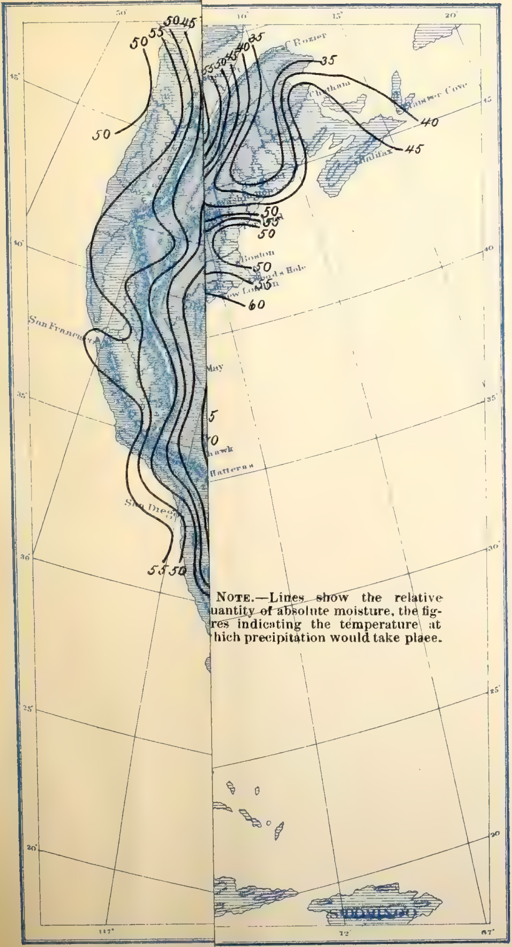

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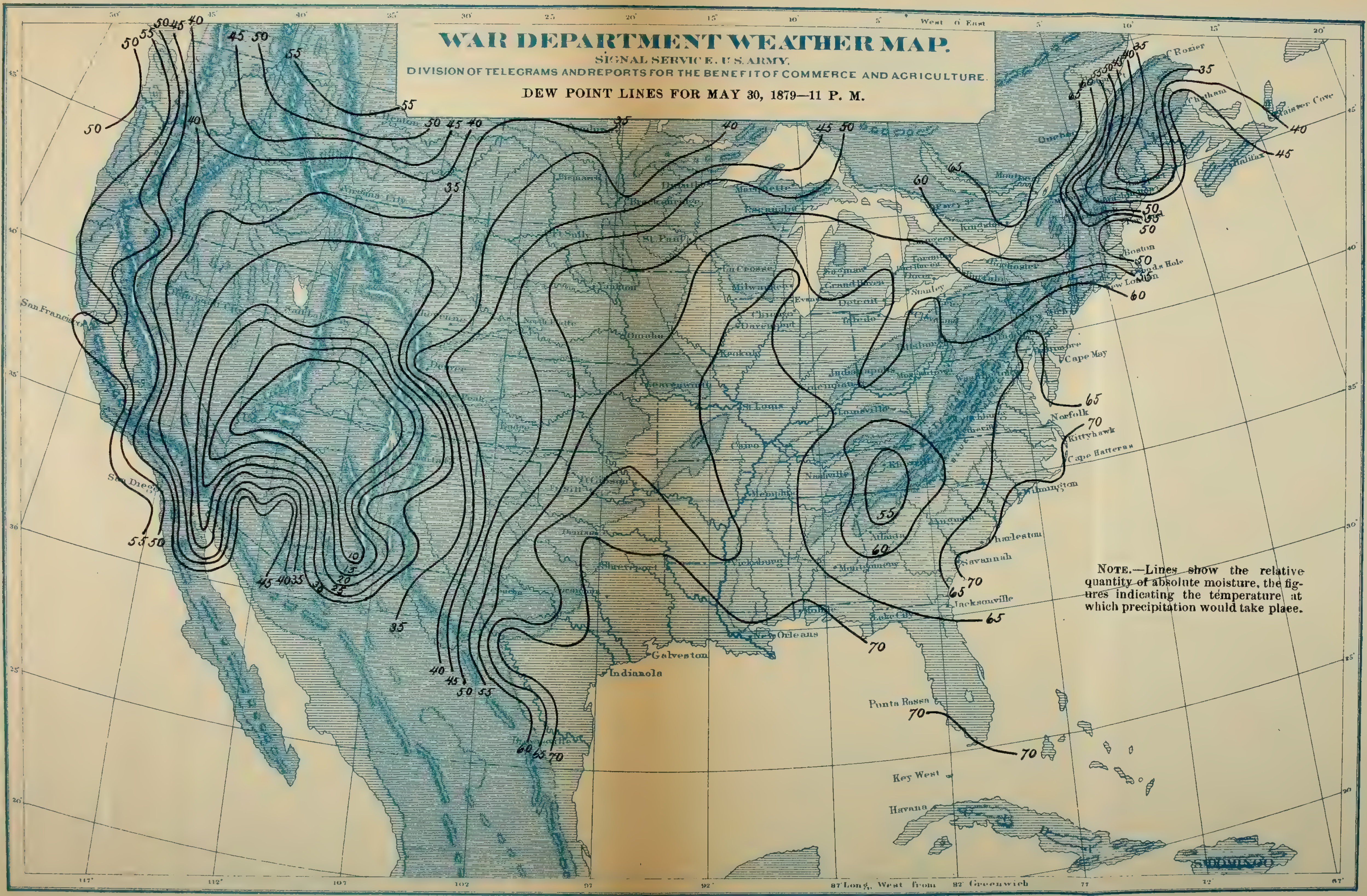

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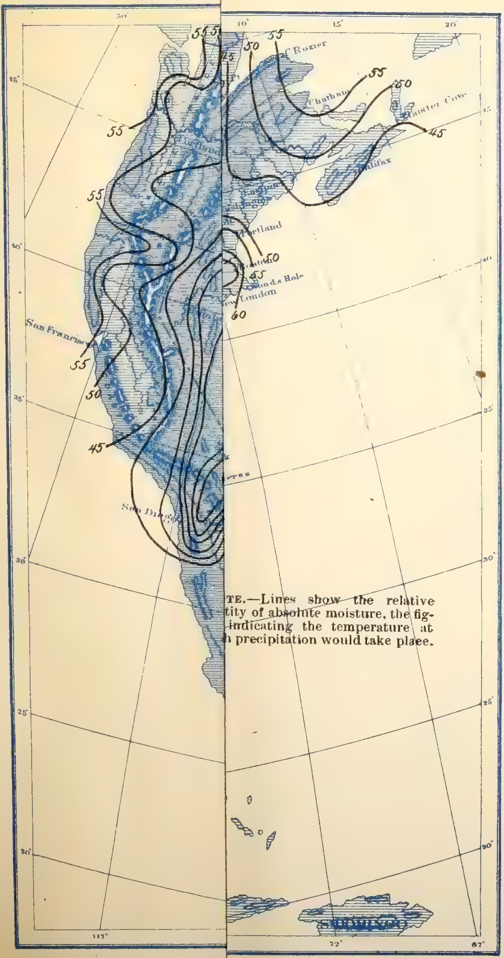

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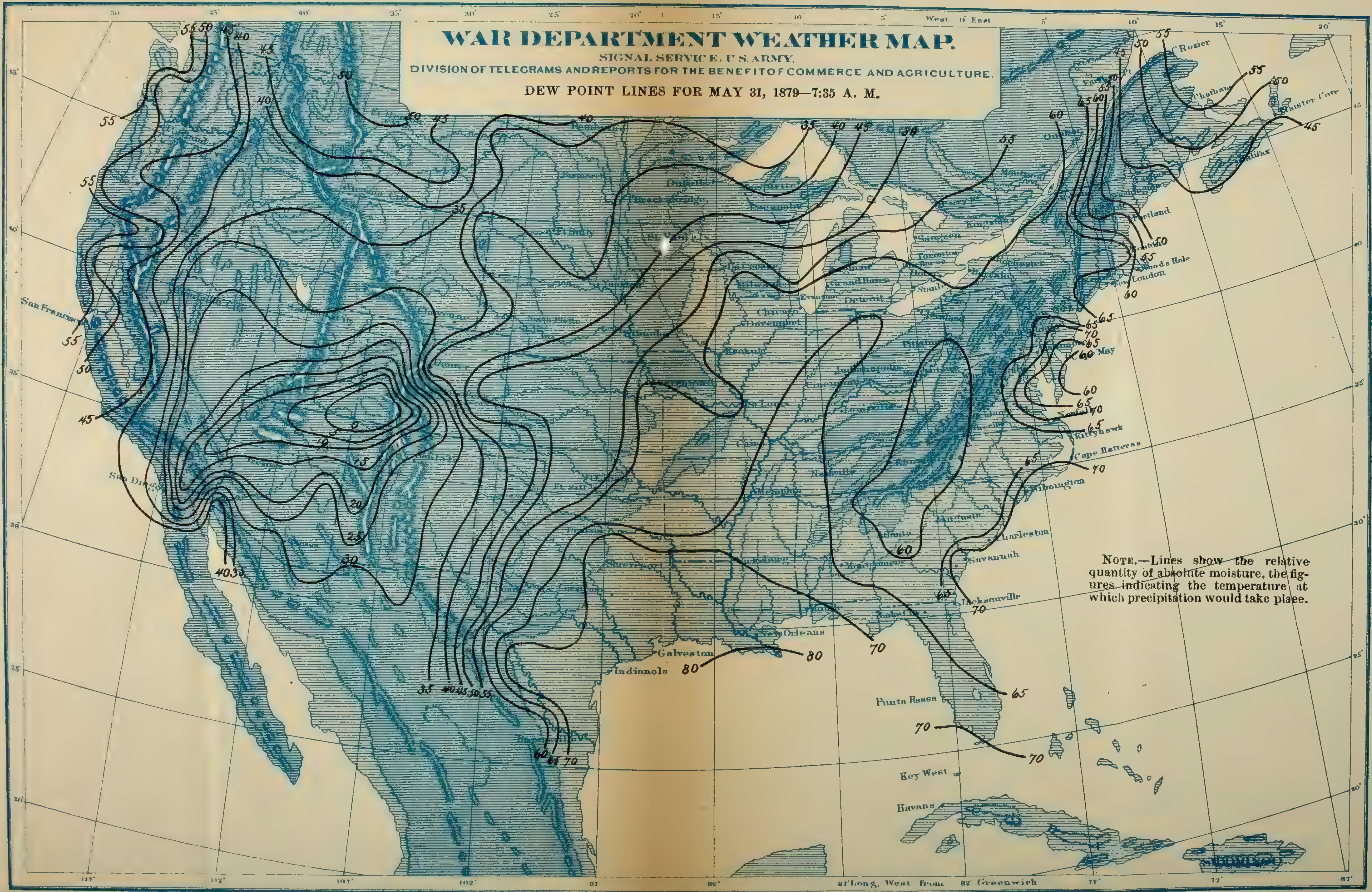

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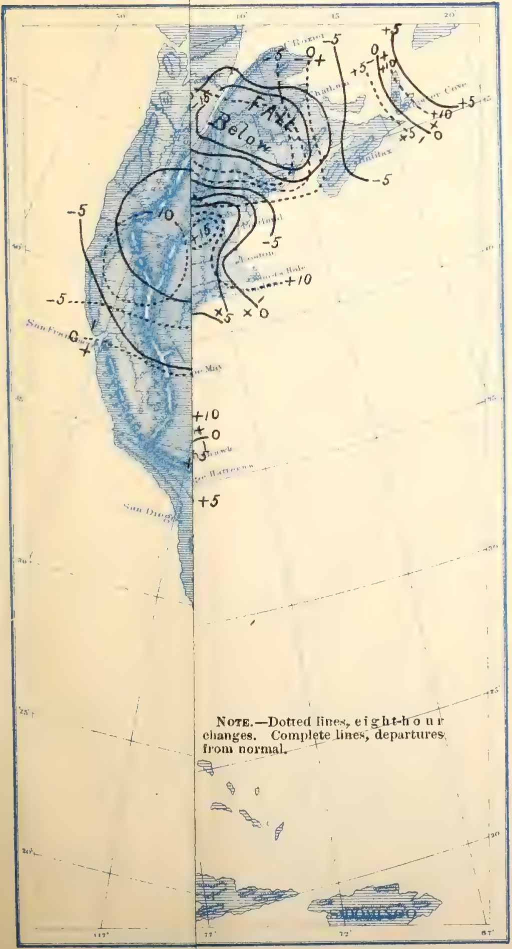
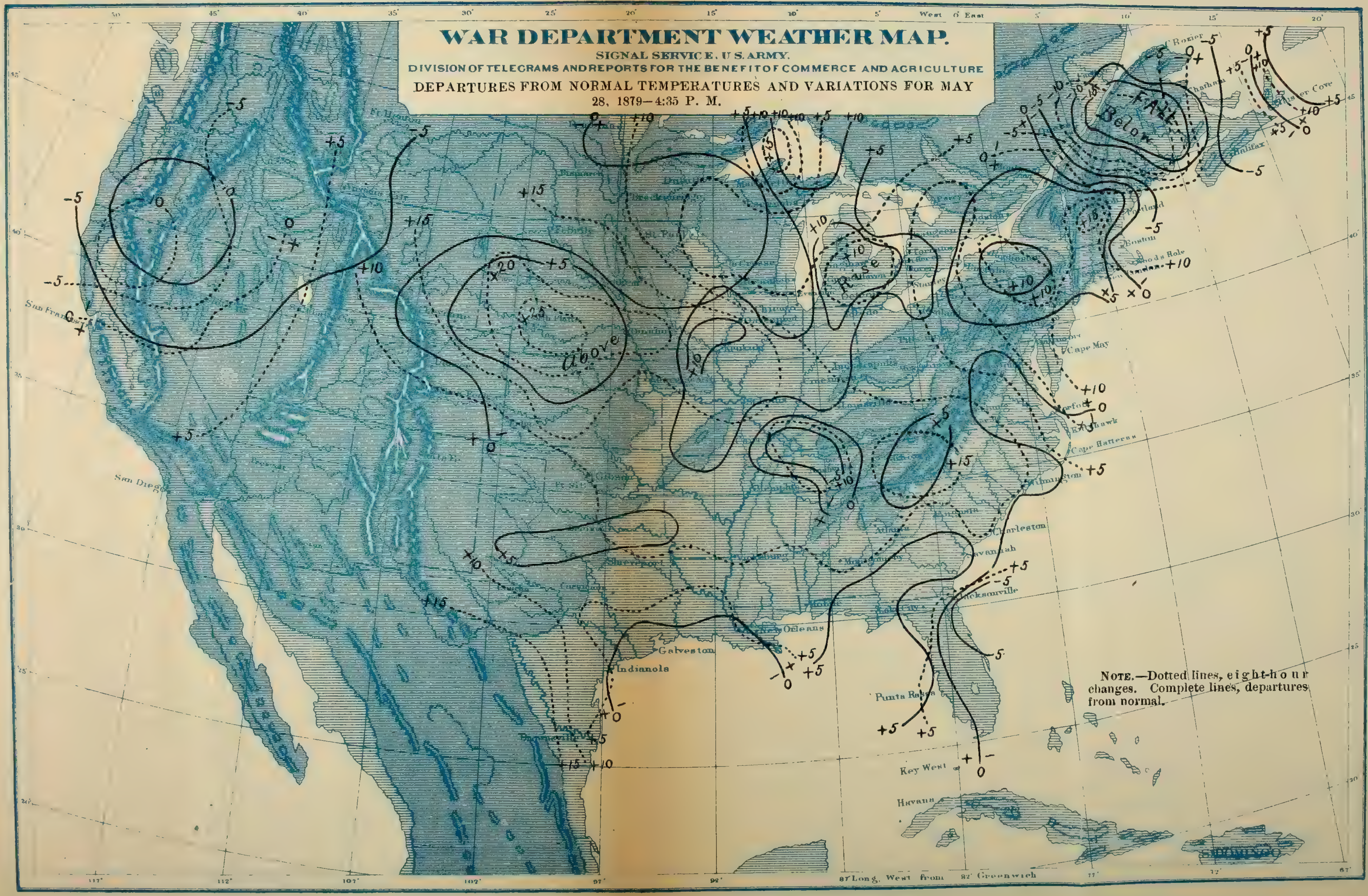


Note.—Dotted lines, eight-hour changes. Complete lines, departures from normal.



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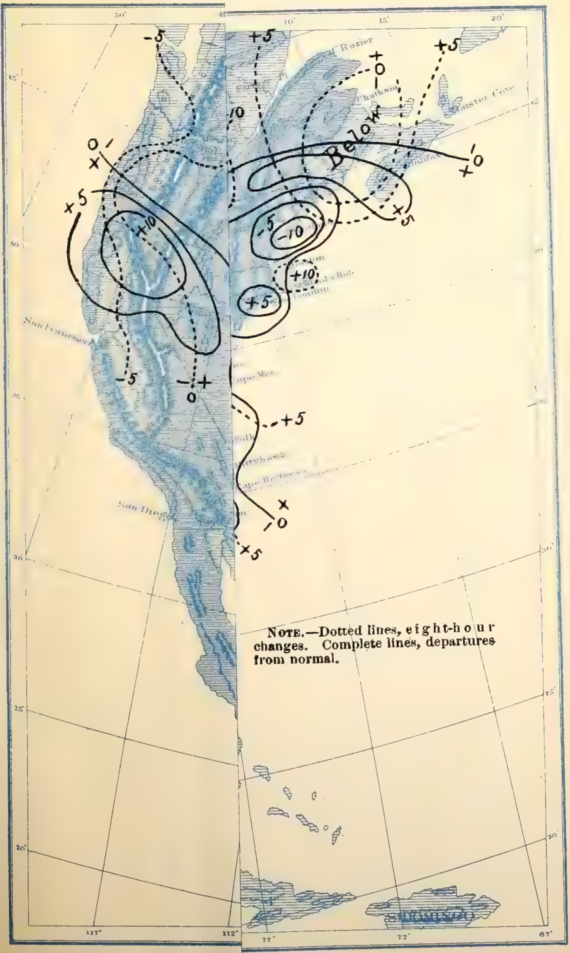
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE

DEPARTURES FROM NORMAL TEMPERATURES AND VARIATIONS FOR MAY 28, 1879—4:35 P. M.

NOTE.—Dotted lines, eight-hour changes. Complete lines, departures from normal.



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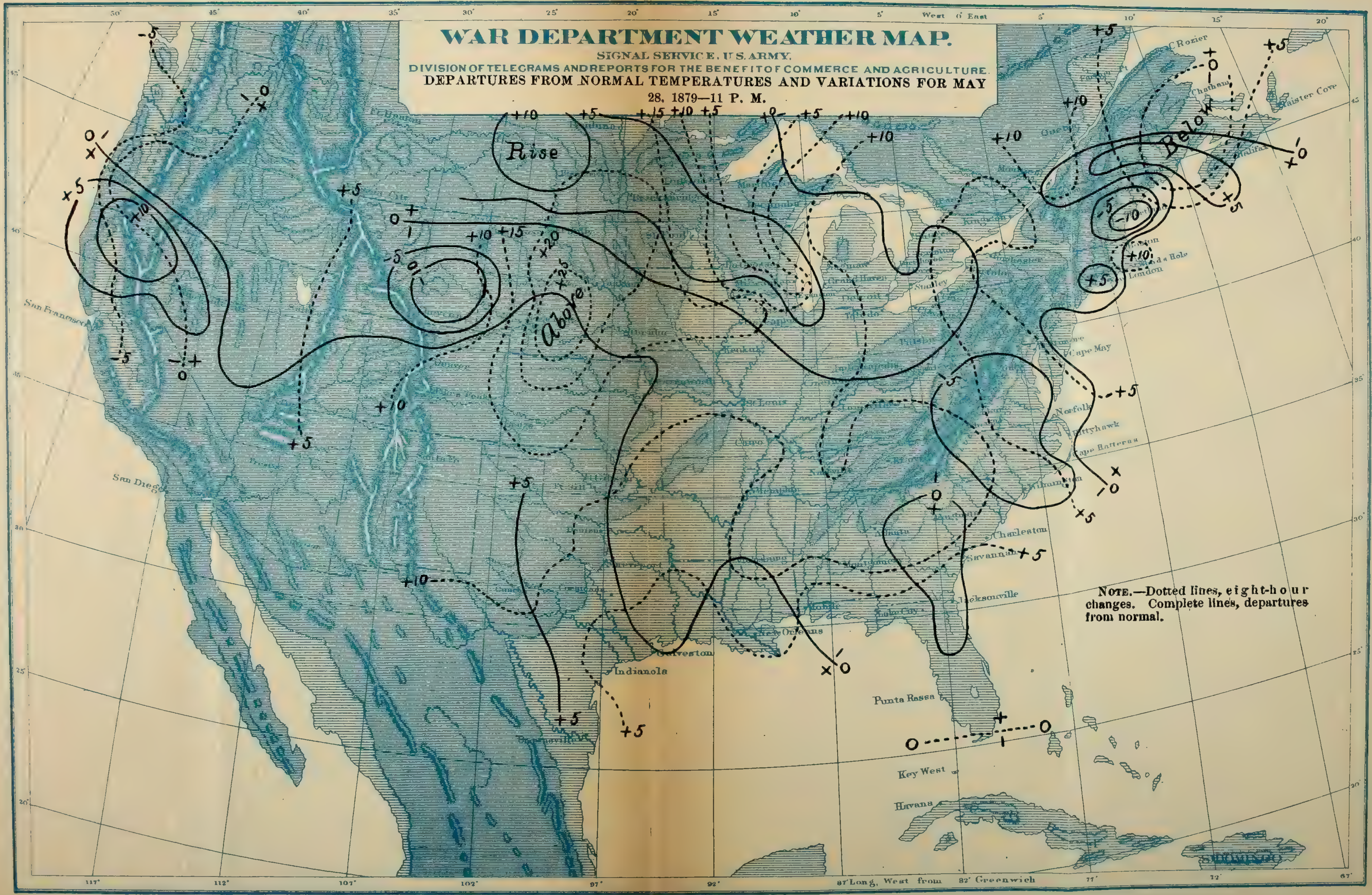

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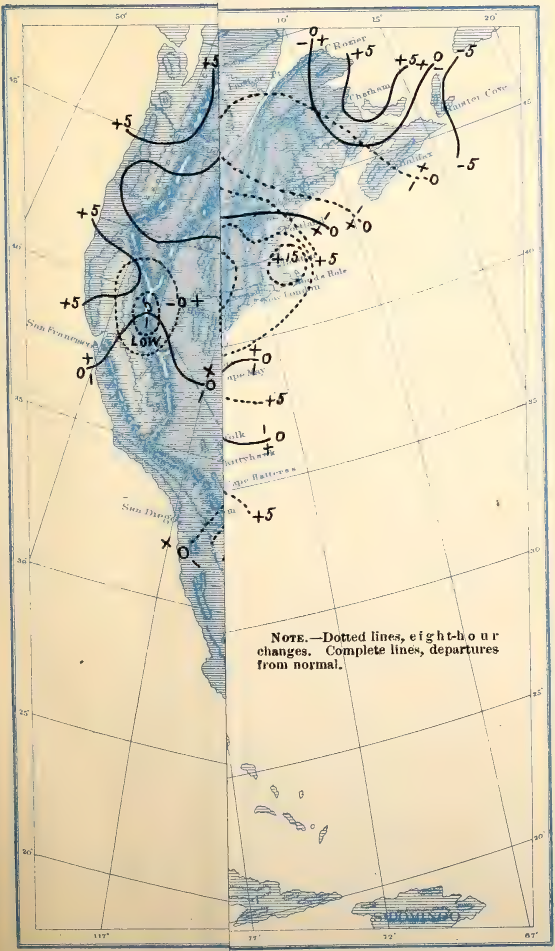

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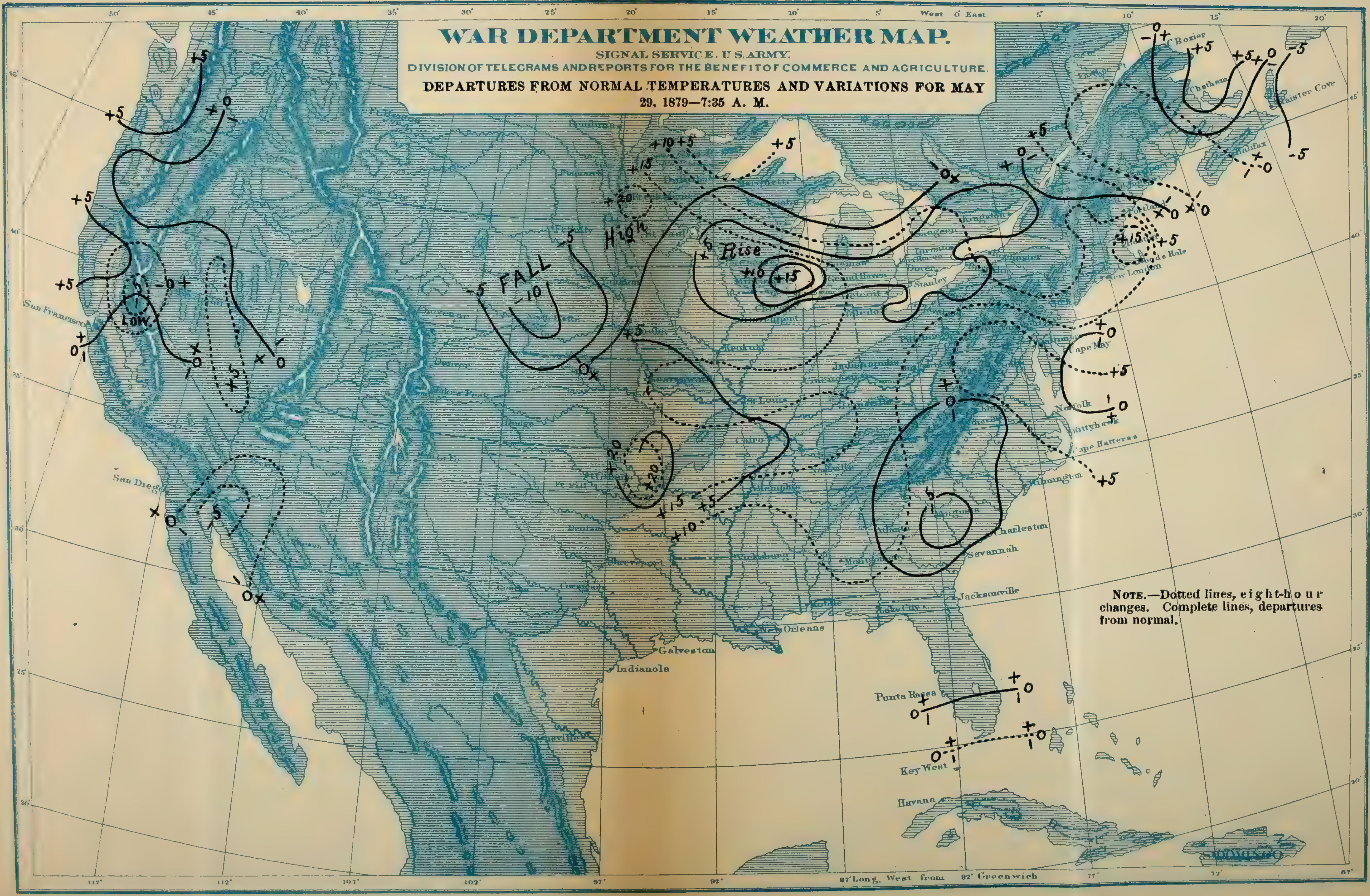

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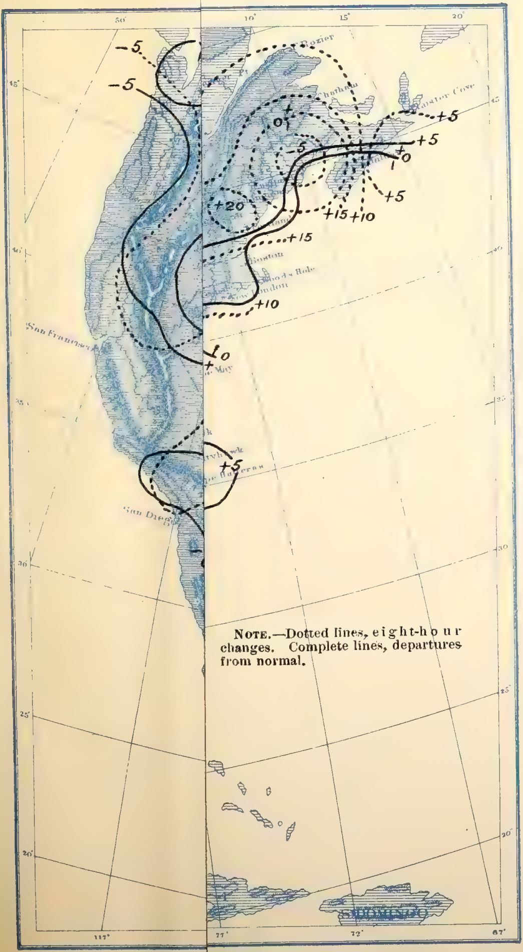

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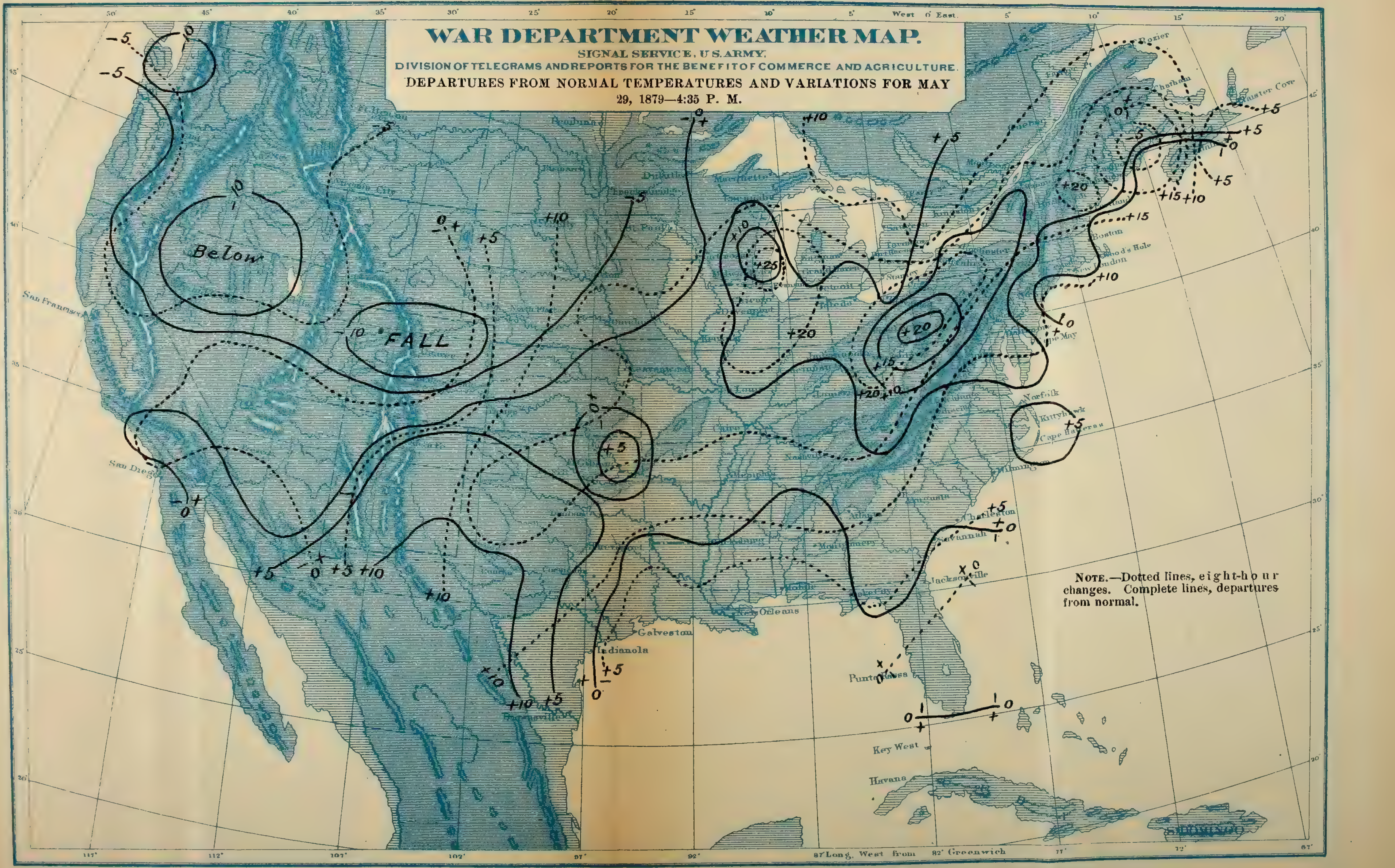

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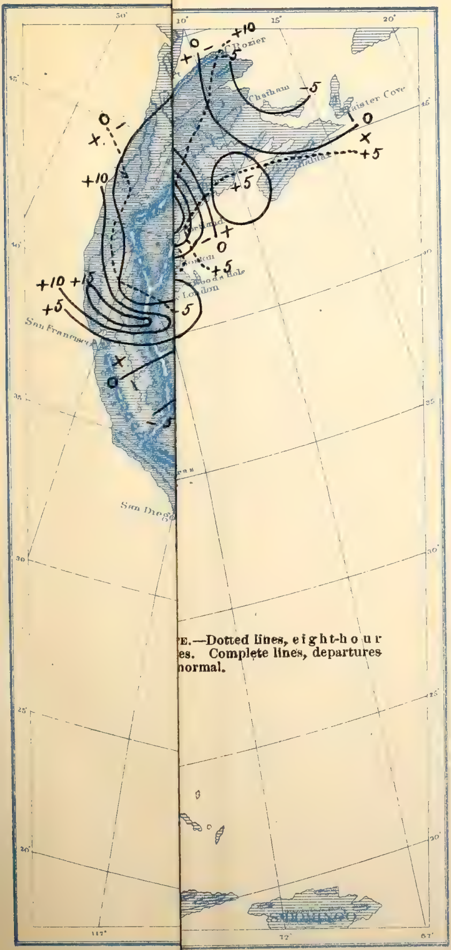

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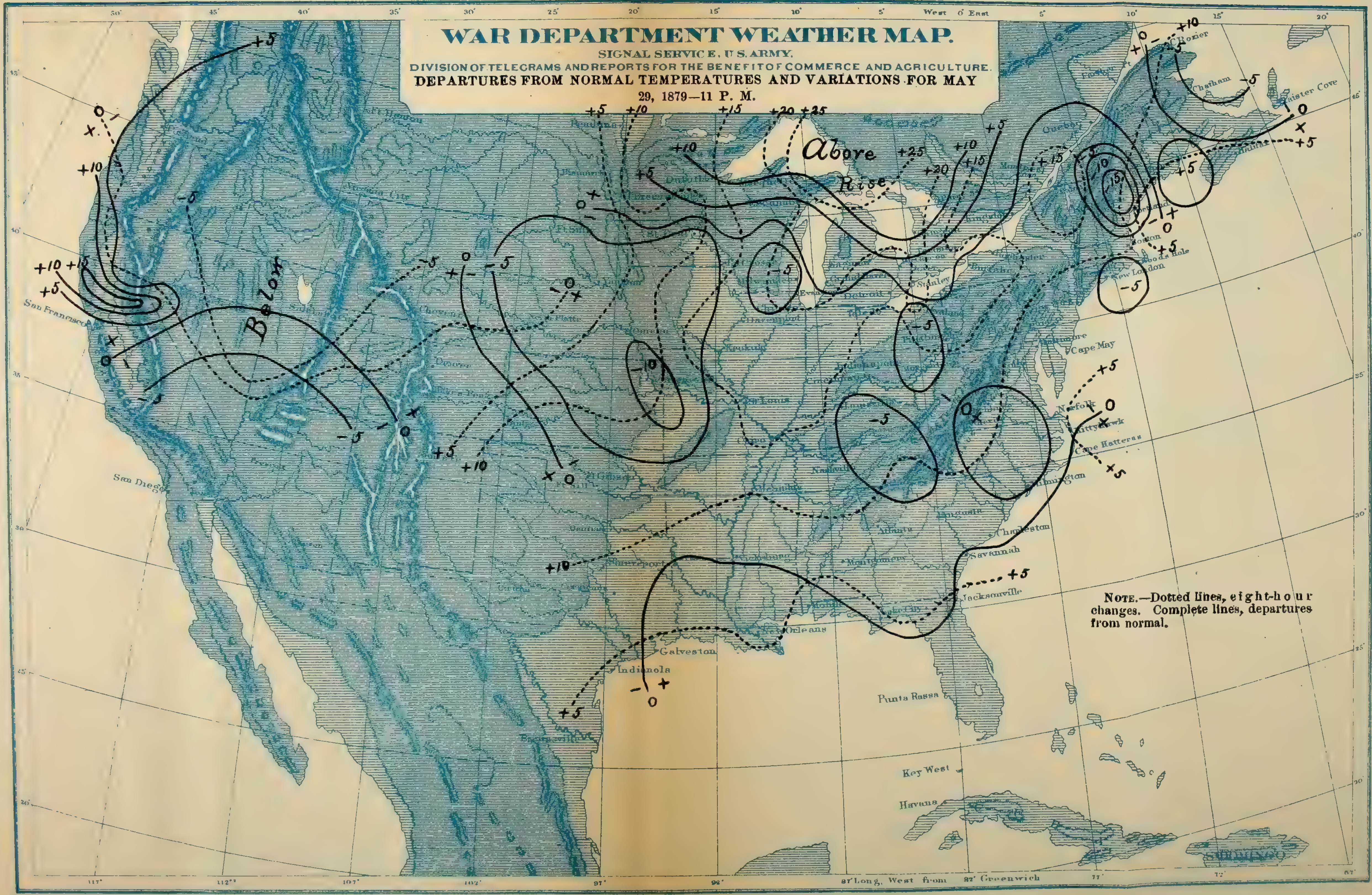

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DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

DEPARTURES FROM NORMAL TEMPERATURES AND VARIATIONS FOR MAY 29, 1879—11 P. M.

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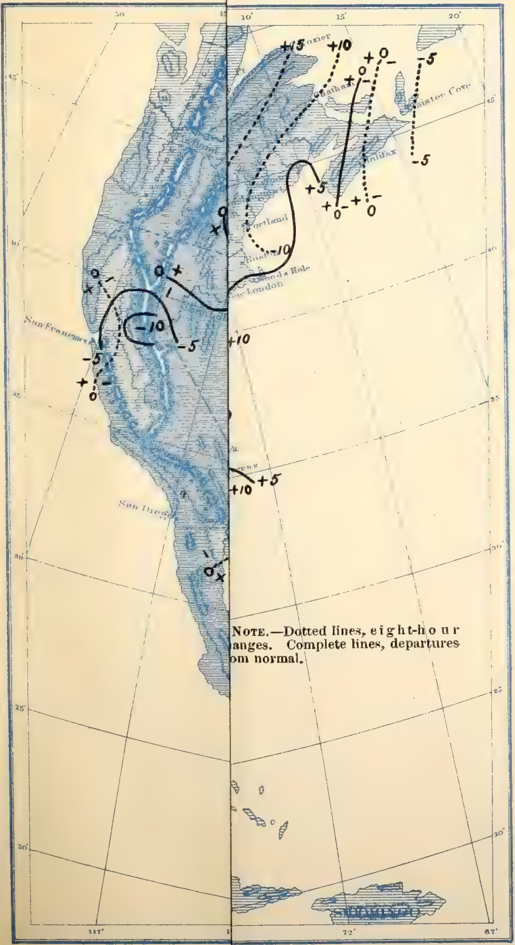

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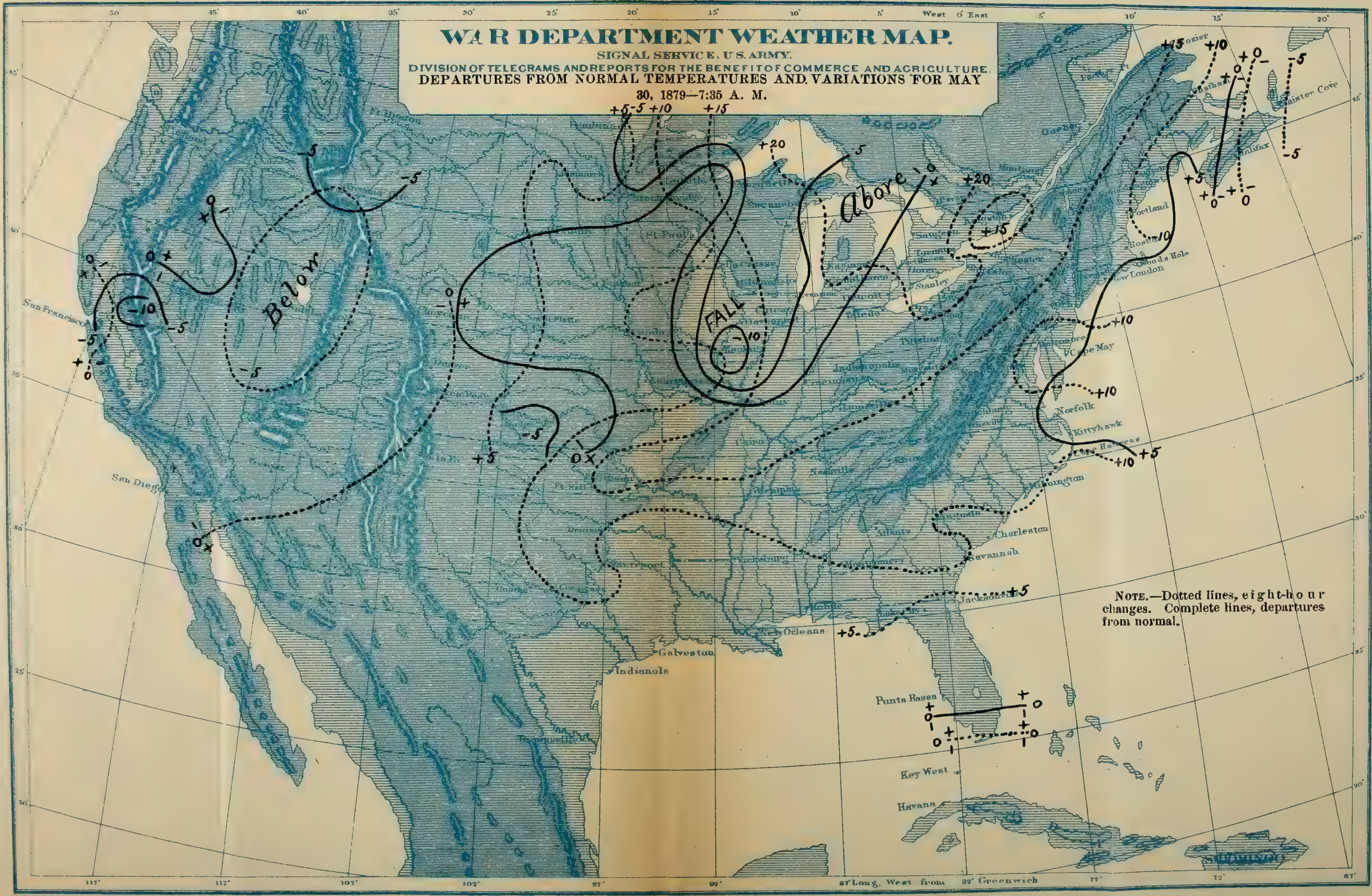

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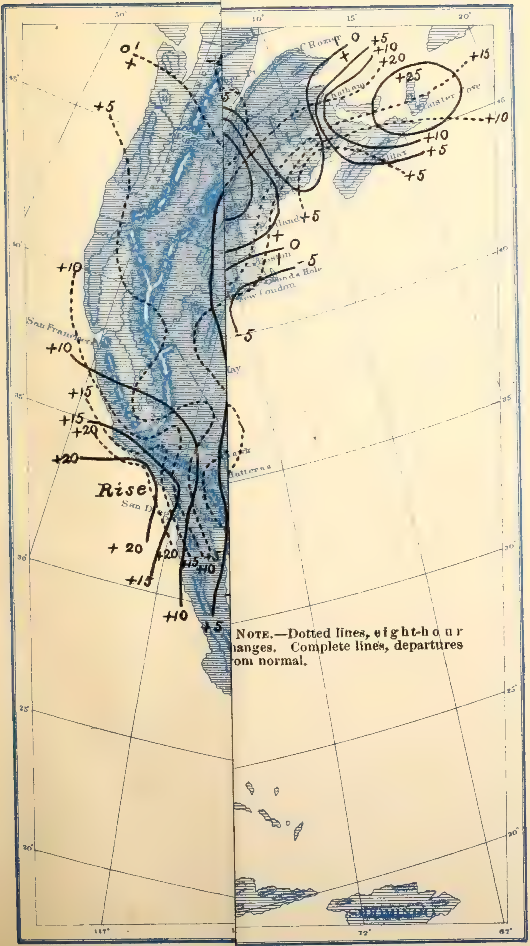

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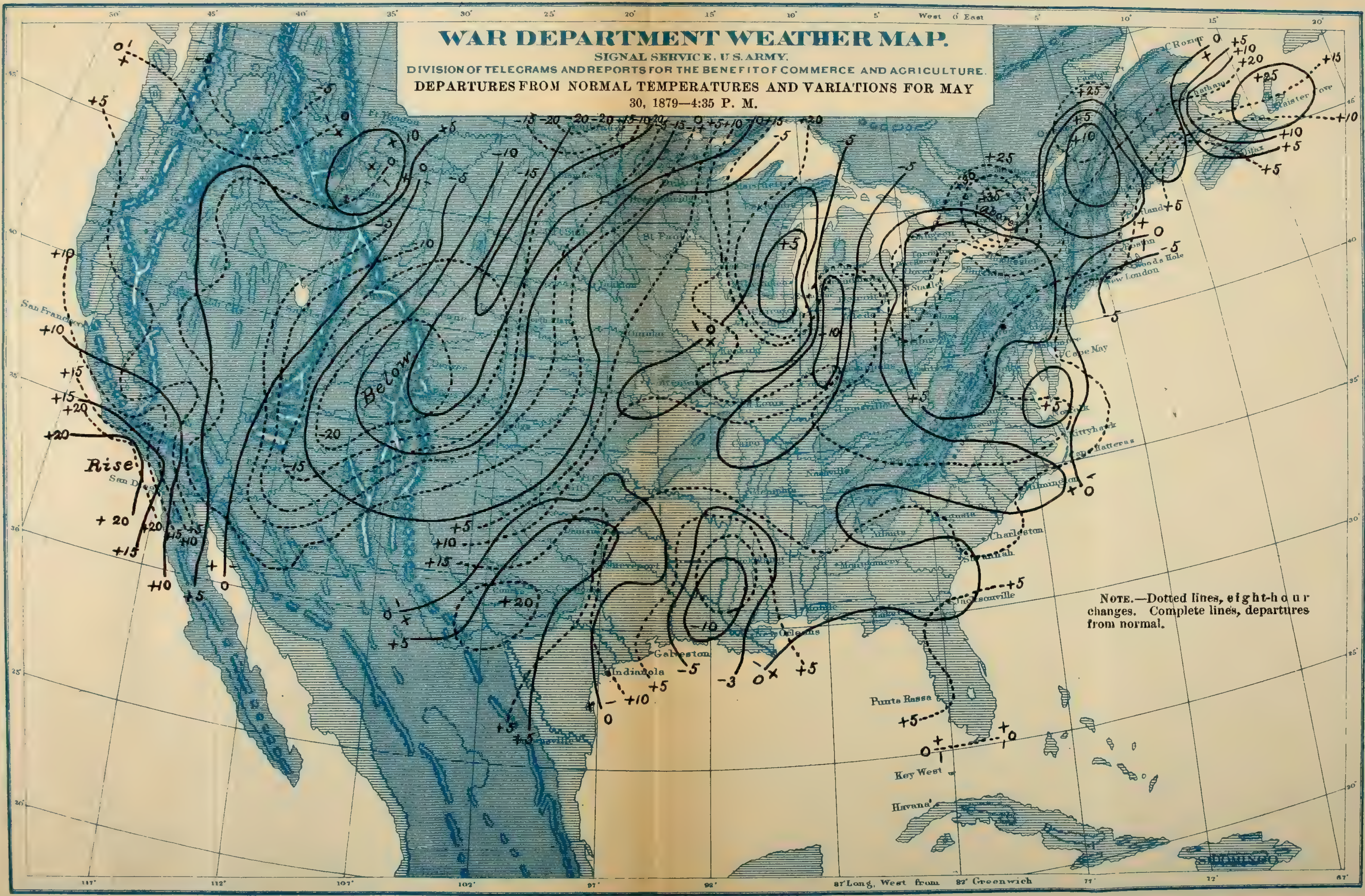

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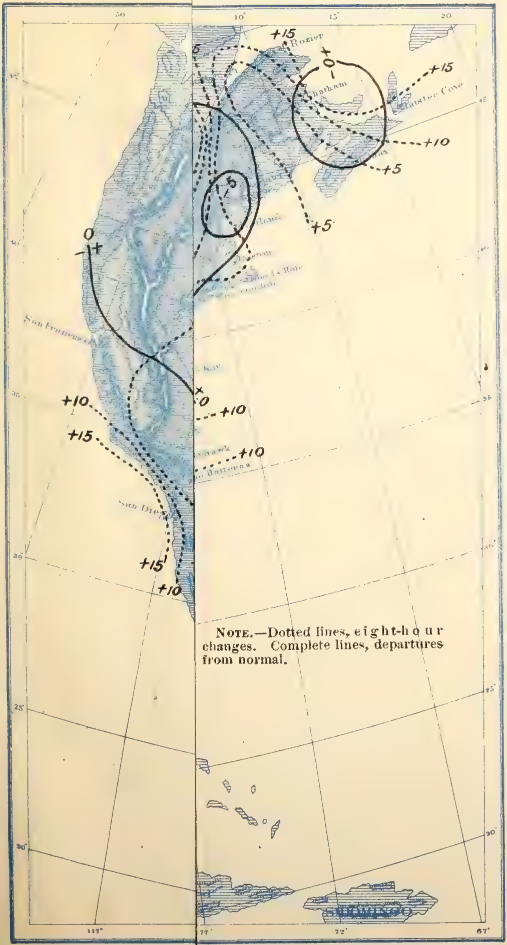
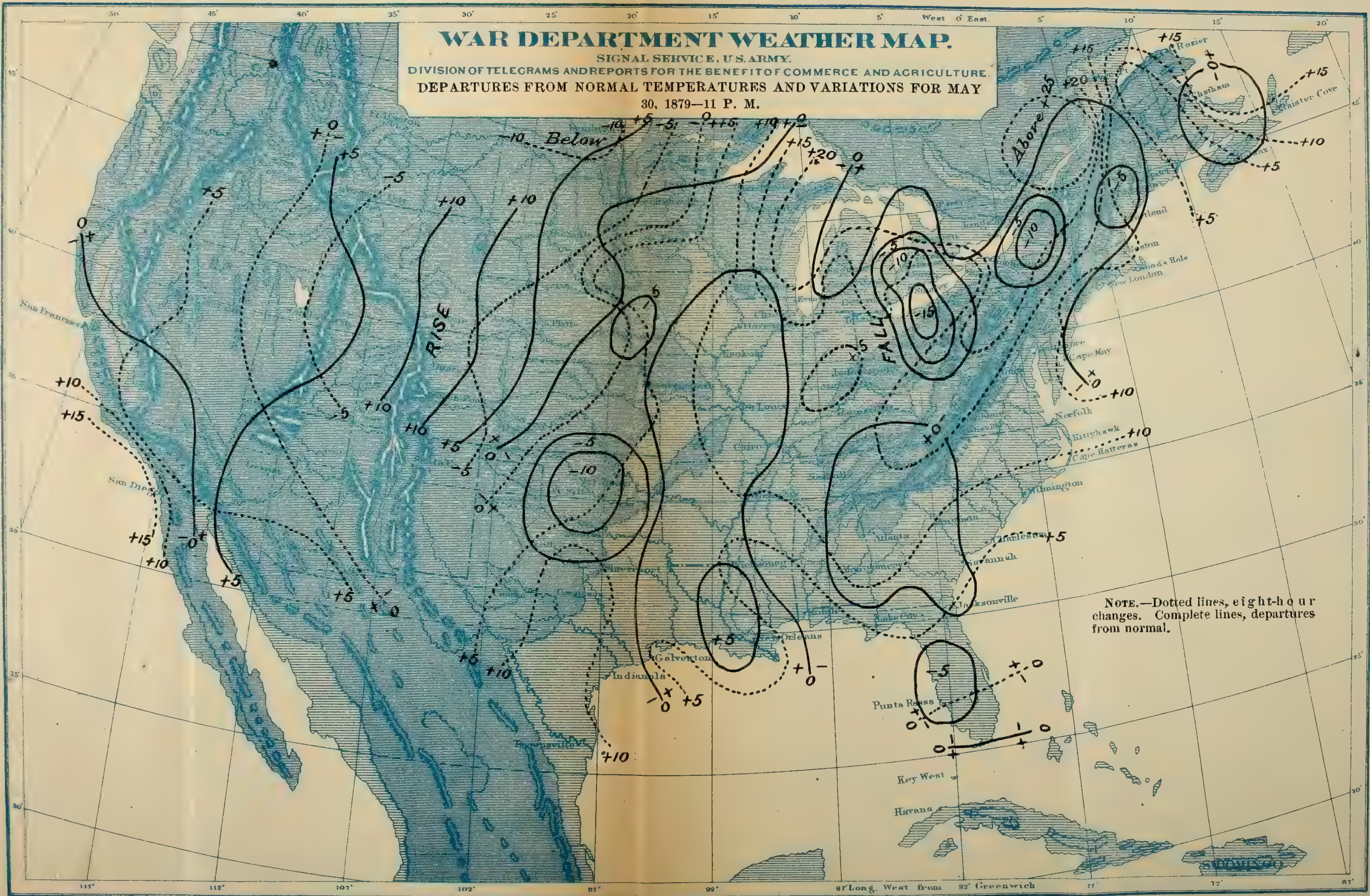
DEPARTURES FROM NORMAL TEMPERATURES AND VARIATIONS FOR MAY 30, 1879—4:35 P. M.

NOTE.—Dotted lines, eight-hour changes. Complete lines, departures from normal.



Note.—Dotted lines, eight-hour changes. Complete lines, departures from normal.



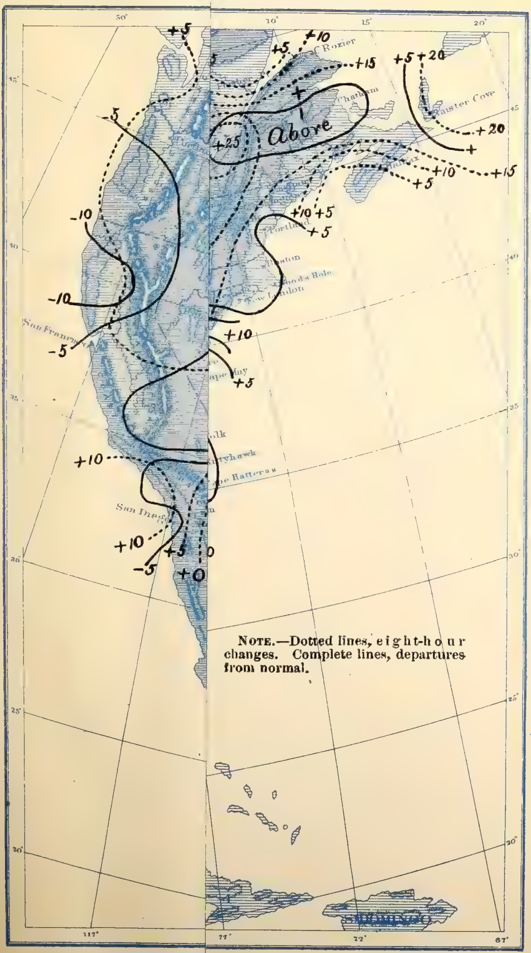
WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

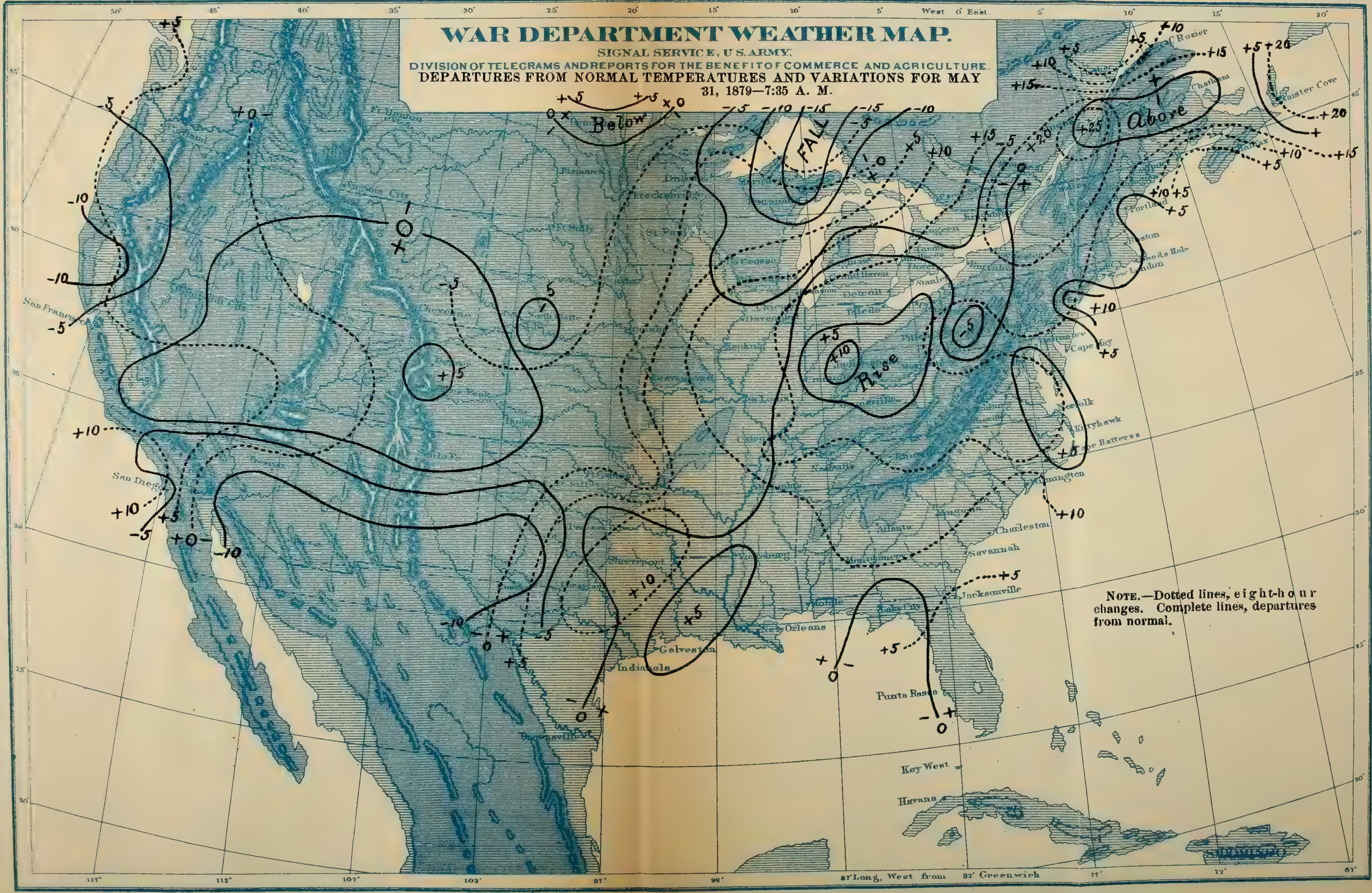
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

DEPARTURES FROM NORMAL TEMPERATURES AND VARIATIONS FOR MAY 30, 1879—11 P. M.

NOTE.—Dotted lines, eight-hour changes. Complete lines, departures from normal.



NOTE.—Dotted lines, eight-hour changes. Complete lines, departures from normal.



WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

DEPARTURES FROM NORMAL TEMPERATURES AND VARIATIONS FOR MAY 31, 1879—7:35 A. M.

NOTE.—Dotted lines, eight-hour changes. Complete lines, departures from normal.

AUGUST, 1873.

21.—*Iowa:* Dubuque, 8.45 to 9 p. m.

22.—*Massachusetts:* Boston, 10 p. m. *Minnesota:* Duluth, suspected, 9.30 p. m.; Saint Paul, 11 p. m. *Michigan:* Detroit, 10.30 p. m.

23.—*Connecticut:* New London, 11.15 to 12 p. m. *Dakota:* Pembina, 10 p. m. *Maine:* Gardiner, 9 till after 11.59 p. m.; Portland. *Minnesota:* Breckinridge. *New York:* Rochester, 9 p. m. to 1.30 a. m.

24.—*Dakota:* Pembina, 9 till after 10.25 p. m. *Maine:* Gardiner, began at 11 p. m. *Minnesota:* Breckinridge; Duluth, 9.45 to 10.20 p. m.; Saint Paul, 11 p. m. *Wisconsin:* Milwaukee, after 9 p. m.

25.—*Dakota:* Pembina, 9.30 till after 11 p. m. *Maine:* Gardiner, soon after 9 p. m. *Michigan:* Alpena, 9.30 till after 10.34 p. m. *Minnesota:* Duluth, suspected, 10.34 to 12 p. m. *Pennsylvania:* Erie, suspected. *Wisconsin:* La Crosse, 9 till after 10 p. m.

26.—*Dakota:* Pembina, 8.35 p. m. *Maine:* Gardiner, 9 p. m. till after 1 a. m. *Michigan:* Alpena, 9 p. m. *Minnesota:* Breckinridge; Duluth, suspected, 10 p. m.; Saint Paul, 10.50 to 11.50 p. m. *New Hampshire:* Mount Washington, from 10 p. m. *New York:* Rochester, 8 p. m. to 2 a. m. *Pennsylvania:* Erie, 10.47 p. m. to 1 a. m.

27.—*Michigan:* Alpena, 9 till after 10.34 p. m. *Minnesota:* Saint Paul. *New Hampshire:* Mount Washington, from 9 p. m.

28.—*Dakota:* Pembina, 9.50 p. m. *Michigan:* Marquette, early evening to 11.10 p. m.

29.—*Dakota:* Pembina, 10 till after 11 p. m. *Maine:* Gardiner, 11.59 p. m. *Michigan:* Alpena, 9 till after 10.34 p. m. *Minnesota:* Duluth, 10 till after 11 p. m.

SEPTEMBER, 1873.

1.—*Alaska:* Saint Paul's Island.

4.—*Minnesota:* Duluth, 10.30 to 10.45 p. m.

6.—FULL MOON.

10.—*Wisconsin:* La Crosse, 9 to 10.30 p. m. *Dakota:* Pembina, 9.30 to 10 p. m.

11.—*Montana:* Fort Benton.

13.—*Dakota:* Pembina, 8.15 till after 9.15 p. m. *Michigan:* Alpena, 9 p. m.; Escanaba, 9 to 11 p. m.; Grand Haven, 8 p. m. *Minnesota:* Breckinridge, suspected; Saint Paul, early evening to 10 p. m. *Wisconsin:* La Crosse, 9 to 10.15 p. m.; Milwaukee, 7.30 to 11.25 p. m.

14.—*Dakota:* Pembina, 9.50 p. m. *Michigan:* Alpena, 8.30 p. m. *Ohio:* Toledo, 9 to 9.20 p. m.

16.—*Dakota:* Pembina, 8.40 to 9.30 p. m.

18.—*Iowa:* Keokuk, 10 p. m. *Michigan:* Alpena, 8 till after 10 p. m.

19.—*Minnesota:* Duluth, 10 p. m.; Saint Paul, 9.30 p. m. *New York:* Oswego, 10.30 p. m. to 2 a. m. *Ohio:* Toledo, 10.30 to 12 p. m.

20.—*Maine:* Gardiner, began at dark. *Michigan:* Alpena, 10 p. m.

21.—*Alaska:* Saint Paul's Island, 9.20 p. m. *Maine:* Gardiner, began about 9 p. m. *Michigan:* Alpena, 8.30 till after 10.34 p. m.

22.—*Connecticut:* New Haven, 8 till after 9 p. m. *Minnesota:* Saint Paul, 11.15 p. m.

24.—*Maine:* Gardiner, 9 till after 10 p. m. *Massachusetts:* Boston, 9 till after 12 p. m. *New Hampshire:* Mount Washington, 10 to 11.30 p. m.

25.—*New York:* Oswego, 9 to 10.30 p. m.; Rochester, 8.45 to 11 p. m. *Pennsylvania:* Erie.

29.—*Michigan:* Alpena, 8 p. m. *Minnesota:* Saint Paul, 10 to 11.30 p. m. *Wisconsin:* La Crosse, 8.15 to 10 p. m.

30.—*Maine:* Gardiner, 10 p. m., till after 11.59 p. m. *Massachusetts:* Boston, 11 to 12 p. m. *Michigan:* Marquette, 10 till after 11.25 p. m. *Minnesota:* Breckinridge; Saint Paul, 11 p.m. *Vermont:* Burlington, 10.20 to 11.35 p. m. *Wisconsin:* La Crosse, 9 till after 11 p. m.

OCTOBER, 1873.

1.—*Maine:* Gardiner, 11.59 p. m.

3.—*Maine:* Eastport, 9 p. m.

5.—FULL MOON.

7.—*Alaska:* Saint Paul's Island.

10.—*New Hampshire:* Mount Washington, 7.30 to 12 p. m. *Maine:* Gardiner, 8 p. m.

11.—*Maine:* Eastport, 10.20 p.m.

12.—*Iowa:* Dubuque, 8 p. m. *New York:* New York, for 30 minutes.

14.—*Alaska:* Saint Paul's Island.

15.—*Dakota:* Pembina, 8.20 till after 10 p. m. *Michigan:* Alpena, 8 till after 10.34 p. m. *Ohio:* Toledo, 9.30 to 10.30 p. m.

16.—*Michigan:* Marquette, 9.20 till after 10.45 p. m.

18.—*Iowa:* Dubuque, 8 till after 10 p. m. *Maine:* Eastport, 10.30 p. m.; Gardiner, 1 till after 1.30 a. m. *Michigan:* Alpena, 8 p. m., till after 9 p. m.

19.—*Dakota:* Pembina, 8.20 till 10.15 p. m. *Michigan:* Alpena 8 to 10 p. m.

October, 1873.

21.—*Connecticut:* New Haven, 11.16 to 12 p. m. *Maine:* Gardiner, 9 till after 11.59 p. m. *New Hampshire:* Mount Washington, 10 to 11.30 p. m.

22.—*Maine:* Gardiner, obscured, before 11 p. m. *Michigan:* Alpena, 8 p. m. *New Hampshire:* Mount Washington, 9 to 10.15 p. m.

23.—*Alaska:* Saint Paul's Island; *Michigan:* Alpena, 8 p. m.

24.—*Alaska:* Saint Paul's Island.

November 1873.

3.—Full moon.

11.—*Maine:* Eastport, 8 till after 9 p. m.

13.—*Maine:* Gardiner.

14.—*Dakota:* Pembina, 7.10 to 8.50 p. m. *Minnesota:* Duluth, 10 to 11.30 p. m.

15.—*Minnesota:* Duluth, 9 to 9.50 p. m.

19.—*Maine:* Eastport, 8 p. m.; Gardiner. *Minnesota:* Duluth, 6.30 p. m.

21.—*Minnesota:* Breckinridge, 9.40 to 10 p. m.

22.—*Maine:* Gardiner. *Minnesota:* Saint Paul, 9 to 10 p. m. *Montana:* Fort Benton, 9 to 10.30 p. m. *Pennsylvania:* Erie, 9 to 11.30 p.m.

23.—*Maine:* Eastport, 11 to 12 p. m.

25.—*Maine:* Eastport, 12 p. m.

26.—*Maine:* Eastport, 9 to 12 p. m.

27.—*Dakota:* Pembina, 8.15 to 10.30. p. m.

December, 1873.

1.—*Montana:* Fort Benton, for 30 minutes.

3.—Full moon.

9.—*Dakota:* Pembina, 8.15 to 9.20 p. m.

10.—*Maine:* Eastport, 8.30 to 10.30 p. m. *New Hampshire:* Mount Washington, 8 p. m.

11.—*Minnesota:* Saint Paul, 9 to 10 p. m. *Wisconsin:* La Crosse.

14.—*Maine:* Gardiner, till after 10 p. m. *Michigan:* Alpena, 8 till after 10.34 p. m.; Escanaba, 7 to 8 p. m.; Marquette, 8.45 till after 11 p. m. *Minnesota:* Breckinridge. till 11 p. m.; Duluth, 6.30 to 9.45 p. m.; Minneapolis, 9 p. m.; *Wisconsin:* Milwaukee, 8.45 to 9.15 p. m.

15.—*Maine:* Eastport, 8.40 to 12 p. m. *Michigan:* Alpena, 7.30 till after 10.34 p. m. *Minnesota:* Duluth, suspected, 7 to 9.30 p. m.

18.—*Missouri:* Richland, 8 to 10 p. m.

23.—*Maine:* Eastport, 9.30 to 11.45 p. m.

29.—*Dakota:* Pembina, 8 p. m.

January, 1874.

2.—Full moon.

3.—*District of Columbia:* Washington, 7 p. m. to daylight.

4.—*Vermont:* Woodstock, 11.15 p. m.

5.—*District of Columbia:* Washington, midnight to 4 a. m., 6th. *Maine:* Eastport, 11 p. m.

6.—*Newfoundland:* St. John's.

10.—*Iowa:* Dubuque, 8 to 9.30 p. m. *New York:* Palermo, 7 p. m.

11.—*Maine:* Gardiner. *Minnesota:* Duluth, 8.30 to 11 p. m.; Saint Paul, 10 to 11 p. m. *Michigan:* Alpena, 8 p. m. *New Hampshire:* Contoocookville, 9 p. m. *Vermont:* Woodstock. *Wisconsin:* Manitowoc, 11 p. m. to 12.

12.—*Maine:* Eastport, 8 to 11 p. m.; Gardiner, began at 10 p. m. *Massachusetts:* Boston, 11.30 to 11.40 p. m. *New York:* North Argyle, 9.30 p. m.

13.—*Dakota:* Pembina, 8.15 to 10.20 p. m.

14.—*Michigan:* Detroit, after 8 p. m. *New York:* Buffalo, 10.15 p. m. to 12. 15 a. m.

15.—*Connecticut:* Scuthington, 6 to 10 p. m. *Indiana:* Indianapolis, 10.40 to 11.20 p. m. *Maine:* Eastport, 6.20 till after 11.38; North Palermo, after 7 p. m.; *Massachusetts:* Boston, 11 p. m. to 1.35 a. m. *Michigan:* Alpena, 8 p. m.; Detroit, after 7.30 p. m.; Grand Rapids, 6 to 11 p. m. *New Hampshire:* Dunbarton; Contoocookville, 7 to 9 p. m. *New Jersey:* Barnegat, 9 p. m.; Somerville, 5.30 to 8 p. m. *New York:* Buffalo, 9.15 to 10.15 p. m.; New York City, 11 to 12 p. m.; North Volney, 10 p. m. *Ohio:* Toledo, 10 p. m to 12.30 a. m. *Vermont:* Burlington. *Wisconsin:* Manitowoc, 10 p. m.; Le Roy, 6 to 12 p. m.; Rocky Run, 7.30 to 9 p. m.

16.—*Connecticut:* Southington, from 6.15 p. m. *Maine:* Cornish, all evening; Eastport, 6.30 till after midnight; Gardiner, 10 p. m. till after 2.30 a. m.; North Palermo, 7 a. m., and in evening, 6.20 p. m.; Orono and Oxford, 9. p. m.; Portland. *Maryland:* Fallston, 8 p. m., suspected. *Massachusetts:* Andover, 8 to 9.30 p. m.; Boston, 8.35 p. m. to 2.20 a. m. *Michigan:* Alpena, 8 p. m.; Detroit, 7.30 till after 9.30 p. m. *Minnesota:* Saint Paul, from 10.30 p. m. *Newfound-*

JANUARY 16, 1874.

land: Harbor Grace; Saint John's, 7.30 p. m. *New Hampshire:* Contoocookville, 9 p. m. *New Jersey:* Somerset. *New York:* Houseville, 7 p. m. to 4 a. m.; North Argyle, 8.45 p. m.; Palermo; Troy; after 9 p. m.; Waterburg, 9 p. m. *Ohio:* Carthagena, 11 p. m. *Vermont:* Burlington; Castleton, 8 to 10 p. m.; Woodstock, 7 p. m. *Wisconsin:* Elkhorn, 10 p. m.

17.—*Connecticut:* Middletown; New Haven, 9 till after 10 p. m.; Southington. *Dakota:* Pembina, 7.10 till obscured at 9.20. *Delaware:* Milford, 9 p. m. *Indiana:* Bloomington, 9 p. m.; Fort Wayne, 9 p. m.; Indianapolis, 8.40 p. m. till after 12; Spiceland, 11 p. m. to 12. *Maine:* Cornish, all evening; Eastport, all evening from 6.40 p. m.; Gardiner, 8 p. m. till after 3.30 a. m.; Mount Desert, dusk to 9 p. m.; North Palermo, all evening; Orono; Oxford, 9 p. m.; Portland; Standish, 10 p. m.; West Waterville, 9 p. m. *Maryland:* Fallston; Woodlawn, 8 p. m. *Massachusetts:* Andover, 8 to 11 p.m.; Boston, 8.30 till after 2.15 a. m.; Florida, 8 to 11 p. m.; Vineyard Haven, 10 p. m. *Michigan:* Alpena, 9 p. m.; Grand Rapids, 7 to 11 p. m. *Minnesota:* Breckinridge, 9.40 till after 10 p. m. *Montana:* Fort Benton, 8.30 to 11 p. m.; Virginia City, 8 to 9 p. m. *New Hampshire:* Contoocookville, 8.30 to 10 p. m.; Dunbarton; Mount Washington, 7 till after 9. *New Jersey:* Barnegat, 8 to 10.15 p. m.; Cape May, 9.30 to 10 p. m.; Chester, 9 p. m.; Long Branch, 8 p. m. to 2 a. m.; New Germantown, 9 p. m.; Peck's Beach, 9.10 to 10.30 p. m.; Sandy Hook, 9.30 to 10 p. m.; Somerset. *New York:* Albany, 8.43 to 9.32 p. m.; Brook Haven, 9 to 10 p. m.; Cazenovia, 9 p. m.; Hempstead, 8 to 9.30 p. m.; Houseville, from 7 p. m.; Jamestown, 8.30 to 10 p. m.; Kensico, 10 p. m.; Lockport, from 9 p. m.; New York City, 8.40 to 10 p. m.; North Argyle, most of evening; North Volney, from 8 p. m.; Palermo, all evening; Rochester, 9 p. m. to 12 m.; Troy, 8.30 to 10 p. m.: Waterburg, 9. p. m. *Ohio:* Bellefontaine, 8 to 9.15 p. m.; Carthagena, 7 p. m.; Hillsborough; Jacksonburg, 8 to 10 p. m.; Mount Auburn, 8 to 9 p. m.; Oberlin; Ruggles; Toledo, 9 to 9.15 p. m.; Urbana, 7.30 to 10 p. m. *Pennsylvania:* Erie, 9 p. m. to 1 a. m.; Fallsington, 9 p. m; Perryville, 8 to 10 p. m.; Philadelphia, 9 to 9.45 p. m.; Plainfield. *Vermont:* Castleton, 9 p. m.; Burlington; Woodstock, 7 to 10.30 p. m. *Virginia:* Accotink; Keswick Depot, 7 to 9.30 p. m.; Prospect Hill. *Wisconsin:* Elkhorn, 10 to 11 p. m.; LeRoy, during evening; Rocky Run.

18.—*Connecticut:* New Haven, 7 to 10 p. m. *Dakota:* Pembina, 8.30 to 10.30 p. m. *New York:* Lockport, 8.20 p. m., suspected.

19.—*Michigan:* Alpena, 7.30 to 10.34 p. m. *Newfoundland:* Harbor Grace; St. John's, 7.30 p. m.

20.—*Vermont:* West Charlotte, 7 a. m.

21.—*Dakota:* Pembina, 9 till after 10.40 p. m.

23.—*Maine:*—Eastport, midnight.

25.—*Dakota:* Fort Sully, 7 to 8.30 p. m. *Massachusetts:* Boston, 11.10 to 11.30 p. m.

27.—*Minnesota:* Duluth, 9,30 to 11.30 p. m. *Newfoundland:* Harbor Grace.

29.—*New Jersey:* Peck's Beach, 10.50 to 11 p. m.

31.—FULL MOON.

FEBRUARY, 1874.

5.—*Connecticut:* Middletown, 7 to 9 p. m. *Maine:* Cornish, till 9 p. m.; Eastport, 7.25 to 10.10 p. m.; Gardiner, 7 p. m. till after 1 a. m.; Orono; West Waterville, 7 to 9 p. m. *Massachusetts:* Boston, 8.40 to 9.40 p. m.; Mendon; Somerset, 6 to 9 p. m. *Michigan:* Alpena, 7.30 to 10.34 p. m. *New Hampshire:* Contoocookville, 8.30 to 10 p. m; Whitefield, from 7.10 p. m. *New Jersey:* Long Branch, 9 p. m. *New York:* Albany, 8.40 to 9.11 p. m.; Depauville, 9 p. m.; Houseville, all the evening; Kensico, 7 p. m.; North Argyle; North Volney, from dusk till after 9 p. m.; Oswego, 7.15 to 10 p. m.; Palermo, 9 p. m.; Rochester, 8.30 to 10 p. m. *Pennsylvania:* Plainfield, 9 p. m. *Vermont:* Burlington, 7 till after 10 p. m.; Castleton, 7 to 10 p. m.

6.—*Dakota:* Pembina, 7.50 to 9.55 p. m. *Maine:* Gardiner, suspected, 7 to 9 p. m. *Montana:* Fort Benton, 6.30 to 10 p. m.

7.—*Maine:* Eastport, 10.30. *Michigan:* Alpena, 9 p. m.; Marquette.

9.—*Dakota:* Pembina, 8.40 to 9.30 p. m. *Indiana:* Fort Wayne, 9 p. m.

10.—*New Jersey:* South Trenton. *Newfoundland:* Harbor Grace.

13.—*Vermont:* West Charlotte, 6.40 p. m.

14.—*Maine:* Eastport, 8 p. m.; Gardiner, 9 p. m., till after 1.15 a. m. *Minnesota:* Breckinridge, 9.41 to 10.15. *Montana:* Fort Benton, 9 p. m. *New York:* Depauville, 9 p. m.; Houseville, 10 p. m.; North Argyle, 9 p. m.; Rochester, 10.45 to 12 p. m.; Waterburg, 8.50 p. m. *Pennsylvania:* Erie, 10.47 to 11.30 p. m. *Vermont:* Burlington.

16.—*Dakota:* Pembina, 8.10 to 8.45 p. m. *Minnesota:* Saint Anthony, 10 p. m.

17.—*Maine:* Gardiner, 8.30 p.m. till after 12 p. m. *Michigan:* Alpena, 7.30 till after 10.34; Marquette, Sugar Island, suspected. *Minnesota:* Saint Anthony, 9 p. m. *New*

FEBRUARY 17, 1874.

York: North Argyle; Palermo, 9 p. m.; *Vermont:* Burlington, 9 to 9.45 p. m. *Wisconsin:* Leroy, 9 p. m.

18.—*Massachusetts:* Boston, 8.45 to 11.15 p. m.

20.—*Dakota:* Pembina, 9 to 10.10 p. m. *Iowa:* Clarinda, 9.30 p. m. *Maine:* Eastport, 8 to 12 p. m.

21.—*Dakota:* Pembina, 7.50 to 9 p. m.

23.—*Connecticut:* Middletown, 4 to 5 a. m.

24.—*New York:* North Argyle.

MARCH, 1874.

2.—FULL MOON.

5.—*Dakota:* Pembina, 7.30 to 9.10.

6.—*Maine:* Eastport, 7.30 to 10 p. m. *Newfoundland:* St. John's. *North Carolina:* [?Lenoir, 6 p. m.]

7.—*Colorado:* Denver, 8.35 to 11.45 p. m.; Pike's Peak, 9 p. m., first aurora since station opened. *Dakota:* Fort Pembina; Fort Sully—till after 10 p. m.; Pembina, 8.15 to 10.30 p. m.; Yankton. *District of Columbia:* Washington, 9.20 to daylight. *Georgia:* Augusta. *Iowa:* Afton, 8 to 10 p. m.; Clarinda, 7 to 10.30 p. m.; Council Bluffs, 9 p. m.; Cresco, 9 p. m.; Davenport, 7.45 till after 12 p. m.; Fontanelle, 7 to 10 p. m.; Fort Madison, 7 till after 10 p. m.; Guttenburg, 9 p. m.; Keokuk, 9 to 11.25 p. m. *Illinois:* Bloomington, 7 to 10 p. m.; Champaign; 7 to 9.30 p. m.; Tiskilwa, from 8 p. m.; Wyanet, 7 p. m. *Indiana:* Indianapolis, 7.10 till after midnight; Laconia, 6.30 p. m.; Spiceland, 9 p. m. *Kansas:* Burlingame, from dark till 11 p. m.; Holton, 8 p. m. *Kentucky:* Louisville, 7.14 to 8.15 p. m. *Maine:* Eastport, 6.50 to 9.50 p. m. *Maryland:* New Market, 8.45 p. m. *Michigan:* Adrian, 9 p. m. *Minnesota:* Breckinridge, 9 to 10.30 p. m.; Saint Anthony; Saint Paul, 8 till after 9 p. m. *Missouri:* Wet Glaze, 7 to 7.45 p. m. *Nebraska:* Omaha, 7 to 12 p. m.; Santee Agency, 7 p. m. *New Jersey:* Peck's Beach, 7.30 to 8 p. m. *New York:* Albany, 8, obscured 9.25 p. m.; Troy, 8.05, obscured 9.30 p. m. *Ohio:* Bellefontaine, 7.30 p. m.; Bethel, from dark; Cincinnati (College Hill), from 8 p. m.; Hillsborough; Jacksonburg, 9 p. m.; Urbana, 9 p. m. *Tennessee:* Castilian Springs, 7 to 7.35 p. m.; Knoxville, 7 to 9 p. m. *Virginia:* Cape Henry, 7, obscured at 10 p. m.; Hampton, 7.15 p. m.; Lynchburg, 7.15 to 7.55 p. m.; Norfolk, 7 p. m., obscured 7.55 p. m.; Wytheville, 7.30 to 10 p. m. *West Virginia:* Morgantown, 9.15 to 11.30 p. m. *Wisconsin:* Embarras, 7.30 p. m.

8.—*Dakota:* Pembina, 8.20 to 9.50 p. m. *Illinois:* Rockford. *Indiana:* Rising Sun, 8 to 9 p. m. *Iowa:* Cresco, 7 to 8 p. m. *Minnesota:* Duluth, 7 to 8.30 p. m. *Tennessee:* Knoxville, 7.30 p. m. *Wisconsin:* Leroy, 9 p. m.; Manitowoc, 8.30 to 10 p. m.; Rocky Run, 7.30 p. m.; Wien, 7 p. m.

9.—*Maine:* Eastport, about midnight. *Michigan:* Alpena, 8 p. m. *Ohio:* Mount Auburn (Cincinnati).

10.—*Dakota:* Pembina, 8.40 to 10.20 p. m. *Iowa:* Cresco, 8 to 9 p. m. *Wisconsin:* Embarras, 8.30 p. m.

12.—*Dakota:* Pembina, 8 to 10.15 p. m. *Michigan:* Escanaba, 10 p. m. *Minnesota:* Saint Paul, 10 till after 12 p. m.

15.—*New Hampshire:* Mount Washington, 8.45 p. m. to 12.45 a. m.

16.—*Missouri:* Wet Glaze, 6.30 to 8.30 p. m. *Newfoundland:* St. John's. *New York:* Waterburg, 9 p. m.

17.—*New York:* Waterburg, 9 p. m.

18.—*Dakota:* Pembina, 8.30 till after 10 p. m. *Michigan*: Alpena, 7.30, obscured at 8 p. m.

19.—*Iowa:* Cresco, 10 p. m. *Newfoundland:* St. John's, 7.30 p. m.

20.—*Iowa:* Clarinda, 7 till after 11 p. m.; Cresco, suspected. *Maine:* Eastport, midnight, suspected. *Michigan:* Alpena, 7.30 till after 11 p. m.

23.—*Connecticut:* New Haven, 1 a. m.

27.—*Dakota:* Pembina, 9.50 till after 11 p. m.

31.—*New York:* Palermo, 7 to 9 p. m.

APRIL, 1874.

1.—FULL MOON. *Dakota:* Pembina, 8.30 to 9.45 p. m. *Maine:* China Village, 8 p. m.; Eastport, till 2 a. m. of 3d; Gardiner, 10 till about 3 a. m.; Orono, 9 p. m. *Michigan:* Alpena, 8.30, obscured at 10.30 p. m.; Detroit, 12 p. m. to 12.30 a. m., 2d. *Minnesota:* Breckinridge, 9 to 10.30 p. m.; Duluth, 8 to 8.40 p. m.; New Ulm, 9 p. m.; Saint Anthony (Minneapolis), 9 p. m.; Saint Paul, 8 to 10.40 p. m. *Montana:* Fort Benton, 7 to 8.30 p. m. *Newfoundland:* Harbor Grace. *New Hampshire:* Contoocookville, 9 p. m.; Whitefield, 8.03 p. m. *New York:* Houseville, 11.30 p. m.; North Argyle, 9 p. m.; Oswego, 8 to 1 a. m. *Ohio:* Toledo, 9 to 10 p. m. *Vermont:* Lunenburg; Woodstock, 9 p. m.

APRIL, 1874.

2.—*Pennsylvania:* Erie, 12.05 a. m.

3.—*Dakota:* Pembina, 8 to 10.15 p. m. *Minnesota:* Saint Paul, 9.30 to 10.15 p. m. *Wisconsin:* Embarras, 8 p. m.

4.—*Dakota:* Pembina, — to 9.30 p. m. *Maine:* Eastport, 8.30 to 10 p. m.; Gardiner, early evening. *Michigan:* Alpena, 7.30 till after 10.34 p. m. *Minnesota:* Breckinridge, 9 till after 10.30 p. m. *New York:* Depauville, 9 p. m.; North Argyle, 9 p. m.

5.—*Minnesota:* Breckinridge, 8.15 to 9.30 p. m.; Saint Anthony (Minneapolis), 9 p. m.

6.—*Connecticut:* Greenwich; Southington. *Dakota:* Fort Sully, p. m.; Pembina, 7.55 to 10.15 p. m. *Indiana:* Vevay, 9 p. m. *Iowa:* Cresco, 8 to 9 p. m.; West Union. *Kansas:* Medicine Lodge. *Maine:* China Village, 7 p. m.; Cornish, Eastport, 7.20 p. m. to 1 a. m.; Gardiner, 8 p. m. to 1 a. m., obscured; Orono; Standish, 9 p. m. *Massachusetts:* Boston, 8.15 to 10.20 p. m.; Florida; Somerset; Vineyard Haven; Williamstown. *Michigan:* Alpena, 8.30 till after 10.34 p. m.; Litchfield, 8 to 11 p. m.; Sugar Island, 9 to 10, obscured. *Minnesota:* Breckinridge, 8 p. m.; Duluth, 8 to 11.30 p. m.; Saint Paul, 8.30 to 11.30, p. m. *New Hampshire:* Contoocookville, 9 p. m.; Whitefield. *New Jersey:* New Germantown, 7 to 10 p. m. *New York:* Albany, 8 to 9.20 p. m.; Benton Centre, all the evening; Cazenovia, 9 p. m.; Depauville, 9 p. m.; Houseville, 9 to 10 p. m.; North Argyle, 9 p. m.; North Volney, Rochester, 9.10 p. m.; Troy, 8.40 to 9.30 p. m., obscured; Waterburg, 8 p. m. *Pennsylvania:* Factoryville, 6.45 to 7.45 p. m. *Wisconsin:* Embarras, 8 p. m.; Leroy, 8 to 9 p. m.; Manitowoc, 8 to 10 p. m.; Rocky Run, 7 p. m.; Wien, 8 p. m.

*7.—*Canada:* Algona, about 9 p. m.; Granton, 10 p. m.; Huntingdon, 9.40 p. m. Ingersoll; Little Current; Montreal, 11.45 p. m.; Mount Forest, 9.15 p. m.; Point Clark, 8 to 10 p. m.; Toronto, 7.09 to 10.09; Welland, about 9 p. m. *Connecticut:* New Haven, 7.44 to after 12.44 a. m.; New London, 8.20 p. m. to after midnight; Southington. *Dakota:* Fort Sully, 6.25 to after 7.50 p. m.; Pembina, 9.45 to 11.15 p. m. *Illinois:* Hennepin; Riley, 8.46 to 11.16 p. m.; Wyanet, 8.51 p. m. *Indiana:* Vevay, 9.32 to 10.02 p. m. *Indian Territory:* Fort Gibson, 7.12 to 8.12. *Iowa:* Boonesborough; Clarinda, 9.30 to after 12.13 a. m.; Cresco, 8.46 to 11.01 p. m.; Davenport, 9.54 to 10.14 p. m.; Dubuque, 9.55 to after 11 p. m.; Guttenburg, 12.55 to 2.55 a. m. (8th); Independence, 9 p. m. to after 9.30 p. m.; West Union, — after 11.59 p. m. *Kansas:* Medicine Lodge. *Maine:* Cornish, all night; Eastport, 11.15 p. m.; Oxford, 8.34 p. m. *Manitoba:* Winnipeg. *Maryland:* Fallston, till 9.30 p. m. *Massachusetts:* Florida, 7.44 to 10.44 p. m.; Kingston, 10.05 p. m.; North Adams, 8.44 to after 10.44 p. m.; Williamston, 8.50 to after 11 p. m. *Michigan:* Alpena, 7.56 to 11.26 p. m.; Detroit, 7.54 to 11.24 p. m.; Grand Haven, 8.07 to 3.37 a. m.; Grand Rapids, 8.04 p. m. to 12.04 a. m.; Marquette, 8.01 to after 11.26 p. m.; Northport, 11.37 p. m.; Sugar Island, 9.00 p. m.; Traverse City, 9.49 to after 10.34 p. m. *Minnesota:* Breckinridge, soon obscured; Saint Anthony, 10.05 p. m.; Saint Paul, 8.04 to after 12 p. m. *New Brunswick:* Fredericton, Saint John. *Newfoundland:* Harbor Grace, suspected. *New Hampshire:* Contoocookville, 7.39 to 9.39 p. m. *New Jersey:* Barnegat, 10.49 p. m.; Chester 7.30 to 9 p. m.; Freehold, 7.49 to after 9.39 p. m.; Long Branch, 10.45 to after 12.18 a. m.; New Germantown, 6.51 to 9.51 p. m.; Sand Beach, 10.18 to 11.18 p. m.; Sandy Hook, 10.38—obscured at 11.08 p. m.; South Orange. *New York:* Adams, 8.06 to 9.11 p. m.; Albany, 7.07 to 10.47 p. m.; Benton Center, all the evening; Buffalo, 8.58 to after 4 a. m.; Cazenovia, 8.55 p. m.; Depauville, 8.58 to after 10.28; Houseville, 7.54 to after 9.24; Lockport, 8.37 p. m.; Nicholls, 10.53 p. m.; North Argyle, 8.50 to 9.55 p. m.; North Hammond, 8.54 p. m.; North Volney, 8.57 to 9.57; Oneida, 8 to 10 p. m.; Oswego, 8.39 to after 12.29 a. m.; Palermo; Rochester, 9.08 p. m.; Rodman, 8.25 p. m.; South Trenton, 7.51 to 1.51 a. m.; Troy, 7.16 to after 10.46 p. m.; Waterburgh, 7.59 to 9.29 p. m. *Nova Scotia:* Sydney. *Ohio:* Margaretta, 8.22 p. m.; Toledo, 9.26 to 10 p. m., when obscured. *Pennsylvania:* Erie, 8.13 p. m. to 12.13 a. m.; Factoryville, 8.25 to 9.55 p. m.; Fallsington; Pennville, 7.36 to after 10.06 p. m.; Sandusky, 8.22 p. m.; obscured later. *Vermont:* Burlington 10 to after 10.45 p. m.; Castleton, till after 9.44 p. m.; Lunenburg; West Charlotte, 7.15 to 7.45 p. m.; Woodstock, early evening to after 10.17 p. m. *Wisconsin:* Embarrass, 8.49 to after 10.16 p. m.; La Crosse, till after 11.03; Le Roy, from 8.46; Manitowoc, 8.43 to after 12.43 a. m.; Milwaukee, 9.13 to after 2.43 a. m.; Rocky Run, 9.34 p. m.; Sturgeon Bay, from 8.12 p. m.; Wautoma, 9.50 p. m.

8.—*Massachusetts:* Florida, after 11 p. m. *Michigan:* Alpena, 8 to after 11 p. m.; Escanaba, 10 p. m.; Sugar Island, suspected. *New Hampshire:* Whitefield, 8.45 p. m. *New York:* Rodman.

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* The times given under *this date* are Washington mean time, having been reduced by Prof. C. Abbe in his report on this aurora, published in the annual Reports of the Chief Signal Officer for 1875 and 1876.

APRIL, 1874.

9.—*Michigan:* Escanaba, 10.30 p. m. *Vermont:* West Charlotte, 7.40 p. m.

12.—*Maine:* Eastport, 11.30 to 2 a. m. *New Jersey:* Sandy Hook, 11.30 p. m.

13.—*Maine:* Eastport, midnight; Gardiner, 8 p. m. *New Hampshire:* Contoocookville, all the evening; Mount Washington, 8.30 to 10.10 p. m. *New York:* Albany, 12.45 to 2.15 a. m.; Depauville, 9 p. m.; Houseville; North Argyle, 9 p. m. *Pennsylvania:* Erie, 12.25 a. m. *Vermont:* Lunenburg, Woodstock, 1 to 3 a. m.

14.—*Dakota:* Pembina, 8.15 to 10.20 p. m. *Maine:* Gardiner, 10.30 p. m.; Oxford, 11 p. m. *Minnesota:* Saint Paul, 9.30 to 10.30 p. m. *New Jersey:* Long Branch, about 12.30 a. m. *New York:* Albany, 1.30 to 2.30 a. m.; Houseville, 1.30 a. m.

15.—*Maine:* China Village, 9 p. m.

16.—*Maine:* Gardiner, 11.59 p. m. *New York:* Depauville, 9 p. m., suspected. *Wisconsin:* Wautoma.

17.—*Maine:* Eastport, 1.45 a. m.

25.—*New York:* Houseville, 1.45 a. m. *Vermont:* Woodstock, 2 a. m.

26.—*Kansas:* Medicine Lodge. *Wisconsin:* Le Roy, 8.30 p. m.

27.—*Vermont:* West Charlotte, 7.30 to 3 a. m.

28.—*Maine:* Gardiner, 10 p. m., soon obscured. *Minnesota:* Saint Paul, 10.30 p. m. *Montana:* Ft. Benton, 8 to 10 p. m. *Vermont:* West Charlotte, 7.30 p. m. *Wisconsin:* Wien.

29.—*Maine:* Eastport, 1 a. m.

30.—FULL MOON.

MAY, 1874.

1.—*New York:* Argyle, suspected.

2.—*Dakota:* Pembina, 8.30 to 10.35 p. m.

3.—*District of Columbia:* Washington, 2.30 a. m. to daylight. *Maine:* Eastport, 8.30 to 10 p. m.; Gardiner, early evening, obscured by moon before 11 p. m. *Montana:* Ft. Benton, 7.40 to 9.25 p. m, *New York:* Waterburgh, 9 p. m. *Wisconsin:* Embarrass, 9.30 p. m.

4.—*Dakota:* Pembina, 8.40 to 9.15, obscured; Yankton. *Iowa:* West Union. *Maine:* Eastport, 8.30 to 12.30 a. m.; Gardiner, obscured by moon before 11.59 p. m.; Surry, early in the morning. *Michigan:* Alpena, 9 to after 10.34 p. m.; Escanaba, 9.40 to after 10.30 p. m. *Minnesota:* Breckinridge; Duluth, 9.10 to 10 p. m.; Saint Anthony (or Minneapolis) 9 p. m.; Saint Paul, 9.30 to 10.15 p. m. *New Hampshire:* Mt. Washington, 8.05 to 1.10 a. m. *New York:* Troy, after 10.50 p. m.

5.—*Dakota:* Pembina, 9 to 9.40 p. m. *Maine:* Eastport, 8.30 to 1 a. m; Gardiner, 10 to 11 p. m.

7.—*Vermont:* Lunenburg.

10.—*Montana:* Fort Benton, 8 to 12 p. m.

11.—*Maine:* Eastport, 9 to 11 p. m.

13.—*New York:* New York City, 9 to 10.30 p. m.; North Argyle, suspected.

14.—*Maine:* Eastport, 9 p. m.; Gardiner, early evening till 1 a. m.

15.—*Maine:* Eastport, midnight; Gardiner, 11.59 p. m. till 1 a. m. *Minnesota:* Duluth, 10 to 10.30, when obscured; New Ulm, 9 p. m.; Saint Anthony (or Minneapolis), 9 p. m.; Saint Paul, 9.30 to 11 p. m. *New York:* Houseville, 9.30 p. m; North Argyle, 10.30 p. m.

17.—*New York:* North Argyle, 9 p. m. *Vermont:* Woodstock, 3 a. m.

20.—*Maine:* Eastport, 12 p. m. *Vermont:* Lunenburg.

21.—*New York:* Buffalo, 11 to 4 a. m.

23.—*New York:* Buffalo, 1.30 a. m. till dawn.

24.—*Dakota:* Pembina, 9 to 9.35 p. m. *Maine:* Eastport. *Vermont:* Lunenburg

27.—*New York:* Buffalo, 8.30 to 9.05 p. m.; Rochester, 9.05 to 9.50 p. m.

28.—*New York:* Buffalo, 2.30 a. m. to dawn.

30.—*Dakota:* Pembina, 9.30 to 10.10 p. m.

30.—FULL MOON.

JUNE, 1874.

1.—*Iowa:* Guttenburg, 9 to 11 p. m.

2.—*Vermont:* West Charlotte, 8.30 p. m.

3.—*Iowa:* Cresco, 10 p. m.; Independence, 9 p. m. *Maine:* Eastport, midnight; *Minnesota:* St. Paul, 10 to 11.30 p. m. *Newfoundland:* Harbor Grace. *New York:* Depauville.

4.—*Illinois:* Rockford, 9 p. m. *Maine:* Eastport. *Wisconsin:* LaCrosse, 9 to 10.10 p. m.

5.—*Illinois:* Augusta. *Iowa:* Cresco; Independence, 9 p. m.

6.—*Colorado:* [? Denver, 8.15 to 10.42.] *Maryland:* Annapolis, 8.30 p. m. *New York:* New York City, 9.30 to 10.30 p. m.

7.—*Colorado:* [? Denver, 8.25 to 10.40 p. m.] Pike's Peak, 9.30 to 10 p. m. *Dakota:* Ft. Sully, in evening. *District of Columbia:* Washington, 11.20 to 12 p. m. *Illinois:* Chicago, 10.30 p. m. to after 12.15 a. m.; Manchester; Riley, from 10.30 p. m.; Wyanet, till 1 a. m.

June, 1874.

8.—*Iowa:* Afton, 10 to after 10.30 p. m.; Keokuk, 9.25 to 11.45 p. m. *Maryland:* Annapolis, 8 p. m. *Michigan:* Detroit, 9 to 11 p. m.; Escanaba, 10 to 11.40 p. m.; Grand Haven, 9.30 to 10.45 p. m.; Grand Rapids. *Missouri:* Corning, 9.30 to 10 p. m., when obscured. *Nebraska:* Omaha, 9 to after midnight. *New York:* Buffalo, 10.45 to 12.45 a. m.; Depauville; Oswego, 10.55 to 11.55, when obscured; Rochester, 9.15 to 11.30 p. m. *Ohio:* Carthagena, 8 p. m. to after 2 a. m.; Hillsboro'; Toledo, 10 to 11.50 p. m. *Pennsylvania:* Erie, 9.30 to 1 a. m. *Tennessee:* Knoxville, 11.59 p. m. to 12.15 a. m. *Vermont:* Burlington, 11.30 p. m. to 1 a. m. *Virginia:* Wytheville, 10 to 11.30 p. m. *Colorado:* [? Denver, 8.20 to 9.55 p. m.] *Illinois:* Mattoon, suspected. *Nebraska:* Emerson, 9 p. m. *New York:* Rochester, 9.40 to 10.45 p. m. *Ohio:* Little Mountain, suspected. *Tennessee:* Knoxville, till 10 p. m.

9.—*District of Columbia:* Washington, 2.30 to 3.10 a. m. *Maine:* Gardiner, 1 a. m., obscured 2 a. m. *Vermont:* W. Charlotte, 8.30 p. m.

10.—*Colorado:* [? Denver, 8.35 to 10.40 p. m.] *Vermont:* W. Charlotte, 8.30 p. m.

11.—*Colorado:* [? Denver, 8.20 to 10.20 p. m.] *Vermont:* W. Charlotte, in the morning.

12.—*Colorado:* [? Denver, 8.15 to 10.45 p. m.] *Maryland:* Annapolis. *Wisconsin:* Beloit, 9 p. m., suspected.

13.—*Colorado:* [? Denver, 8.40 to 9.50 p. m.] *Maine:* Gardiner, 11.59 p. m. to 1 a. m. *Vermont:* W. Charlotte, 8.30 p. m. *Wisconsin:* Beloit, 9 p. m., suspected.

14.—*Connecticut:* New Haven, 8.30 to dawn. *New Jersey:* New Germantown, 9 p. m. *Pennsylvania:* York Sulphur Springs, 9 p. m. *Vermont:* West Charlotte, 8.30 p. m.

17.—*Maryland:* Annapolis. *Michigan:* Alpena, 9.30 to after midnight.

18.—*Pennsylvania:* Factoryville, 9 to 9.30 p. m.

19.—*Iowa:* Independence, 9 p. m.

21.—*Maine:* Eastport. *Vermont:* West Charlotte, 8.30 p. m.

22.—*New York:* New York City, 1.30 a. m. *Vermont:* West Charlotte, 8.30 p. m.

23.—*Vermont:* W. Charlotte, 8.30 p. m.

26.—*Vermont:* W. Charlotte, 8.30 p. m.

28.—*Indiana:* Fort Wayne, 10.30 p. m. *Iowa:* Independence, 9 p. m.

29.—*Iowa:* Independence, 9 p. m.

29.—Full moon.

30.—*Iowa:* Independence, 9 p. m.

July, 1874.

1.—*Iowa:* Independence.

2.—*Iowa:* Independence.

3.—*Dakota:* Pembina, 9.40 to 10.25 p. m. *Maryland:* Woodlawn. *Minnesota:* Duluth, 10 to 10.50 p. m.; East Minneapolis, 10 p. m.; Minneapolis (St. Anthony) 9 p. m. *Vermont:* West Charlotte, in the evening.

4.—*Michigan:* Alpena, 10 p. m. to after midnight. *Montana:* Carroll. *Vermont:* West Charlotte, in the morning.

5.—*Maine:* Eastport, in the evening. *Vermont:* West Charlotte, p. m.

6.—*Dakota:* Fort Rice.

7.—*Michigan:* Sugar Island, in the evening.

9.—*Michigan:* Escanaba, 10.30 to 10.50 p. m.

10.—*Dakota:* Fort Wadsworth; Pembina, 9.55 to 10.50 p. m. *Iowa:* Cresco, 10 to 10.15 p. m. *Michigan:* Alpena, 9.30 till early dawn. *Minnesota:* Duluth, 10 to 11.10 p. m; Saint Paul, 8.30 till after midnight. *Nebraska:* Omaha, 10.10 p. m. *Vermont:* West Charlotte, suspected. *Wisconsin:* La Crosse, 9.15 to 10 p. m.; Manitowoc, from 10.30 p. m.

11.—*Iowa:* Cresco, 10.30 p. m. *Michigan:* Alpena, 9 p. m. till dawn; Escanaba, 9.30 to 10.20 p. m. *Minnesota:* Duluth, 10.15 to 10.50 p. m. *Montana:* Carroll. *New York:* South Trenton. *Washington Territory:* Neah Bay. *Wisconsin:* La Crosse, 10 to 11 p. m.; Manitowoc, from 10 p. m.

12.—*Dakota:* Pembina, 10.15 till after 11 p. m. *District of Columbia:* Washington, 9 p. m. till dawn. *Indiana:* Burlington. *Iowa:* Cresco, 9.45 p. m; Davenport, 10.10 to 10.35 p. m. *Michigan:* Detroit, 9 p. m.; Escanaba, 10 to 11.40 p. m. *Montana:* Camp Baker; Fort Benton, 9.40 to 10.45 p. m. *Newfoundland:* Saint John's, in the evening. *Ohio:* Jacksonburg, 11 p. m.; Toledo, 10 to 12 p. m. *Vermont:* West Charlotte, in the morning. *Wisconsin:* Manitowoc, 11 p. m. till after 2 a. m.

13.—*Dakota:* Yankton, about 12.30 a. m. *Iowa:* Cresco, 10.45 p. m.; Guttenburg, early evening till after1.30 a. m. *Minnesota:* Duluth, 11 till after 12.45 a. m.; Saint Paul, 10.45 to 11.45 p. m. *Montana:* Carroll. *Nebraska:* Omaha, 11.10 till midnight, when obscured. *New York:* Buffalo, 10.15 p. m. to 1.45 a. m.; Oswego, 1.20 a. m. *Wisconsin:* Manitowoc, from 10 p. m.

14.—*Maine:* Gardiner, 10 till after 12.30 a. m.; North Palermo, 10 p. m.; Orono, nearly all night. *Massachusetts:* Newburyport. *Minnesota:* Duluth, 9.30 to 10.30 p. m.; Saint Paul, 9.20 p. m. *Montana:* Fort Benton, 9.20 to 10.30 p. m. *New*

JULY 14, 1874.

Hampshire: Mount Washington, 9.35 to 11.55 p. m. *Ohio:* Toledo, 12.15 to 12.45 a. m. and 10 to 11 p. m. *Vermont:* Castleton, 1.40 to 2.15 a. m.; West Charlotte, 1 a. m.; Woodstock, 1 to 3 a. m. and 11 p. m.

15.—*Maine:* Eastport, 1 a. m. *Minnesota:* Duluth, 9.40 to 11.10 p. m.

16.—*New Hampshire:* Auburn, 9.10 to 9.50 p. m. *New York:* South Trenton. *Ohio:* Toledo, 9.30 to 10.30 p. m.

17.—*Dakota:* Pembina, 9.50 to 11.35 p. m. *Vermont:* West Charlotte, in the morning and evening.

18.—*Maine:* Gardiner, began at 11.59 p. m. *New York:* South Trenton.

19.—*Dakota:* Pembina, 10 to 10.50 p.m.

20.—*North Carolina:* Wilmington. *Ohio:* Cleveland. *Vermont:* West Charlotte, in the evening.

21.—*Vermont:* West Charlotte, in the evening.

22.—*Maine:* Eastport, midnight; Gardiner, after 11.45 p. m. *New York:* South Trenton.

23.—*Maine:* Gardiner, — p. m. till after midnight.

26.—*Indiana:* Bloomington. *Ohio:* Cleveland.

27.—*Iowa:* Dubuque, 9 to 10 p. m.

28.—FULL MOON.

29.—*Vermont:* West Charlotte, in the evening.

30.—*Maine:* Eastport, 8.20 to 10.10 p. m. *Ohio:* Cleveland.

31.—*Vermont:* West Charlotte, in the morning.

AUGUST, 1874.

1.—*Maine:* Standish. *Michigan:* Alpena, 2 a. m. till dawn. *New York:* Houseville, 9 to 10 p. m. *Vermont:* Woodstock, 2 a. m.

2.—*Michigan:* Alpena, 9.30 to 10.10 p. m.; Northport.

3.—*Washington Territory:* Cathlamet. *Michigan:* Sugar Island.

6.—*Maine:* Gardiner, in the evening.

7.—*Dakota:* Pembina, 9.50 to 2 a. m.

8.—*Maine:* Gardiner. *Michigan:* Sugar Island. *Wisconsin:* Manitowoc.

11.—*Idaho:* Fort Lapwai. *Indiana:* Vevay. *Maine:* Gardiner, 9 p. m. till after 1 a. m. *Montana:* Virginia City, 9.30 to 10.05 p. m. *New York:* Depauville, 9 p. m. *Vermont:* West Charlotte, in the morning. *Washington Territory:* Neah Bay, in the evening.

12.—*Dakota:* Fort Sully, 8 p. m., all night. *Illinois:* Chicago, 5.30 a. m. till daybreak. *Iowa:* Crescó; Davenport, 12.40 to 1 a. m. *Michigan:* Port Huron, 10.40 p. m. *Minnesota:* East Minneapolis; Saint Paul, till 11.50 p. m. *Ohio:* Carthagena, 11 p. m.

13.—*Michigan:* Alpena, 10 p. m. to 1.35 a. m. *Minnesota:* Duluth, 10.10 to 11.30 p. m. *Wisconsin:* Manitowoc.

14.—*Dakota:* Pembina, 8.50 to 11.20 p. m.; Fort Pembina; Fort Sully, 8.30 to 11 p. m. *Michigan:* Alpena, 8.30 to 12 p. m.; Port Huron, 10.40 to after 12 p. m. *Minnesota:* Duluth, 10.10 to 10.40 p. m.; Saint Paul, 9.40 to 11.30 p. m. *New York:* Oswego, 10.45 p. m. to 12.30 a. m.; Rochester, 10.40 to 12 p. m., Waterburgh. *Vermont:* Waterbury, 9 p. m.; West Charlotte, from 11.55 p. m. *Wisconsin:* Milwaukee, 9.30 p. m. to 1 a. m.
Embarrass.

15.—*Maine:* Standish.

16.—*Vermont:* West Charlotte, p. m.

17.—*Dakota:* Fort Seward; Pembina, 9.15 to 10.50 p. m. *Maine:* Eastport, 1.30 a. m., and 9.40 p. m. to 3.20 a. m. 18th; Standish. *Michigan:* Alpena, 10.10 to 11.55 p. m.

18.—*Maine:* Eastport, 9 p. m. to 3 a. m.; Gardiner, 9 p. m. to after 3 a. m. *Wisconsin:* Le Roy, 11 p. m.

26.—FULL MOON.

30.—*Michigan:* Alpena, 8.20; obscured 9.40 . m.

SEPTEMBER 1874.

1.—*Michigan:* Detroit.

2.—*Michigan:* Detroit. *Washington Territory:* Neah Bay, p. m.

3.—*Dakota:* Fort Pembina; Pembina, 8.50 to 10 p. m. *Florida:* [?Punta Rassa.]

4.—*Dakota:* Pembina, 9.05 to 11.20 p. m. *Maine:* Gardiner, about 11.45 p. m.

5.—*Dakota:* Pembina, 9.15 to 11.05 p. m. *Maine:* Eastport, 10 p. m. to 2 a. m. *Michigan:* Alpena, 10.10 p. m. to 12.10 a. m. *Minnesota:* Duluth, 9.45 to 11.50 p. m.

6.—*Massachusetts:* Fort Independence, 10 p. m.

7.—*Dakota:* Fort Pembina; Fort Seward; Fort Totten; Pembina, 8.30 p. m. to 2 a. m. *Iowa:* Rockford, 10 p. m. to 2 a. m. *Maine:* Gardiner, 11 p. m. *Massachusetts:* Boston. *Michigan:* Alpena, 8.50 to 11.10 p. m; Marquette. *New York:* House-

SEPTEMBER 7, 1874.

ville, 9 till after 10 p. m.; Oswego, 9, obscured 10.55 p. m. *Wisconsin:* Manitowoc, 10 to 11 p. m.; Rocky Run, 8.15 to 9 p. m.; Wien, 9 p. m.

8.—*Dakota:* Fort Pembina; Fort Seward; Fort Totten. *Iowa:* Independence, 8.30 p. m. *Maine:* Gardiner, 11.59 p. m., nearly obscured. *Michigan:* Alpena, 8 till after 10.34 p. m.; Marquette, Sugar Island.

9.—*Dakota:* Fort Pembina. *Maine:* Gardiner, 11.59 p. m. *Michigan:* Port Huron, 9 till after 12 p. m.

10.—*Dakota:* Fort Pembina; Fort Seward; Fort Totten; Pembina, 8.55 p. m. to 2 a. m. *Maine:* Eastport, 12.15 a. m. and at 9.10 p. m. *New Jersey:* Atlantic City, 1 a. m. *New York:* Albany, 12.40 to 3.15 a. m.; Houseville, 12.15 a. m. *Pennsylvania:* Erie, 12.05 a. m. *Vermont:* Woodstock, 1 a. m. *Alaska:* Saint Michael's.

11.—*Dakota:* Fort Pembina; Fort Sully, p. m.; Fort Totten; Fort Wadsworth, 9 p. m.; Pembina, 8.50 to 11.15 p. m. *Iowa:* Cresco, p. m. *Maine:* Eastport, 9 p. m. to 2 a. m.; Gardiner, 8 till after 12 p. m.; Orono, 9 p. m. *Michigan:* Alpena, 9 to 11.35 p. m.; Grand Rapids, 10.30 to 12 p. m. *New Hampshire:* Mount Washington, 8 till after 12 p. m. *Ohio:* Toledo, 10 to 10.45 p. m. *Pennsylvania:* Erie, 8 p. m. to 1 a. m. *Wisconsin:* La Crosse; Le Roy, 8.30 to 10 p. m.; Manitowoc, 10 to 11 p. m.; Rocky Run, 8 till after 9 p. m.

12.—*Connecticut:* New Haven, 9, obscured 10.30 p. m. *Dakota:* Fort Pembina; Fort Seward; Fort Sully, p. m.; Fort Wadsworth, 7 p. m.; Pembina, 7.40 to 10.50 p. m. *Indiana:* Spiceland, 10 p. m. *Maine:* Eastport, 7.20 p. m. to 2 a. m.; Cornish; Fort Preble, p. m.; Gardiner, till after 12 p. m.; Mount Desert, p. m.; Orono, 9 till after 10 p. m.; West Waterville, 8 to 10 p. m. *Massachusetts:* Boston, till after 11.23 p. m.; Fall River; North Billerica, p. m.; Wood's Holl, 8 to 10 p. m. *Michigan:* Detroit, 9 to 10 p. m.; Grand Rapids, 10.30 to 11.30 p. m.; Litchfield, 9 p. m. till after 3 a. m.; Port Huron, 9 till after 12 p. m.; Sugar Island. *Minnesota:* Breckinridge, 7.30 to 9.30 p. m.; Duluth, 8 to 8.12 p. m. *New Hampshire:* Auburn, 8.30 p. m.: Contoocookville, 7.30 to 9.30 p. m.; Mount Washington, 7.30 till after 12 p. m.; Whitefield, before 7 p. m. *New York:* Depauville, 9 p. m.; Lockport, 9 p. m.; North Argyle, p. m.; Plattsburgh Barracks, p. m.; Waterburg, from 9.10 p. m. *Ohio:* Bellefontaine, 8.20 to 9.35 p. m.; Carthagena, 8 to 11 p. m.; Toledo, 8 to 11 p. m. *Pennsylvania:* Erie, 8.30 till after 11 p. m. *Tennessee:* Clarksville, suspected, p. m. *Vermont:* Lunenburgh; West Charlotte, 8 till after 9 p. m.; Woodstock, 10 p. m. *Alaska:* Saint Michael's.

13.—*Massachusetts:* Newburyport, 9 to 10 p. m.

14.—*Dakota:* Pembina, 10.05 to 11.30 p. m.

15.—*Vermont:* Lunenburgh.

16.—*Minnesota:* Duluth, 10.10 to 10.45 p. m.

17.—*Iowa:* Council Bluffs, all the eve, suspected

21.—*Virginia:* Accotink, p. m., suspected.

23.—*Michigan:* Alpena, 8 to 11.35 p. m.

25.—FULL MOON.

27.—*Dakota:* Pembina, 8 to 11.30 p. m.

30.—*Missouri:* Rolla.

OCTOBER, 1874.

1.—*Indiana:* Fort Wayne, 7.30 p. m.

2.—*Canada:* York Factory, 9 p. m. *Dakota:* Fort Pembina; Fort Totten. *Indiana:* Laconia, 7.30 p. m. *Maine:* Fort Preble, 7 p. m.; Gardiner, 10, obscured 12 p. m. *Maryland:* Woodlawn. *Michigan:* Detroit, 7.30 till after 12.50 a. m. *New Hampshire:* Whitefield, from 7.45 p. m. *Ohio:* Jacksonburg, 7 to 10 p. m.

3.—*Canada:* York Factory, 7.30 to 9.30 p. m. *Connecticut:* Middleton, early eve, obscured 9 p. m.; New Haven, 7, obscured 11.30 p. m.; New London, 7, obscured 11.30 p. m.; Southington, p. m. *Dakota:* Fort Sully, p. m.; Fort Totten. *Delaware:* Milford, 8 to 10.30 p. m. *District of Columbia:* Washington, dark to 1 a. m. *Idaho:* Fort Lapwai, 10 p. m. *Georgia:* Atlanta, p. m. *Illinois:* Chicago, 9 to 3 a. m.; Hennepin, 8 to 9 p. m.; Louisville, 9 to 10 p. m.; Lyndon, 7 p. m.; Mattoon; Peoria; Riley, 6.45 till after 8 p. m.; Rockford, 7 till after 11 p. m.; Tiskilwa, p. m.; Wyanet, 7.30 p. m. *Indiana:* Bloomfield, 7.15 p. m. till after 12.30 a. m.; Burlington; Fort Wayne, 8 to 10 p. m.; Indianapolis, 7.05 p. m. till dawn; South Bend, 8 to 10 p. m.; Spiceland, 7 to 10 p. m.; Vevay, 6.30 to 8 p. m. *Iowa:* Boonesboro', 10 to 11 p. m.; Cresco, 7.15 to 11 p. m.; Davenport, 7 to 9 p. m.; Dubuque, p. m.; Fort Madison, from 7 p. m.; Guttenburg, 7 p. m. till after 1 a. m.; Independence, 7 till after 9 p. m.; Keokuk, 9 to 11 p. m.; Muscatine, 8 p. m.; Rockford, p. m. *Kansas:* Holton, 8 p. m , soon obscured. *Kentucky:* Danville; Pine Grove. *Maine:* Cornish, all the eve from dark; Eastport, 8 p. m. to 1.30 a. m.; Fort Preble, 7 p. m.; Gardiner, before 8 p. m. till after 2.30 a. m.; Mount Desert; Orono, 8.45 till after 9.45 p. m.; Portland, 8 p.

OCTOBER 3, 1874.

m. to 3 a. m.; Standish, 7.10 till after 9 p. m.; Surry; West Waterville, 7 p. m. till dawn. *Maryland:* Fallston, 7 till after 8 p. m.; Woodlawn, 7 to 9 p. m.; Woodstock, 7.15 to 9.15 p. m. *Massachusetts:* Amherst; Andover, 7 till after 9 p. m.: Boston, 7.15 p. m. till after 12.20 a. m.; Fall River; Florida, 7 p. m. till dawn; Fort Independence, 7 p. m.; Mendon, 9 p. m.; Milton; Newburyport, 7 till after 8 p. m.; North Billerica, 8 p. m.; Somerset, 6.20 till after 12 p. m.; Vineyard Haven, 6 p. m. all the eve; Williamstown all the eve; Wood's Holl. 7 p. m. to 1 a. m. *Michigan:* Alpena, 7.30 p. m. to 1.35 a. m.; Detroit, till 11 p. m.; Escanaba, 7.30 p. m. to 2.15 a. m.; Grand Haven, 7.15 to 11.40 p. m.; Grand Rapids, 7 p. m. till after 1.30 a. m.; Hudson, 7 till after 9 p. m.; Litchfield, 8 p. m. to 3 a. m.; Port Huron, 7 till after 12 p. m.; Traverse City, 8 till after 9 p. m. *Minnesota:* Duluth, 7.10 to 9.50; Fort Snelling; Saint Paul, 7.20 till after 12 p. m. *Montana:* Carroll; Fort Benton, 10.30 to 2 a. m. *Nebraska:* North Platte, 8.30 to 10.30 p. m. *Newfoundland:* Harbor Grace. *New Hampshire:* Auburn, 7.30 p. m. till dawn; Contoocookville, 8.30 till after 10 p. m.; Dunbarton, p. m. *New Jersey:* Atco, 7.30 to 8.30 p. m.; Atlantic City; Cape May, 6.40 p. m. to 2 a. m.; Freehold, dusk till after 9.30 p. m.; Long Branch, 7.20, obscured, 9.15 p. m.; Moorestown, till 9 p. m.; Mount Holly, 8 p. m.; Peck's Beach, 7.25 to 9.30 p. m.; Vineland, from 6 p. m. *New York:* Albany, suspected, 9 p. m.; Benton Centre, p. m.; Brookhaven, till after 9 p. m.; Cazenovia, 8.30 to 10 p. m.; Depauville, from 9 p. m.; Houseville, 9 p. m.; North Hammond, 8 p. m.; North Argyle; North Volney, p. m.; Rochester, 7.15 till after 12 p. m.; Troy, 7 till after 12 p. m.; Waterburg, till dawn of 4th. *North Carolina:* Mount Pleasant, 8 to 9 p. m.; Weldon, 8.30 to 9 p. m. *Ohio:* Bellefontaine, 7.30 p. m. till after 2.30 a. m.; Bethel; Carthagena, 8 p. m.; Hillsboro', p. m.; Margaretta, 9 p. m.; Mount Auburn (Cincinnati), dusk till 8.50 p. m.; Toledo, 7.30 to 12 p. m.; Urbana, till 10.30 p. m.; Westerville, 8 p. m. *Pennsylvania:* Erie, 10.30 p. m. to 2 a. m.; Fallsington, 7 to 9.30 p. m.; Pennsville, 8 till after 10.30 p. m.; Philadelphia, 7.30 to 10 p. m.; Plainfield, 8 till after 9 p. m.; Tioga, 7 to 10 p. m.; Westchester, 7 till after 8.30 p. m. *Rhode Island:* Dutch Island, 8 p. m.; Newport, p. m.; Providence, p. m. *Tennessee:* Castilian Springs, 8.30 p. m., all night. *Vermont:* Lunenburg. *Virginia:* Accotink, p. m.; Cape Henry, 8 till after 11.35 p. m.; Hampton, p. m till dawn; Lewisville, 6.30 to 11 p. m.; Lynchburg, 7.30 to 8.45 p. m.; Marion, 8 p. m.; Mount Solon, 9 till after 11 p. m.; Powhatan Hill, from 8 p. m.; Prospect Hill, 7 till after 10 p. m.: Woodlawn (Accotink), p. m.; Wytheville, 8 till after 10.44 p. m. *West Virginia*; Morgantown, 7.30 p. m. to 12.10 a. m. *Wisconsin:* Beloit, p. m.; Bloomfield, p. m.; Embarrass, from 6.45 p. m.; La Crosse, 7.30 to 11 p. m.; Le Roy, from 6.30 p. m.; Manitowoc, from 7.30 p. m.; Milwaukee, 7.45 till after 8.45 p. m.; Rocky Run, 6.30 to 8.30 p. m.; Waupaca; Wautoma, 8 p. m.; Wien, 7 till after 12 p. m.

4.—*Canada:* York Factory, 9 p. m. *Connecticut:* New London, dark till dawn; New Haven, 9.30 p. m. till after 1 a. m.; Southington, 7.20 till after 9 p. m. *Dakota:* Bismarck, 9.50 to 11.42 p. m.; Fort Pembina; Fort Sully, p. m. *Delaware:* Milford, 9 p. m. *District of Columbia:* Washington, 10 p. m. to 3.03 a. m. *Idaho:* Fort Lapwai, p. m. *Illinois:* Lyndon, 8 p. m.; Rock Island Arsenal; Wyanet, 8 p. m. till dawn. *Indiana:* Rising Sun, 7 to 9.30 p. m. *Iowa:* Dubuque; Rockford, p. m. *Kentucky:* Pine Grove. *Maine:* Cornish, from dark all the eve; Eastport, 7.30 p. m. to 1 a. m.; Gardiner, 8 p. m. till after 2 a. m.; Mount Desert, p. m.; Orono, 9 p. m.; Portland, 7.35 p. m. to 2.15 a. m.; Surry; West Waterville, 7 to 9 p. m. *Maryland:* Fallston, p. m.; Woodlawn. *Massachusetts:* Amherst; Andover, 8 p. m.; Boston, 8 p. m. to 4 a. m.; Florida, from 7 p. m.; Fort Independence; Mendon, 9 p. m.; Milton; Newburyport, all night; North Adams, 7.30 till after 11.15 p. m.; North Billerica, all night; Wendell Centre, all night; Williamstown. *Michigan:* Alpena, 8 to 11.30 p. m.; Grand Rapids, 7 to 11 p. m.; Litchfield, 8 p. m. to 3 a. m. *Montana:* Fort Benton, 8 p. m. till after 3 a. m. *Newfoundland:* Harbor Grace. *New Hampshire:* Auburn, 8 p. m.; Contoocookville, 6.30 to 9 p. m.; Dunbarton. *New Jersey:* Freehold, 9 p. m.; Moorestown, 9 p. m. *New York:* Benton Centre, p. m.; Brookhaven, 9 p. m. to 3 a. m.; Houseville, 7.30 to 9 p. m.; North Argyle; Troy, 8.10 till after 9.30 p. m.; Waterburgh, 7, obscured, 10 p. m. *Ohio:* Bellefontaine, 7.20 to 7.50 p. m.; Carthagena, 8 p. m. to 4 a. m.; Ruggles, p. m.; Toledo, 8 to 9.30 p. m.; Urbana, 8.30 to 10 p. m. *Pennsylvania:* Fallsington, 7 to 9.30 p. m.; Plainfield, 8 to 9 p. m.; Westchester, from 9 p. m. *Vermont:* West Charlotte, 4 a. m.; Woodstock, 4 a. m. *Virginia:* Lewisville, p. m. *Wisconsin:* Le Roy, 7 to 11 p. m.; Milwaukee, 9 p. m.; Rocky Run, 6.30 till after 9.15 p. m. *Alaska:* Saint Michael's.

5.—*Connecticut:* Middletown, 8 to 9 p. m.; New Haven, 8 to 11.30 p. m. *Iowa:* Independence; Rockford, all night. *Maine:* Standish, 4.20 a. m. *Maryland:* Fallsington, p. m. *Massachusetts:* Fall River; Florida, p. m.; North Adams, OCTOBER 5, 1874.

early a. m. *New York:* Brookhaven, p. m.; Houseville; North Argyle, 9.30 p. m.; Troy, 7.15 till after 9 p. m.; Waterburg, 9 p. m. *Ohio:* Hillsborough; Marion, p. m. *Pennsylvania:* Westchester, 9 p. m. *Vermont:* Rutland, 10 p. m.; West Charlotte, from 1 a. m.

6.—*Canada:* York Factory, dusk. *Connecticut:* Southington. *Dakota:* Bismarck, 8.40 to 10.50 p. m.; Fort Totten; Fort Seward; Yankton, p. m. *Iowa:* Cresco, from 8.30 p. m. *Massachusetts:* Andover, 9 p. m.; Boston, 11.23 p. m.; Milton; Somerset, p. m.; Wood's Holl, 8.30 to 9.20 p. m. *Maine:* Eastport, 7.20 p. m. to 1.20 a. m.; Gardiner; Mount Desert. *Michigan:* Escanaba, 8 to 11.15 p. m. *Minnesota:* Duluth, 6.30 to 11.15 p. m.; Fort Snelling; Saint Paul, 8 to 12 p. m. *Montana:* Fort Benton, 7 to 11 p. m. *Nebraska:* Omaha, 9.45 p. m. *New York:* North Argyle. *Vermont:* West Charlotte. *Wisconsin:* Wien, 12 p. m.

7.—*Dakota:* Fort Seward; Fort Wadsworth, 8.45 p. m. *Illinois:* Mount Sterling. *Maine:* Eastport, suspected, 11.55 p. m.; Mount Desert. *Michigan:* Escanaba.

8.—*Maine:* Mount Desert. *Montana:* Fort Benton, 9.30 to 10.30 p. m.

9.—*Dakota:* Pembina, 8.30 to 11.30 p. m. *New York:* Depauville, 9 p. m. *Wisconsin:* Rocky Run, 10.30 p. m.

10.—*Dakota:* Fort Pembina. *Ohio:* Hillsborough, p. m. *Canada:* York Factory, 9 p. m.

11.—*Iowa:* Dubuque. *Ohio:* Hillsborough.

12.—*Canada:* York Factory, 9 p. m. *Connecticut:* New Haven, 8 till after 12 p. m. *Dakota:* Fort Pembina, p. m. Pembina, 8.55 to 11 p. m. *Illinois:* Lyndon, 10 p. m. *Iowa:* Dubuque. *Maine:* Cornish; Eastport, 11.55 p. m. to 3.30 a. m.; Gardiner; Orono 9 p. m.; Oxford, p. m.; Standish, 8 to 10 p. m. *Massachusetts:* Fall River. *Minnesota:* Duluth, 10.30 to 11.20 p. m. *Montana:* Carroll; Fort Benton, 8.30 to 11.45 p. m.; *New Hampshire:* Mount Washington, 8.30 till after 12 p. m. *Pennsylvania:* Carlisle, 7 to 9 p. m. *Wisconsin:* Embarrass, 11 p. m.; LeRoy, dark till after 12 p. m.; Rocky Run, 7 p. m. till dawn.

13.—*Connecticut:* New London, 12.30 to 3.15 a. m. *Dakota:* Bismarck, 8 to 10.10 p. m.; Fort Sully, p. m. *Idaho:* Fort Hall, 8 p. m.; Fort Lapwai, 9 p. m. *Maine:* Eastport, 11.55 p. m., obscured 1.30 a. m. *Massachusetts:* Boston, 11.23 p. m.; Newburyport, 3 a. m. *Michigan:* Alpena, 6.55 p. m. till 1.25 a. m. Grand Rapids, 8 till after 12 p. m. Port Huron, 9 to 12 p. m.; Sugar Island, 9 p. m.; Traverse City, p.m. *Montana:* Carroll; Fort Benton, 7 to 11 p. m. *Pennsylvania:* Carlisle, 7 to 9 p. m. *Wisconsin:* LeRoy, dark till 2 a. m.; Rocky Run, 7 p. m. till dawn.

14.—*Canada:* York Factory, 9 p. m. *Connecticut:* New Haven, 8 till after 12 p. m. *Maine:* Cornish; Eastport, 8 p. m. to 1.45 a. m.; Orono, 9 p. m.; Oxford, Standish, 9 p. m. *New York:* Depauville, 9 p. m.

15.—*Connecticut:* New Haven, 8.30 till after 12 p. m. *Maine:* Cornish; Eastport, 8 till 1 a. m.; Orono, 9 p. m. *Massachusetts:* Amherst; Andover, 9 p. m.; Boston, 11.23 p. m.; Fall River, p. m. *New Hampshire:* Contoocookville, 9 p. m.; Mount Washington, 9.30 till after 12 p. m. *New York:* Cazenovia, 9 p. m.; Depauville, 9 p. m.; Fort Niagara; North Argyle, 9 p. m.; North Volney, 9.45 p. m.; Oswego, 9 till 11.30 p. m.; Rochester, 8.45 till after 12 p. m.; Troy 8.30 p. m.; Waterburgh, 9 p. m. *Ohio:* Hillsborough, p. m. *Pennsylvania:* Erie, 8 to 10 p. m. *Vermont:* West Charlotte, 8 p. m. to 3 a. m.

16.—*Maine:* Eastport, 7.30 p. m. to 1 a. m. *New Hampshire:* Contoocookville, 9 p. m. *Vermont:* Lunenburgh; West Charlotte, 8 p. m. till dawn; Woodstock, 11.55 p. m.

17.—*New York:* Oswego, 12.10 to 1.10 a. m.

18.—*Canada:* York Factory, 9 p. m. *Washington Territory:* Neah Bay, 11 p.m. to 2 a. m.

19.—*Canada:* York Factory, 9 p. m. *Dakota:* Pembina, 9.30 to 11.30 p. m.

24.—FULL MOON.

26.—*Canada:* York Factory, 9 p. m.

27.—*Minnesota:* Duluth, 6.30 to 11.20 p. m.

31.—*Ohio:* Hillsborough, p. m.

NOVEMBER, 1874.

1.—*Dakota:* Pembina, 8 to 11.10 p. m.

2.—*Canada:* York Factory, 9 p. m. *Dakota:* Pembina, 10.10 p. m. to 2.40 a. m.

3.—*Canada:* York Factory, 9 p. m. *Dakota:* Fort Pembina. *Iowa:* Dubuque, 7 p. m. to 2 a. m. *Michigan:* Escanaba, 7.30 to 9.30 p. m. *New Hampshire:* Mount Washington, 9 till after 12 p. m.

4.—*Canada:* York Factory, 9 p. m. *Iowa:* Dubuque, 9 to 10.30 p. m.

5.—*Dakota:* Fort Pembina. *Michigan:* Alpena, from 10.15 p. m. all night.

6.—*Canada:* York Factory, p. m. *New York:* Houseville, 10.30 p. m.; Oswego, 10.30 p. m. to 1 a. m.

7.—*Canada:* York Factory, p. m. *Maine:* Eastport, 12 p. m. *New York:* Houseville, 9 p. m. *Vermont:* West Charlotte.

8.—*Michigan:* Alpena, 7.20 p. m. till dawn.

NOVEMBER, 1874.

9.—*Wisconsin:* Le Roy, 7 p. m.
10.—*Alaska:* Saint Michael's.
11.—*Canada:* York Factory, 9 p. m. *Iowa:* Dubuque, 7 till after 12 p. m. *New Jersey:* Freehold, suspected, 9 p. m. *Vermont:* West Charlotte, suspected, 2 a. m.
12.—*Canada:* York Factory, 9 p. m. *Iowa:* Dubuque. *Maine:* Cornish; Eastport, suspected, till 10 p. m.; Standish, 9 p. m.
13.—*Maine:* Cornish. *Michigan:* Alpena, 9, obscured 11 p. m.
15.—*Canada:* York Factory, p. m.
16.—*North Carolina:* Wilmington, suspected, 10 p. m. *Vermont:* Lunenburgh.
21.—*Canada:* York Factory, p. m. *Ohio:* Mount Auburn (Cincinnati).
22.—*Canada:* York Factory, p. m.
23.—*Alaska:* Saint Michael's.
23.—FULL MOON.
24.—*Ohio:* Mount Auburn (Cincinnati).
26.—*Canada:* York Factory. *Dakota:* Pembina, 7.50 to 10.55 p. m. *Vermont:* Lunenburgh.
27.—*New Jersey:* [? Trenton, 8 to 9 p. m.]
28.—*Dakota:* Pembina, 6.30 to 10.50 p. m. *New Hampshire:* Contoocookville, 9 p. m. *Wisconsin:* Rocky Run, 7 p. m.; Utica, p. m.
29.—*Canada:* York Factory, 9 p. m. *Dakota:* Fort Pembina; Pembina, 6 50 p. m. to 12.20 a. m. *New York:* Buffalo, 8.45 p. m.; Waterburgh 9 to 10 p. m. *Wisconsin:* Embarrass, 8.20 p. m.; Rocky Run, 8 p. m. Utica, p. m. *Alaska:* Saint Michael's.
30.—*Canada:* York Factory, 6.33 a. m. till dawn. *Dakota:* Fort Pembina; Pembina, 7 to 9.30 p. m. *Alaska:* Saint Michael's.

DECEMBER, 1874.

2.—*Canada:* York Factory, 10 p. m. *Dakota:* 9.40 to 11.30 p. m.
3.—*Maine:* Cornish, p. m. *Michigan:* Alpena, 6 to 11.30 p. m.; Escanaba, 8 to 10.30 p. m. *Wisconsin:* Le Roy, 8 to 10 p. m.
4.—*Dakota:* Pembina, 6.45 to 9.30 p. m.
6, 7, 8.—*Alaska:* Saint Michael's.
9.—*Canada:* York Factory, 9 p. m. *Minnesota:* Duluth, 8 to 9.30 p. m. *Wisconsin:* Embarrass, 8 p. m.; Marathon, 8 p. m.
10.—*New Jersey:* Sandy Hook, suspected, 9 to 11.30 p. m. *Minnesota:* Fort Snelling.
11.—*Canada:* York Factory, 9 p. m.
14.—*Michigan:* Alpena, 8, obscured 8.20 p. m. *Alaska:* Saint Michael's, evening till 4 a. m. 15th, splendid.
15.—*Canada:* York Factory, 9 p. m. *Alaska:* Saint Michael's, evening until a. m. of 16th.
21.—*New Hamsphire:* Auburn, 8.30 p. m.; Mount Washington, 8 to 9.15 p. m. *Vermont:* Woodstock, 11 to 12 p. m.
22.—FULL MOON.
26.—*Canada:* York Factory, 9 p. m.
27.—*Canada:* York Factory, 9 p. m. *Maine:* Eastport, 8.30 to 10.20 p. m.
28.—*Canada:* York Factory, 9 p. m.
29.—*Minnesota:* Fort Snelling.
30.—*Canada:* York Factory.
31.—*Alaska:* Saint Michael's.

JANUARY, 1875.

1.—*Alaska:* Saint Michael's, 5.25 p. m. to 1.45 a. m. *Canada:* York Factory. *Maine:* Eastport, p. m.
2.—*Dakota:* Fort Pembina. *Wisconsin:* Maritoma.
5.—*Canada:* York Factory. *Kansas:* Leavenworth. *Wisconsin:* La Crosse, 9.30, obscured 11.30 p. m.
6.—*Michigan:* Alpena, 7 to 9 p. m. *Wisconsin:* Rocky Run, 10.30 p. m.
7.—*Minnesota:* Duluth, 7.05 to 7.20 p. m. *Wisconsin:* Rocky Run, 7.30 to 9 p. m.
8.—*Canada:* York Factory.
9.—*Louisiana:* [? Shreveport suspected, 8 to 10.30 p. m.]
11.—*Michigan:* Escanaba, 10 p. m. to 12.30 a. m.
12.—*Maine:* Eastport, 11.55 p. m.
13, 14, 15.—*Canada:* York Factory, 9 p. m.
17, 18, 19.—*Michigan:* Sugar Island, suspected, 9 p. m.
21.—FULL MOON.
22.—*Canada:* York Factory.
23.—*Pennsylvania:* Fallsington, 8 p. m.

JANUARY, 1875.

24.—*Iowa:* Afton, 9 p. m.

25.—*Canada:* York Factory, 9 p. m. *Michigan:* Escanaba, 7.45 to 8.30 p. m.

26.—*Canada:* York Factory, 9 p. m.

27.—*Canada:* York Factory, 9 p. m. *Michigan:* Escanaba, 10 to 12 p. m.

30.—*Canada:* York Factory, 9 p. m. *Colorado:* Golden City, about 8 p. m.

31.—*Michigan:* Alpena, 10.34 p. m. till after 12 p. m.; Sugar Island, 11 p. m. till after 11.59 p. m. *Utah:* Salt Lake City, about 8 p. m.

FEBRUARY, 1875.

2.—*Canada:* York Factory, 9 p. m. *Texas:* [? Houston suspected.]

3.—*Canada:* York Factory.

4.—*Georgia:* [? Savannah (Oglethorpe Barracks.)] *Louisiana:* [? Shreveport suspected, 9 p. m.]

5.—*Connecticut:* New Haven, 8 to 11 p. m. *Montana:* Fort Benton, 9 p. m. to 1 a. m.

6.—*Alaska:* Saint Michael's, 9.35 to 11.20 p. m. *Canada:* York Factory, 9 p. m. *New York:* Depauville, 9 p. m.

7.—*Canada:* York Factory. *Dakota:* Fort Pembina, 10 p. m. *Maine:* Eastport, 1 a. m., and 8.30 p. m. to 2 a. m.; Gardiner. *Michigan:* Escanaba, 7.45 to 8.50 p. m. *Minnesota:* Duluth, 8 to 10.30 p. m.; Minneapolis, 9.30 p. m. *Montana:* Fort Benton, 9 to 10.20 p. m. *New York:* Waterburgh, 9.30 p. m. *Vermont:* Woodstock, 1 to 3 a. m., and 12 p. m.

8.—*Connecticut:* New Haven, 8 to 10.30 p. m.

9.—*New Jersey:* Trenton.

10.—*Canada:* York Factory. *Dakota:* Fort Pembina. *Maine:* Eastport, 8.30 to 11 p. m. *Montana:* Fort Benton, 8.35 to 9.10 p. m.

14.—*Missouri:* Rolla, 9 p. m.

18.—*Vermont:* Lunenburgh.

19.—*Nebraska:* North Platte.

19.—FULL MOON.

23.—*Canada:* York Factory. *Kansas:* Fort Larned, 10 to 11 p. m.

24.—*Canada:* York Factory. *Connecticut:* Southington, 9 p. m. *Maine:* Cornish, all the eve; Standish, 9 p. m. *Michigan:* Alpena, 8 to 10.50 p. m.; Escanaba, 7.20 to 9.15 p. m. *Wisconsin:* Rocky Run, 7 p. m.

25.—*Canada:* York Factory. *Michigan:* Alpena, 10.34 p. m. to 12.15 a. m.; Escanaba, 7.30 to 11.30 p. m. *Minnesota:* Duluth, 10.15 to 11.50 p. m.; Fort Ripley. *New York:* Kensico.

26.—*Alaska:* Saint Michael's, 7 p. m. to 1.30 a. m. *Connecticut:* Middletown, 7 to 9 p. m.; New Haven, 8, obscured 11.30 p. m.; New London, 7.30 obscured, 11 p. m.; Southington, 9 p. m. *Dakota:* Fort Pembina; Fort Sully, 11 p. m. dawn. *Delaware:* Milford, 8.30 till after 12 p. m. *District of Columbia:* Washington. *Illinois:* Belvidere, Lyndon, 7.30 to 12 p. m.; Riley, from 8 p. m.; Rockford, 9 p. m.; Somonauk, 7.40 p. m. *Indiana:* Vevay, 8 p. m. *Iowa:* Afton, 10 p. m.; Algona, 7 to 12 p. m.; Brookside, all the eve; Burlington; Cresco, 7 to 11 p. m.; Council Bluffs, 11.55 p. m. to 1 a. m.; Dubuque, 7 to 9 p. m.; Guttenburg, 6.30 to 9.30 p. m.; Independence, p. m.; Muscatine, 9 p. m.; Rockford, 9 p. m. *Kansas:* Holton, 8 p. m. *Maine:* Bangor; Cornish, dark, obscured 8.55 p. m.; Eastport, 6 to 8.45 p. m.; Gardiner, 7 till after 12 p. m.; Montville, 9.30 p. m.; Mount Desert, p. m.; Orono, p. m.; Portland, 7 to 3.25 a. m.; Standish, 9 p. m.; West Waterville, 7.30 till after 10 p. m. *Maryland:* Cumberland; Fallston, p. m.; Woodlawn, 9 p. m.; Woodstock, 7.30 to 10.30 p. m. *Massachusetts:* Amherst, p. m.; Andover, 6.55 till after 10 p. m.; Boston, 9 to 4 a. m.; Fall River, 7.30 to 10 p. m.; Florida, from 8 p. m.; Hillsdale, 7.30 till after 10.30 p. m.; Mendon, 7 p. m.; Milton, 7 to 12 p. m.; Newburyport, early eve till 5 a. m.; North Billerica, p. m.; Somerset, 6.30 to 12 p. m.; Springfield, 9 p. m.; Vineyard Haven, p. m.; Westborough. *Michigan:* Alpena, 7 to 11.30 p. m.; Grand Haven, 7 p. m. till after 12 p. m.; Grand Rapids, 6.30 p. m. to 1 a. m.; Sugar Island, 7 p. m. *Minnesota:* Breckinridge; Duluth, 6.42 to 10 p. m.; Fort Snelling; Hutchinson, 7 to 11 p. m.; New Ulm, 7 to 11 p. m.; Saint Paul, 8 till after 12 p. m.; Sibley, 6.30 p. m. to 6 a. m.; South Minneapolis, 7 till after 10.15 p. m. *Nebraska:* Clear Creek, 7.15 to 10 p. m.; North Platte. *New Jersey:* Atco, 8.30 to 9 p. m.; Atlantic City; Barnegat; Freehold, 7 to 8.15 p. m.; Moorestown, 7 till after 10 p. m.; New Germantown, 9 to 10 p. m.; Peck's Beach, 7.20 to 9 p. m.; Squan Beach, p. m.; Trenton, 8 to 9 p. m.; Vineland, from dark. *New Hampshire:* Auburn, 9 p. m.; Contoocookville, 7 till after 9.30 p. m.; Whitefield, 7 till after 9 p. m. *New York:* Adams, p. m.; Albany; Ardenia, 9 to 10 p. m.; Brookhaven, p. m.; Depauville, 9 p. m.; Lockport, 9 to 11 p. m.; New York City, 9 to 9.20 p. m.; North Argyle, till 11 p. m.; North Hammond, 8.40 till after 8.54 p. m.; Oswego, 7.30 p. m., obscured 12.30 a. m.; Plattsburgh (Barracks), p. m.; Troy, 7.30, obscured 11 p. m.; Waterburgh, 9 p. m. *Pennsylvania:* Egypt, FEBRUARY, 1875.

p. m.; Fallsington, 7 to 9 p. m.; Philadelphia, 9 to 10 p. m.; Plainfield, 7 to 10 p. m.; York Sulphur Springs, 9 p. m. *Texas:* Indianola. *Vermont:* Burlington, 8.15 to 12 p. m.; Lunenburgh, West Charlotte, 7.30 p. m. dawn; Woodstock, all night. *Virginia:* Alto Vista, 7 to 8 p. m.; Cape Henry, 8.15 to 9.15 p. m.; Goshen Bridge, p. m.; Lewisville, 7 to 9 p. m.; Lynchburgh, Norfolk, 8.15 to 8.55 p. m.; Powhatan Hill, 9 p. m.; Prospect Hill, 7.30 till after 9 p. m.; Woodlawn (Accotink), p. m.; Wytheville, 7 to 9.15 p. m. *West Virginia:* Morgantown, 8.25 to 9.20 p. m. *Wisconsin:* Beloit, p. m.; Embarrass, 7.30 p. m.; LeRoy, 7 to 10 p. m.; Manitowoc, from 7 p. m.; Milwaukee; Rocky Run, 7 till after 9 p. m.; Utica, from 7 p. m.; Wien, 8 p. m.

27.—*Alaska:* Saint Michael's, 9.15 to 10.30 p. m.; *Canada:* York Factory. *Iowa:* Burlington, p. m. *Illinois:* Belvidere, obscured at 8.30 p. m. *Maine:* Augusta; Orland. *Maryland:* Fallston, p. m. *New Jersey:* New Germantown, 9 p. m. *New York:* North Hammond, 8 p. m. *Texas:* [?Houston.] *Virginia:* Mount Solon; Prospect Hill.

28.—*Alaska:* Saint Michael's, 8.30 p. m. to 2 a. m. *Canada:* York Factory, 7.30 till after 9.30 p. m. *Connecticut:* Southington, 8.30 p. m. *Indiana:* Bloomington, 7 to 8.20 p. m. *Maine:* Augusta; Eastport; Fort Preble; Gardiner, 8 to 10 p. m.; Orland; Portland, 8.15 to 9.45 p. m. *Massachusetts:* Fall River, 10 p. m.; Florida, till 9 p. m.; Hinsdale; Somerset, 8 to 10 p. m. *New Hampshire:* Contoocookville, 9 p. m. *New York:* Adams, p. m.; North Argyle till 9 p. m.; North Hammond, 8 p. m.; Nichols, early eve; Plattsburgh (Barracks) p. m.; Waterburgh, 8 to 9 p. m. *Rhode Island:* Dutch Island, 9 p. m. *Tennessee:* Estill Springs. *Vermont:* Woodstock, early eve 3 a. m.

MARCH, 1875.

1.—*Alaska:* Saint Michael's, 9.30 to 10.40 p. m. *Dakota:* Bismarck, 7 to 9 p. m. *Minnesota:* Fort Snelling. *Montana:* Fort Benton, 10.30 to 11 p. m. *Vermont:* West Charlotte, 8 to 8.30 p. m.; Woodstock, 3 a. m.

2.—*Alaska:* Saint Michael's, 7.25 to 11.40 p. m. *Canada:* York Factory, 9 p. m. *Connecticut:* Southington, suspected, 9 p. m. *Dakota:* Fort Pembina; Fort Sully, 8 p. m. to 1.30 a. m. *Iowa:* Afton, 9 p. m.; Cresco, 7.45 to 8 p. m.; Independence. *Massachusetts:* Springfield, 9 p. m. to 3 a. m. *Michigan:* Adrian, 9 to 9.30 p. m.; Alpena, 7.15 to 11.40 p. m.; Detroit; Escanaba, 8.30 to 9.15 p. m.; Grand Rapids, 8 to 11 p. m.; Marquette, 8 to after 11 p. m.; Northport, p. m.; Port Huron; Sugar Island, 9 p. m. *Minnesota:* Duluth, 7 to 8.35 p. m.; Fort Snelling; Hutchinson, p. m.; Minneapolis, 7 to 11 p. m. *Nebraska:* Clear Creek. *New York:* Albany, 8.30 p. m. to 12.45 a. m.; Houseville, 9.30 p. m.; Oswego, 8.30 to after 12 p. m.; North Argyle; North Volney, 9.45 p. m.; Troy. *Pennsylvania:* Erie, 10.30 to 11.30 p. m.; Philadelphia. *Vermont:* Woodstock. *Wisconsin:* Embarrass, from 8 p. m.; LeRoy, 9 p. m.; Manitowoc, 8 to after 10 p. m.; Maritoma; Milwaukee, 8 to 9.30 p. m.; Rocky Run, 8 to after 9 p. m.; Wautoma, 8 p. m.

3.—*Alaska:* Saint Michael's, 10.15 p. m. to 3.25 a. m. *Iowa:* Algona, 7 to 9 p. m. *Massachusetts:* Springfield. *Montana:* Fort Benton, 2.30 a. m. *Vermont:* Woodstock, 1 to 3 a. m.

6.—*Alaska:* Saint Michael's, 8.15 p. m. *Canada:* York Factory, 9 p. m. *Wisconsin:* Rocky Run, 9.30 p. m.

7.—*Alaska:* Saint Michael's, 7.45 to 11.55 p. m. *Canada:* York Factory, 9 p. m. *Michigan:* Alpena, 8.50 to 11.50 p. m.; Escanaba; Marquette, 9 to after 10 p. m.; Sugar Island, 9 p. m. *Newfoundland:* Saint John's, p. m. *Wisconsin:* Rocky Run, 9.30 p. m.

8.—*Canada:* York Factory, p. m. *Michigan:* Alpena, 8.40 to 11.44 p. m. *New Hampshire:* Whitefield, late in evening. *Ohio:* Carthagena, 2 a. m.

9.—*Canada:* York Factory.

13.—*Canada:* York Factory, 7.15 p. m.

14.—*Canada:* York Factory, 7.45 p. m.

15.—*Canada:* York Factory, 9 p. m.

16.—*Canada:* York Factory, 8 p. m.

19.—*Canada:* York Factory, 8 to after 10 p. m.

20.—*Canada:* York Factory.

21.—FULL MOON.

21.—*New York:* Buffalo, 9 p. m. to 2 a. m.

23.—*Kansas:* Ellinwood, 10 p. m.

27.—*Alaska:* Saint Michael's, 8.40 p. m. to 3.15 a. m.

28.—*Alaska:* Saint Michael's, 8.20 to 11.20 p. m. *Dakota:* Bismarck, 8.10 to 11.35 p. m.; *Massachusetts:* Springfield, 11 18 p. m. to 4 a m. *Maine:* Eastport, 11.55 p. m.; Gardiner, 11 p. m. to 3 a. m. *Michigan:* Alpena, 10.15 p. m. to 12.15 a. m.; Escanaba; Marquette. *New York:* Depauville, 9 p. m.; Oswego. *Vermont:* Woodstock, 10 p. m. to 2 a. m. *Wisconsin:* Rocky Run, 9 p. m.

MARCH, 1875.

29.—*Alaska:* Saint Michael's. *Vermont:* West Charlotte, 10 to after 12 p. m.

30.—*Alaska:* Saint Michael's, 8.30 p. m. to 3.35 a. m. *Canada:* York Factory, 8.30 to 8.50 p. m. *Dakota:* Pembina, 8.45 to 10 p. m. *Maine:* Eastport, 12 p. m. *Michigan:* Alpena, 10.30, obscured 11.30 p. m. *Vermont:* Woodstock, 11 p. m.

31.—*Canada:* York Factory, 9 p. m. *Dakota:* Pembina, 9 to 11 p. m.

APRIL, 1875.

1.—*Dakota:* Pembina, 9.10 to after 11.50 p. m. *Maine:* Gardiner, 3 a. m. to dawn.

2.—*Iowa:* Independence.

3.—*Canada:* York Factory, 9.30 p. m.

4.—*Canada:* York Factory. *North Carolina:* [? Weldon 3 to 4 a m.]

5.—*Maine:* Bangor.

6.—*Alaska:* Saint Michael's, 9 p. m. to 3.10 p. m. *Illinois:* Havana. *Maine:* Eastport, 10 to 11.30 p. m.; Gardiner, 10 to 11 p. m.; Kent's Hill, 9 p. m.: *Montana:* Fort Benton, 8 to 11.15 p. m. *New York:* Oneida.

7.—*Alaska.*—Saint Michael's, 9 p. m. to 2.25 a. m. *Canada:* York Factory. *Connecticut:* Middletown, 9 p. m. New Haven, 9.30 to 10.55 p. m.; Southington, 9 p. m. *Illinois:* Lyndon, 8 to 8.40 p. m. *Maine:* Cornish, all the evening; Eastport; Kent's Hill, 9 to 10 p. m.; Gardiner, 3 a. m. till dawn, and from 8 till about 11.59 p. m.; Mount Desert, p. m.; Portland, 9.50 p. m. to 1 a. m.; Orono, p. m.; Standish, 9 p. m. *Massachusetts:* Amherst; Andover, 8.15 p. m.; Fall River, 9 p. m.; Florida; Somerset, 7.30 to 9 p. m.; Springfield, 9 p. m. to 4 a. m.; Westborough; Wood's Holl. *Michigan:* Port Huron, 7 to 11 p. m.; Traverse City, p. m. *Montana:* Fort Benton, 9.30 to 11.40 p. m. *New Hampshire:* Auburn; Contoocookville, 8.15 to 9 p. m.; Mount Washington, 8 p. m.; Whitefield, 8.45 till after 11 p. m. *New Jersey:* Barnegat; Freehold, 9.30 to 11 p. m.; Long Branch. *New York:* Albany, 8.30 to 11.50 p. m.; Ardenia, 9 p. m.; Brook Haven, till after 10 p. m.; Cazenovia, 9 p. m.; Depauville, 9 p. m.; Houseville, 9 to 10.15 p. m.; North Argyle, 9.30 p. m.; North Volney, 9 p. m.; Oswego, 9 p. m.; Stapleton, p. m.; Troy, 9 till after 12 p. m.; Waterburg, from 7.35 p. m. *Ohio:* Carthagena, 3 a. m. *Vermont:* Burlington, 10.30 p. m. to 12.15 a. m.; Newport; West Charlotte, 3 a. m.; Woodstock, till after 11 p.m. *Wisconsin:* Leroy, 9.30 p. m.; Manitowoc, 9 to 10 p. m.; Rocky Run, 7.30 till after 9.30 p. m.

8.—*Alaska:* Saint Michael's, 10.10 to 11.42 p. m. *Canada:* York Factory. *Maine:* Cornish; Eastport; Orono, p. m. *Michigan:* Northport, 11 p. m. *New Hampshire:* Mount Washington, from 8.30 p. m.; Whitefield, 9.05 p. m. *Vermont:* Newport; West Charlotte, 8 p. m.

9.—*Iowa:* Dubuque, 2 to 3 a. m. *Vermont:* Lunenburg.

10.—*Maine:* West Waterville, 9 p. m. *Ohio:* Carthagena, 3 a. m.

12.—*Vermont:* West Charlotte, 2 a. m.

13.—*Michigan:* Alpena, 8.30 to 11 p. m. *Minnesota:* Duluth, 8 to 10.30 p. m.

15.—*Canada:* York Factory. *Vermont:* Lunenburg.

16.—*Canada:* York Factory.

17.—*Connecticut:* New Haven, 9 to 11 p. m.

19.—FULL MOON.

20.—*Canada:* York Factory. *New York:* Buffalo, 7.30 to 8 p. m.

21.—*Connecticut:* Middletown, 9 p. m.

22.—*Canada:* York Factory. *Connecticut:* Middletown, 9 p. m.

23.—*Dakota:* Firesteel, 8 to 10 p. m. *Maine:* Eastport. *Minnesota:* Saint Paul, 10 till after 12 p. m.; Duluth, 11.15 to 11.50 p. m. *Montana:* Fort Benton, 9.30 to 10.15 p. m. *New Hampshire:* Contoocookville, 9 p. m.

24.—*Minnesota:* Duluth, 12.10 to 12.45 a. m.

25.—*Canada:* York Factory. *Connecticut:* Southington, 9 p. m.

26.—*Connecticut:* New Haven, 8.20 p. m. till dawn. *Maine:* Bangor; Cornish, all the evening; Eastport; Gardiner; Standish, 9 p. m. *Massachusetts:* Fall River; Newburyport, 9 p. m.; Springfield, 9 p. m. to 2 a. m. *Michigan:* Alpena, 7.30 p. m. to 3 a. m.; Escanaba, 8 to 11 p. m.; Marquette; Northport. *New Hampshire:* Whitefield. *New York:* Buffalo, 9 to 10 p. m.; Cazenovia, 8 to 9 p. m.; North Hammond, 8 p. m.; North Volney, 8 to 10 p. m. Oswego, 8 to 9 p. m.; Waterburgh, 9 p. m.

27.—*Montana:* Fort Benton, suspected 11 to 11.30 p. m. *New York:* Depauville. *Vermont:* Newport; West Charlotte, 8 p. m.

28.—*Vermont:* West Charlotte, 8 p. m.

29.—*Indiana:* Vevay, 8 to 10 p. m.

30.—*New York:* Buffalo, 7.45 to 8.30 p. m.

MAY, 1875.

2—*Illinois:* Lyndon.

3.—*Canada:* York Factory. *Maine:* Bangor. *Michigan:* Alpena, 9.45 p. m. to 1.30 a. m.; Marquette, 9 till after 11 p. m. *Montana:* Virginia City, 9 p. m.

MAY, 1875.

4.—*Canada:* York Factory. *Maine:* Eastport. *Michigan:* Marquette, 9 till after 11 p. m. *Minnesota:* Duluth, 8.30 to 11.50 p. m.; Minneapolis, 9.40 p. m.; Saint Paul, 10 to 11.30 p. m. *New York:* Depauville, 9 p. m.; Lockport, from 9.30 p. m. *Wisconsin:* Le Roy, 9 p. m.
5.—*Connecticut:* New London, 8.30 to 10.30 p. m. *Vermont:* Norwich.
6.—*Canada:* York Factory.
7.—*Alaska:* Saint Paul's Island, 9 p. m. *Kansas:* Atchison, p. m. *Vermont:* Norwich.
9.—*Dakota:* Bismarck, 11.20 p. m. to 1.40 a. m. *Minnesota:* Breckinridge; New Ulm, 9 p. m. *Montana:* Fort Benton, 8, obscured 11 p. m. *Virginia:* Wytheville, 10.30 to 10.40 p. m. *Wisconsin:* Leroy, 9 p. m.
10.—*Kansas:* Atchison, 10 p. m. *Minnesota:* Fort Snelling. *Ohio:* Carthagena, 3 a. m.
11.—*Dakota:* Pembina, 9.15 to 9.55 p. m. *Maine:* Eastport, 8.30 p. m. till after 12 p. m.; Gardiner, dark to 4 a. m.; Surry. *Minnesota:* Duluth, 8.30 to 11.30 p. m. *New Hampshire:* Contocookville, 9.30 p. m.; Mount Washington, 8.35 to 12 p. m. *Vermont:* Norwich.
12.—*Maine:* Bangor.
13.—*Virginia:* Wytheville.
14.—*Canada:* York Factory.
15.—*Pennsylvania:* Williamsport, 11 p. m.
16.—*New York:* Buffalo, 8.20 to 8.50 p. m. *Vermont:* West Charlotte, 7.30 to 8 p. m.
18.—*Canada:* York Factory. *Maine:* Bangor.
19.—FULL MOON.
22.—*Maine:* Eastport; Fort Preble, 8 to 11.30 p. m.; Gardiner, early evening till moonrise; Standish, 9 p. m.; Surry. *Massachusetts:* Springfield, 8.45 to 10 p. m. *New Hampshire:* Contocookville, 9.15 p. m.; Dunbarton, p. m.; Whitefield, 8.55 p. m. *Michigan:* Alpena, 9 to 10 p. m.; Port Huron, 7 p. m. *Minnesota:* Minneapolis, 8 p. m. *New York:* Albany, 10 to 11 p. m.; Cazenovia, 9 p. m.; North Argyle, 9.15 p. m.; North Volney, p. m.; Troy; Wappinger Falls, 9 p. m.; Waterburgh, 9 p. m. *Ohio:* Cleveland, p. m.; Hillsborough, p. m. *Vermont:* Burlington; Norwich; West Charlotte, 8 p. m. *Wisconsin:* Leroy, 9 p. m.; Rocky Run, 9 p. m.
23.—*Dakota:* Bismarck, 9.37 till after 10 p. m. *Wisconsin:* Leroy, 10 p. m.
24.—*Maine:* Bangor.
26.—*Maine:* Eastport, 9 p. m. *Vermont:* West Charlotte, 8 p. m.
27.—*New York:* Buffalo, 8 to 9 p. m.
29.—*New York:* Buffalo, 8.15 to 9.12 p. m. *Pennsylvania:* York Sulphur Springs, 10 p. m.
30.—*New York:* Buffalo, 8 to 9 p. m. *Indiana:* Vevay, 9 p. m. *Vermont:* West Charlotte, 8.30 p. m.
31.—*Maine:* Eastport, 9 p. m. *Pennsylvania,* Williamsport, 3 a. m. *Vermont:* Burlington; West Charlotte, 8 to 8.30 p. m.

JUNE, 1875.

1.—*New York:* Buffalo, 8.30 to 9.15 p. m.
2.—*Maine:* Gardiner, dark to 12.30 a. m. *Michigan:* Escanaba, from 10.45 p. m.; Marquette, 10 to 11 p. m.
3.—*Minnesota:* Fort Snelling. *New York:* Buffalo, 8.20 to 10.30 p. m.; North Hammond, 9 p. m. *Pennsylvania:* York Sulphur Springs, 9 p. m., obscured 10 p. m.
4.—*Iowa:* Keokuk. *Maine:* Gardiner, till after 11.59 p. m. *New York:* Buffalo, 8.20 p. m., obscured 12 p. m. *Vermont:* Woodstock, 11 p. m.
6.—*Connecticut:* New Haven. *Massachusetts:* Springfield, 10 p. m. *Michigan:* Alpena, 9.30 to 11.50 p. m.; Marquette, 8.40 till after 11 p. m. *Minnesota:* Duluth, 9 to 11.40 p. m.; Fort Snelling. *New Hampshire:* Mount Washington, 9.30 till after 12 p. m. *Vermont:* Lunenburg.
7.—*New York:* Stapleton.
8.—*New York:* Buffalo, 8.30 to 9.15 p. m.; Oswego. *Pennsylvania:* Fallsington, 9.30 p. m.
10.—*New York:* Buffalo, 8.20 to 9.25 p. m.
13.—*New York:* Buffalo, 8.20 to 9.20 p. m.
17.—*Minnesota:* Duluth, 10.20 to 10.40 p. m. *Vermont:* Lunenburg.
18.—FULL MOON.
20.—*Ohio:* Hillsborough. *Pennsylvania:* York Sulphur Springs, 9 p. m.
22.—*Ohio:* Cleveland, p. m.
23.—*New York:* Wappinger's Falls, 9 p. m.
24.—*Iowa:* Dubuque, 7.50 to 9.30 p. m. *Minnesota:* Saint Paul, 8 to 10.15 p. m. *Wisconsin:* La Crosse, 9 to 10 p. m.
27.—*Iowa:* Dubuque, 8 to 9.40 p. m.
30.—*New York:* Wappinger's Falls, 9 p. m. *Wisconsin:* Manitowoc.

July, 1875.

1.—*Minnesota:* Duluth, 8.30 to 11.30 p. m. *New York:* Wappinger's Falls, 9 p. m.

2.—*Ohio:* Jacksonburg, 10 p. m.

3.—*Minnesota:* Duluth, 8.30 to 11 p. m.; Minneapolis, 9 p. m. *New Hampshire:* Mount Washington, 10.10 till after 11.30 p. m.

10.—*Dakota:* Bismarck, 10.30 to 11.56 p. m. *Michigan:* Port Huron, 11 p. m. to 3 a. m.; Alpena, 10.30 p. m. till dawn. *Minnesota:* Duluth, 9.30 to 11 p. m. *Montana:* Fort Benton, 11 p. m. to 12.30 a. m.

11.—*New Jersey:* Sandy Hook, 8.40 p. m., obscured 12.15 a. m. *New York:* Buffalo, 8.45 to 10 p. m.

13.—*Michigan:* Alpena, 11.30 p. m. to 12.30 a. m. *Montana:* Fort Benton, 9 to 10 p. m. *New York:* Buffalo, 8.45 to 11 p. m.

14.—*Dakota:* Bismarck, 9.22 to 11.20 p. m.

16.—*Iowa:* Davenport, 7.50 to 8.05 p. m.

17.—Full moon.

26.—*Michigan:* Alpena, 9.30 till after 12 p. m.; Marquette, 9.40 till after 11 p. m.

27.—*Minnesota:* Saint Paul, 8 to 10 p. m.

28.—*Maine:* Gardiner, 11 p. m. *Michigan:* Litchfield, 9 to 11.30 p. m.

30.—*Canada:* York Factory, 8.30 till after 30 p. m. *Maine:* Bangor.

August, 1875.

7.—*Canada:* York Factory, 9 p. m. *Tennessee:* [?Memphis, 4.30 to 5 a. m.]

8.—*Canada:* York Factory, 9 till after 10 p. m.

9.—*New York:* Buffalo, 8.10 to 8.45 p. m.

11.—*Canada:* York Factory, 9 p. m. *Dakota:* Bismarck, 10.27 p. m. to 1.52 a. m.

15.—*Canada:* York Factory.

16.—Full moon.

20.—*Canada:* York Factory, 8.30 p. m. *Ohio:* Carthagena, 8 p. m.

21.—*Canada:* York Factory, 9 p. m. *Dakota:* Fort Pembina, p. m.

22.—*Dakota:* Fort Buford, p. m.

23.—*Utah:* Salt Lake City.

26.—*New York:* Malone.

28.—*Illinois:* Anna, 9 p. m.

September, 1875.

1.—*Canada:* York Factory, 9 to 10.30 p. m. *Michigan:* Escanaba, 10.30 p. m.

2.—*Montana:* Fort Benton, 9 to 11.40 p. m.

3.—*Alaska:* Saint Michael's. *Dakota:* Fort Pembina, p. m.; Fort Seward. *Idaho:* Fort Lapwai, 9 p. m. *Michigan:* Alpena, 9.30 to 10.30 p. m.; Escanaba, 11 p. m.; Port Huron, 7.45 to 8.30 p. m. *Minnesota:* Duluth, 10.35 p. m. till after 12 p. m.; Minneapolis, 10.25 p. m. *Montana:* Fort Benton. *Vermont:* Woodstock, 1 a. m.

4.—*Dakota:* Fort Pembina, p. m.; Pembina, 9 to 10.15 p. m.; Fort Seward. *Maine:* Gardiner, 10 to 12 p. m. *Michigan:* Alpena, 10 p. m.; Grand Rapids, 9 to 10 p. m. *Minnesota:* Duluth, 9.10 to 9.22 p. m. *Vermont:* Woodstock, 1 a. m.

5.—*Dakota:* Fort Pembina, p. m.; Fort Seward; Pembina, 9.40 to 11 p. m. *Maine:* Cornish. *Virginia:* Fortress Monroe, 7.30 to 8.30 p. m.

6.—*Dakota:* Pembina, till 11.50 p. m.

7.—*Dakota:* Pembina, 8.30 to 10.00 p. m. *Maine:* Eastport, 9 to 12 p. m.

8.—*Dakota:* Fort Pembina, p. m. *Maine:* Eastport, 12 p. m.; Gardiner, 11.59 p. m.; Orono, 10 p. m. *Massachusetts:* Springfield, 8.45 p. m. till dawn. *New York:* Malone, 10 to 12 p. m.; Stapleton. *Vermont:* Woodstock, 11 p. m. till dawn.

10.—*Dakota:* Bismarck, 1 to 3 a. m. *Maine:* Cornish, all night.

11.—*Maine:* Eastport, 1 a. m. *Vermont:* West Charlotte, 1 a. m.

12.—*Canada:* York Factory, 9 p. m. *Vermont:* West Charlotte, 2 a. m.

14.—Full moon.

14.—*Canada:* York Factory, sundown.

15.—*Canada:* York Factory, 9 p. m. *Maine:* Portland, 11 to 11.20 p. m. *Mississippi:* Jackson, 4 a. m. *Montana:* Fort Benton, 10.35 to 2 a. m. *New York:* Stapleton. *Vermont:* West Charlotte, 12 p. m.

16.—*Canada:* York Factory, 9 p. m.

17.—*Michigan:* Escanaba, 8.30 p. m. *New York:* Fort Niagara, 9 p. m.

18.—*Canada:* York Factory, 9 p. m.

20.—*Canada:* York Factory, 9 p. m. *Montana:* Virginia City, 9 to 9.40 p. m.

26.—*Canada:* York Factory, 9 p. m.

27.—*Michigan:* Escanaba, 10.30 p. m.

28.—*Canada:* York Factory, 9 p. m. *Maine:* Eastport, 9 p. m.

SEPTEMBER, 1875.

30.—*Dakota:* Fort Pembina, p. m. *Michigan:* Alpena, 9 to 11.45 p. m. *Minnesota:* Duluth, 8.25 to 8.55 p. m. *New York:* Albany, 8 to 9 p. m.; North Argyle, 9 p. m.; Waterburgh, 8 p. m.

OCTOBER, 1875.

2.—*New York:* Depauville, 2.30 a. m.; Malone, 11.30 p. m.

4.—*Alaska:* Saint Michael's, 6.30 p. m. till after 2 a. m.

5.—*Alaska:* Saint Michael's, 7.35 to 12 p. m.; Fort Wrangel. *Canada:* York Factory, all the evening. *Dakota:* Breckenridge. *Maine:* Eastport, 7 p. m.

6.—*Alaska:* Saint Michael's, 8 p. m. till dawn. *Michigan:* Escanaba, 9.30 to 11.15 p. m.; Marquette, 7.15 till after 11 p. m. *New York:* Malone, 10 till after 11.11 p. m. *Wisconsin:* Rocky Run, 11 p. m.

7.—*Iowa:* Cresco, suspected, 11 p. m. *Maine:* Gardiner, 9 till after 12 p. m. *Massachusetts:* Fall River. *Michigan:* Alpena, 9 to 9.15 p. m. *Minnesota:* Duluth. *Pennsylvania:* York Sulphur Springs, 9 to 12 p. m.

8.—*Maine:* Gardiner. *Pennsylvania:* Fallsington, 7 p. m.

9. *Maine:* West Waterville, 8 till after 12 p. m.

10.—*Canada:* York Factory, 9 p. m. *New York:* Depauville, 9 p. m.

12.—*Canada:* York Factory, 9 p. m.

14.—FULL MOON. *Louisiana:* [? New Orleans, suspected]. *New York:* Malone, 12 p. m. to 1 a. m.

19.—*Colorado:* Silverton, 2 a. m.

20.—*New York:* Hector, 8 to 9 p. m.

24.—*Alaska:* Saint Michael's, 8.40 p. m., obscured 11 p. m. *Dakota:* Fort Pembina. *Michigan:* Escanaba, 8.20 to 11 p. m. *New York:* Depauville, 9 p. m.

26.—*Dakota:* Fort Pembina.

28.—*Canada:* York Factory, 9 p. m.

29.—*Dakota:* Fort Sully, 8.45, obscured 10.20 p. m.

The observer at York Factory attributes the small number of auroras seen to the extreme cloudiness of the month.

NOVEMBER, 1875.

1.—*Alaska:* Saint Michael's, 9 p. m. to 4.50 a. m. *Canada:* York Factory, 9 p. m. *Michigan:* Escanaba, 9.30 to 10. 40 p. m.

2.—*Alaska:* Saint Michael's, 10.30 to 12 p. m. *Canada:* York Factory, 9 p. m. *New York:* North Argyle, early evening. *Ohio:* Carthagena, 4 a. m.

3.—*Alaska:* Saint Michael's, 6.20 to 9 p. m.

5.—*Alaska:* Saint Michael's, 8.35 to 11.15 p. m. *New York:* Buffalo, 9. to 10.15 p. m.

6.—*Canada:* York Factory. *New York:* Troy, 10 p. m.

7.—*Michigan:* Detroit, 6 to 7 p. m.

8.—*Maine:* Eastport, 10 to 11 p. m.

9.—*Vermont:* Lunenburg.

12.—FULL MOON.

12.—*Iowa:* Rockford, 7.30 to 11.30 p. m.

13.—*Canada:* York Factory, 9 p. m.

15.—*Canada:* York Factory, 9 p. m. *Kentucky:* Winchester, 8 p. m.

17.—*Texas:* [? Corsicana, suspected, 8 to 10.50 p. m].

18.—*Kansas:* Burlingame, p. m.; [? Dodge City, 7 to 9 p. m]. *Nebraska:* Omaha, 9.30 p. m.

20.—*Dakota:* Fort Pembina.

21.—*Canada:* York Factory, 9 p. m. *Dakota:* Fort Sully, 10 to 12 p. m. *Massachusetts:* Boston, 11.23 p. m. till after 4 a. m.; Fall River, 11 p. m. Springfield, 11.18 p. m. to 4 a. m. *Michigan:* Alpena, 7.20 till after 12 p. m.; Detroit, 9.30 p. m. to 12.30 a. m.; Escanaba, 8 to 9.15 p. m; Grand Rapids, 9 to 12 p. m.; Marquette, 9 to 11.15 p. m.; Port Huron, 10.30 p. m. *Minnesota:* Duluth, 8.30 to 9.45 p. m. *New Jersey:* New Germantown, 10.30 p. m. *New York:* Malone, 11 p. m. to 12.30 a. m.; Stapleton, p. m. *Vermont:* Burlington, 10 to 12 p. m. *Wisconsin:* La Crosse, 9.20 to 11.45 p. m.; Rocky Run, 10 p. m.; Utica.

22.—*Canada:* York Factory. *Massachusetts:* Waltham, 10 to 11 p. m, *New York:* North Argyle, 10 p. m. *Ohio:* Carthagena, 1 a. m. *Vermont:* Lunenburg; Woodstock, 2. 05 to 3 a. m., and again at 9 p. m. *Wisconsin:* Utica.

23.—*Canada:* York Factory.

24.—*Canada:* York Factory, 10.30 p. m.

25.—*Canada:* York Factory, 9 p. m.

26.—*Alaska:* Saint Michael's, 9.30 p. m. to 5.30 a. m. *Canada:* York Factory, 9.30 p. m. to 3.45 a. m,

27.—*Vermont:* Lunenburg.

28.—*Canada:* York Factory, 9 p. m.

NOVEMBER, 1875.

29.—*Alaska:* Saint Michael's. *Canada:* York Factory, 9 p. m. *Maine:* Eastport, 9 p. m.; Gardiner, 11 p. m. to 5 a. m. *Massachusetts:* Springfield, 11 p. m. till 2 a. m.
30.—*Alaska:* Saint Michael's. *Canada:* York Factory, 9 p. m. *Massachusetts:* Boston, 1.30 till after 3 a. m.

DECEMBER, 1875.

1.—*Alaska:* Saint Michael's, 9.50 p. m. to 4.35 a. m.
2.—*Alaska:* Saint Michael's, 9.10 p. m. *Canada:* York Factory, 9 p. m.
3.—*Alaska:* Saint Michael's, 9.30 p. m. *Canada:* York Factory, 3 a. m.
4.—*Alaska:* Saint Michael's, 9 p. m.
7.—*Maine:* Gardiner, 2 till 4 a. m. *Ohio:* Carthagena, 4.30 a. m.
10.—*Wisconsin:* Leroy, 4.30 a. m. till dawn.
12.—FULL MOON.
14.—*Canada:* York Factory.
15.—*Canada:* York Factory
17.—*Alaska:* Saint Michael's, 9 p. m. to 3.15 a. m.
18.—*Alaska:* Saint Michael's, 9 to 11.45 p. m. *Canada:* York Factory.
19.—*Alaska:* Saint Michael's, 9 p. m. *Dakota:* Bismarck, suspected, 10.20 to 11 p. m. *Vermont:* Woodstock, 11 p. m.
21.—*Canada:* York Factory, p. m. till dawn.
24.—*Canada:* York Factory. *Minnesota:* East Minneapolis, 11 p. m.
25.—*Canada:* York Factory. *Maine:* Eastport, 10 to 11 p. m. *Massachusetts:* Boston, 12.25 to 4.30 a. m. *Michigan:* Alpena, 8.30 p. m. to 2.30 a. m. *New York:* Malone, 9 to 11.30 p. m.
26.—*Canada:* York Factory. *Dakota:* Fort Buford; Pembina, 8.45 to 11 p. m.
27.—*Canada:* York Factory.
28.—*Canada:* York Factory. *Michigan:* Detroit, 9 p. m.
29.—*Alaska:* Saint Michael's, 10.15 p. m. to 7.20 a. m. *Indiana:* Fort Wayne. *Maine:* Gardiner, 11 p. m.
30.—*Alaska:* Saint Michael's, 7.25 p. m. to 7.15 a. m. *Canada:* York Factory.
31.—*Alaska:* Saint Michael's, 10.35 p. m. to 7.35 a. m. *Canada:* York Factory.

Mr. E. D. Couch, voluntary observer at Contoocookville, N. H., reports that he has looked regularly (with but few exceptions) for aurora at 9 p. m. His record shows the following numbers of displays noted annually: 1871, 28; 1872, 32; 1873, 34; 1874, 14; 1875, 4; 1876, 6; 1877, 9; 1878, 4; 1879, 3.

The Signal Service observers at York Factory report that the displays at that station frequently extend through the night, but are rarely noted save at 9 p. m., as the observer is but rarely up much later.

PAPER 51.

GENERAL SUBJECT INDEX TO APPENDICES OF THE REPORTS OF THE CHIEF SIGNAL OFFICER OF THE ARMY, 1870–'79, INCLUSIVE.

[By First Lieutenant A. W. GREELY, Fifth Cavalry, acting Signal Officer and Assistant.]

[NOTE.—Charts and maps are given their running numbers.]

	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.
Acts of Congress:										
Appropriations for—										
Weather Bureau	......	......	168	......	......	366	......	......	......	......
Army signaling	......	......	......	......	......	116 367	......	......	......	......
Two clerks	......	......	......	......	......	365	......	......	......	......
Deficiency	......	......	......	......	......	366	......	......	......	......
Telegraph lines:										
To protect	......	......	......	......	383	365	......	......	......	......
Securing for government use and aiding	......	......	167	......	......	......	......	......	......	......
To construct in Arizona	......	......	......	......	......	364	......	......	......	......
To construct in New Mexico	......	......	......	......	......	365	......	......	......	......
To construct in Texas	......	......	......	......	......	365	......	......	......	......
Signal Service, concerning	......	......	......	......	......	116	......	......	......	......
Agricultural committees:										
List of	......	......	100	968	307	126	136	......	......	......
Circular to	......	142	......	......	......	......	......	......	......	......

Index to appendices, &c.—Continued.

	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.
Allegheny River:										
Oscillations (chart)						74	77	60	56	69
Profile of (chart)					54					
Arkansas River:										
Profile of (chart)					54					
Oscillations (chart)						72				73
Assistant observers, list of instructed			92	314	107	112	123	150	187	229
Atmospheric electricity		65								
Aurora, February, 1872			254							
Auroras seen by Signal Service from November 11, 1870, to July 31, 1873				1098						
Aurora, April 7, 1874					383	367	301			
Balloon ascents			260					541		
Charts			16					542		
Observations								544		
Barnes, Surg. Gen. J. K., offers reports						362				
Barometer, standard, New York									676	500
Barometric depressions:										
June, 1871–'72 (maps)			17, 18							
June, 1871–'73 (maps)					42–53					
June, 1871–'76 (maps)							55–66			
Barometric gradients					385					
Barometric means:										
Sea level				390	127	139	148	179	218	249
Actual									412	454
Normal									418	451
June, 1871			264							
Telegraphic, January (maps)						43–45				
Bill for Signal Corps							473			
Resolutions on							473			
Boards of Trade:										
Circular to	41	142	269						208	
Committees			104	974	398	130	140	168	207	742
Resolutions							473	169		
Canal regions (map)							80			
Centennial Exhibition, report								507		
Charts (river oscillations):										
Allegheny						74	77	60	56	69
Arkansas						72				73
Columbia										74
Cumberland				9	61	76	79	61	57	70
Mississippi				1–4	57, 58 63, 64	63–66	66–70	54, 55	50, 51	63–64
Monongahela					...	73	76	58	54	67
Missouri				7	55, 56	67, 68	71, 72	56	52	65
Ohio				5, 6	59, 60	69, 70	73, 74	57	53	66
Red				8	62	71	75	62	58	71
Tennessee									59	72
Youghiogheny						75	78	59	55	68
Chart, meteorological (No. 16)										3
Chart, river profiles				54						
Circulars:										
Agricultural Societies		142								
Boards of Trade	41	143	269							
Danger line, western rivers						357				
Earthquakes					374					
Enlistment		61		316, 317						
Farmers' Weather Indicator										535
International Observers					362					
Meteorological Committees	41		268						208	
River Gauges					363					
Voluntary Observers					288	464				
Cipher:										
River reports				952						
Sunset reports								342		
Weather reports			169							
Columbia River, oscillations (chart)										74
Committees:										
Agricultural Societies			100	968	307	126	136			
Boards of Trade			104	975	398	130	140	168	207	742
Meteorological	41		268						208	
Meteorological, instructions for								170	209	
Communications sent and received, O. C. S. O.		60	95	385	110	114	124	151	189	233
Course at Fort Whipple				952					185	227
Cumberland River:										
Oscillations (chart)				9	61	76	79	61	57	70
Profile (chart)					54					

Index to appendices, &c.—Continued.

	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.
Cyclones:										
September 8–24, 1875						336				
Indianola, September 25, 1875						378				
August 24–25, 1873, Nova Scotia				1025						
August 24–25, 1873, Nova Scotia (8 maps)				30–37						
Danger line:										
Mississippi River					312					
Missouri					320					
Ohio					321					
Circular						357				
Data, meteorological, furnished								153	191	234
Disasters on lakes		67	195	1034	388	377	360	527	635	744
Display stations										155
District map, United States (map)				47						
Earthquakes, circular on						374				
Electricity, atmospheric		65								
Elevations of stations		58		958						
Elevation:										
Effect on temperature							349			
Effect on temperature (maps)							4–10			
Farmers' Weather Indicator										535
Forest fires, 1871			186							
Forms, meteorological samples:										
No. 1.	20	147								
No. 2.		148			255	339				
No. 3. *a.* Daily bulletin	40	{ 61, 149 }			264	348				
No. 4. Weekly meteorological record	19	150	284				502			
No. 5.	20	151	285							
No. 7. Press report		153								
No. 8. Telegraphic record		158								
No. 14. Inspection report		145								465
No. 15. Indications		141	283		324	445	472			
No. 16. (chart)		{ 82, 160 }					48			13
No. 17. Detailed synopsis and probabilities		161								
No. 18. *a.*							294			
No. 18. *b*							299			
No. 18. Marine record		139								
No. 22. Monthly means		164					507			
No. 23. Cautionary signals		165								
No. 24. Record of bulletins		166	286							
No. 25			287							
No. 26			288							
No. 27. River observations				957						
No. 29. Report railway bulletins										540
No. 31. Temperature water				976	323	444	509			
No. 38. River observations						444	508			
No. G. Messages refused			289							
No. A. Messages refused			289							
No. B. Messages sent and received			290							
No. C. Notification to telegraph companies			291							
No. E. Voluntary observers					291	462				
No. H. Voluntary observers						470				
No. —. Working circuits			272							
No. —. Farmers' bulletin							471			
No. —. International bulletin					273					503
No. —. Assistants on station, instruction							508			
No. —. Signal Service (international observers)									678	498
No. —. Railway daily weather report										540
No. —. Special river report					323					
No. —. For verifications					297	333		331		
No. —. Army surgeons' reports					294					
Fort Whipple:										
Course of instruction		2	3	952				148	185	227
Drills and field practice		52	3	312	106	111	122	149		229
Officers instructed	14	52	90	312		111	122	149		229
Officers' field practice	15	52	91	312		111	122	149		229
Observer sergeants instructed	16	52	91	313	106	111	122	149	187	232
Assistant observers instructed			92	314	107	112	123	150	187	229
General Orders War Department:										
Charging C. S. O. with duties as to telegraph			168							
Charging C. S. O. with weather duties	16									

Index to appendices, &c.—Continued.

	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.
Henry, Professor Joseph:										
Letter transferring Smithsonian observers					286					
Letter transferring voluntary observers					287					
Humidity means, monthly and annual									415	458
Indian troubles in Arizona								569		
Inspections of stations			94	948	374	120	130	160	200	461
Instructions:										
For river observations						364				
For self-recording instruments			181							
For comparing ships' barometers									676	500
To observer sergeants	22	71	138	320						
To observer sergeants (extracts)								321	420	476
To sunset stations										493
Instruction in signaling in Army		54								
Instrument room, report				965						
International meteorology:										
Bulletin					273	446	485	358	678	
Map of stations (chart)					38		46	1		
Weather maps (samples); daily						58–62	47	44		
Joint resolution of Congress:										
Authorizing meteorological observations	6	143	167							
Knoxville, special observations				794						
Lake disasters, list of		67	195	1034	388	377	360	527	635	743
Lapham, A. J.:										
Report on weather predictions		167								
Report on weather predictions (maps)		1–12								
Leavenworth, Kans., weather relative to vegetation			265							
Logs (marine) received					402	138				
Manual of military telegraph			106							
Manual of military telegraph (extracts)						440				
Maps, clouds		92		365						
International meteorology, daily						58–62	47	44		
International stations					38		47	1		
International monthly means, &c										4–16
Study room, O. C. S. O. A					39	39	50	46	43	56
B						40	51	47	44	57
C					40, 41	41	52	48	45	58
D						42	53	49, 53	46	59
E							54	50	47	60
F								51	48	61
G								52	49	62
Railway bulletin service										17
Signal service stations								43		1
Canal regions							80			
United States telegraphs							49			2
Weather, United States, tri-daily		87	19–21							
Merchant marine, list of observers					402	138	148	178	216	501
Meteorological data furnished								153	191	234
Meteorological instruments purchased			96	386						
Military posts making reports						137	147	177	215	530
Mississippi River:										
Danger-line report					312					
Oscillations (charts)				1–4	57, 58 63, 64	63–66	66–70	54, 55	50, 51	63, 64
Profile (charts)					54					
Missouri River:										
Danger-line report					320					
Oscillations (charts)				7	55, 56	67, 68	71, 72	56	52	65
Profile (charts)					54					
Monongahela River:										
Oscillation (charts)						73	76	58	54	67
Profile (charts)					54					
Monthly weather reviews				981	325	268	384	380	460	541
Mount Mitchell:										
Instructions for special observations				770						
Journal				772						
Special observations				794						
Special observations (Knoxville)				794						
Mount Washington:										
Instructions for special observations			205	530						
Journals			207	535						
Special observations			216	557						
Special observations at Portland (simultaneous)			247	758						

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	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.
Myer, A. J., General:										
Letter to Professor Joseph Henry	......	......	......	......	286	......	......	......	......	......
Letter to Surgeon-General J. K. Barnes	......	......	......	......	......	362	......	......	......	......
Letter to voluntary observers	......	......	......	......	287	......	......	......	......	......
Letter to observers, North Carolina coast	......	......	......	......	......	......	......	......	676	......
Letter to international observers	......	......	......	......	......	362	......	......	......	......
Letter inviting river observations	......	......	......	......	......	364	......	......	......	......
Letter to Postmaster-General	......	134	......	......	......	......	......	......	......	......
Navy, United States, reports from	......	......	......	......	......	......	148	178	217	501
Observation offices, location, &c	......	58	......	......	......	......	......	......	......	......
Observations, transit of Mercury	......	......	......	......	......	......	......	......	......	780
Observer sergeants:										
Instructed	16	53	91	313	106	111	122	149	187	232
Instructions to	22	71	138	320	......	......	......	......	......	......
Instructions to (extracts)	......	......	......	......	......	......	......	321	420	476
Office C. S. O., rules	......	......	......	365	......	......	......	......	......	......
Officers instructed	14	52	90	312	......	111	122	149	......	229
Field practice	15	52	91	312	......	111	122	149	......	229
Ohio River:										
Oscillations (charts)	......	......	......	5, 6	59, 60	69, 70	73, 74	57	53	66
Profile (charts)	......	......	......	......	54	......	......	......	......	......
Danger line report	......	......	......	......	321	......	......	......	......	......
Original record	......	......	292	......	......	......	......	......	......	......
Pike's Peak, journal	......	......	......	......	113	......	......	......	......	......
Polaris expedition	......	......	......	996	......	......	......	......	......	......
Portland, Maine, special observations	......	......	247	758	......	......	......	......	......	......
Post-Office Department:										
Bulletins	......	......	......	966	......	......	......	......	......	......
Map	......	......	......	967	......	......	......	......	......	......
Postmaster-General, fixing telegraph rates	......	137	......	......	......	......	......	......	......	......
Practical use weather maps	......	83	269	......	......	......	......	......	......	......
Publications received	......	......	......	387	111	117	125	156	195	242
Rainfall, annual and monthly	......	......	......	433	239	143	152	184	224	255
Red River:										
Oscillations (charts)	......	......	......	8	62	71	75	62	58	71
Profile (charts)	......	......	......	......	54	......	......	......	......	......
River gauges, zeros or benchmarks	......	......	......	962	......	......	......	......	......	......
River reports:										
Instructions	......	......	......	950	......	364	......	......	......	......
Cipher	......	......	......	952	......	......	......	......	......	......
Special	......	......	......	......	323	......	......	......	......	......
Rocky Mountain locusts:										
Correspondence	......	......	......	......	......	......	......	500	......	......
Data	......	......	......	......	......	......	......	504	......	......
Rules, O. C S. O	......	......	......	365	......	......	......	......	......	......
Saint Michael's, Alaska:										
Climate, &c	......	......	......	......	......	......	78	557	......	......
Observations	......	......	......	......	......	......	76	567	......	......
Saint Paul's Island, Alaska:										
Climate &c	......	......	......	446	......	......	......	......	......	......
Observations	......	......	......	473	......	......	......	......	......	......
Instructions for observations	......	......	76	......	......	......	......	......	......	......
Self-recording instruments	......	......	181	......	......	......	......	......	......	......
Signal instruction in Army	......	54	......	......	......	......	......	......	......	......
Signal Service stations	......	54	......	......	......	......	......	......	......	......
Signal Service stations (map)	......	......	......	......	......	......	......	43	......	1
Signals:										
Cautionary	......	109	......	......	......	......	......	......	662	......
Danger or distress	......	......	......	......	......	......	......	......	664	......
Off-shore	......	......	......	......	......	......	......	......	662	......
Stations requested, not established	......	......	97	978	399	122	130	162	201	774
Storms:										
Tornadoes, &c., general list	......	......	190	......	......	......	......	......	......	......
Pacific coast, general list	......	......	262	......	......	......	......	......	......	......
November, 1871	......	......	257	......	......	......	......	......	......	......
November, 1871 (chart)	......	......	1	......	......	......	......	......	......	......
March, 1872	......	......	258	......	......	......	......	......	......	......
March, 1872 (7 maps)	......	......	2–8	......	......	......	......	......	......	......
September, 1872	......	......	259	......	......	......	......	......	......	......
September, 1872 (7 maps)	......	......	9–15	......	......	......	......	......	......	......
April, 1873	......	......	......	1097	......	......	......	......	......	......
April, 1873 (9 maps)	......	......	......	38–46	......	......	......	......	......	......
March 27, 1877	......	......	......	......	......	......	......	545	......	......
Sun's power at summer solstice (map)	......	......	......	......	......	......	......	45	......	......
Sunset stations:										
Cipher	......	......	......	......	......	......	......	342	......	......
Forms	......	......	......	......	......	......	......	354	......	......
List of	......	......	......	......	......	......	......	337	......	......
Rules for	......	......	......	......	......	......	......	337	430	......

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	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.
Telegraphic circuits established		57								
Telegraphs:										
Act protecting						365				
Arizona, act for						365				
Correspondence on circuits	36									
Correspondence on rates		133								
Instructions for construction, &c						440				
New Mexico, act for						365				
Northwestern Division, act for									172	223
Order Secretary War regarding					378					
Postmaster-General fixes rates		137								
Texas, act for						365				
Texas, instructions for building					379					
Sea-coast, instructions for					375					
Temperature:										
Means, annual and monthly				392	130	142	151	182	221	252
Maxima and minima				393	132	145	155	186	228	259
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March, 1875 (Alabama, Georgia, South Carolina, &c)						398				
June, 1875 (Detroit)						438				
June, 1877 (Mount Carmel, Ill.)								518		
June, 1877 instructions for report								517		
April, 1878 (Georgia)									646	
August 9, 1878 (Wallingford, Conn.)									654	
August 9, 1878 (Wallingford, Conn.)									658	
Transit of Mercury, observations										780
Unalaska, Alaska, observations				459						
Verifications:										
Forms for					297	333		331		
Instructions for making					296	332	472	330		
Percentages				1109						
Vessels:										
Naval, making reports							147	178	217	501
Merchant, making reports								178	216	501
Vienna Meteorological Congress correspondence				1107						
Voluntary observers:										
Forms for					291	462				
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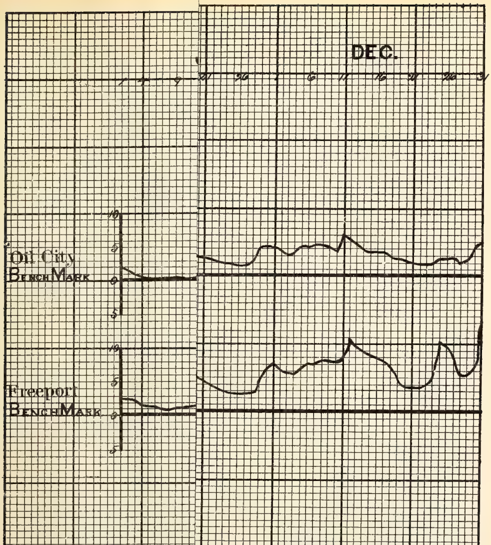
Letter transferring, by J. Henry					287					
Instructions to					288	464				
List of						131	142	172	211	530
Weather map:										
Samples			19–21							
Account of sales				389						
Weather reports, number of words in		59								
Weather Review, monthly				981	325	268	384	380	460	541
Weather circuit, forms, &c	27	57, 115	272							
Weekly Weather Chronicle			282		324	331	383			
Winds:										
Summary of				435	242	254	279	307	395	434
Wet and dry									616	
Wet and dry (chart)							46–57			
Youghiogheny River:										
Oscillations (chart)						75	78	59	55	68
Profile (chart)					54					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1
4
9
21
26
1
6
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16
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26
31
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Oil City
Bench Mark
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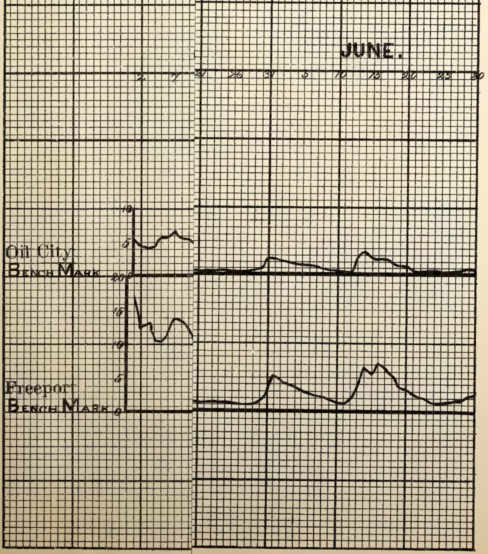
5
10
5
Freeport
Bench Mark
0
5


JUNE.
2
7
21
26
31
5
10
15
20
25
30
10
5
Oil City
Bench Mark
20
15
10
5
Freeport
Bench Mark
0

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Texas, instructions for building					379					
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Temperature:										
Means, annual and monthly				392	130	142	151	182	221	252
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Naval, making reports							147	178	217	501
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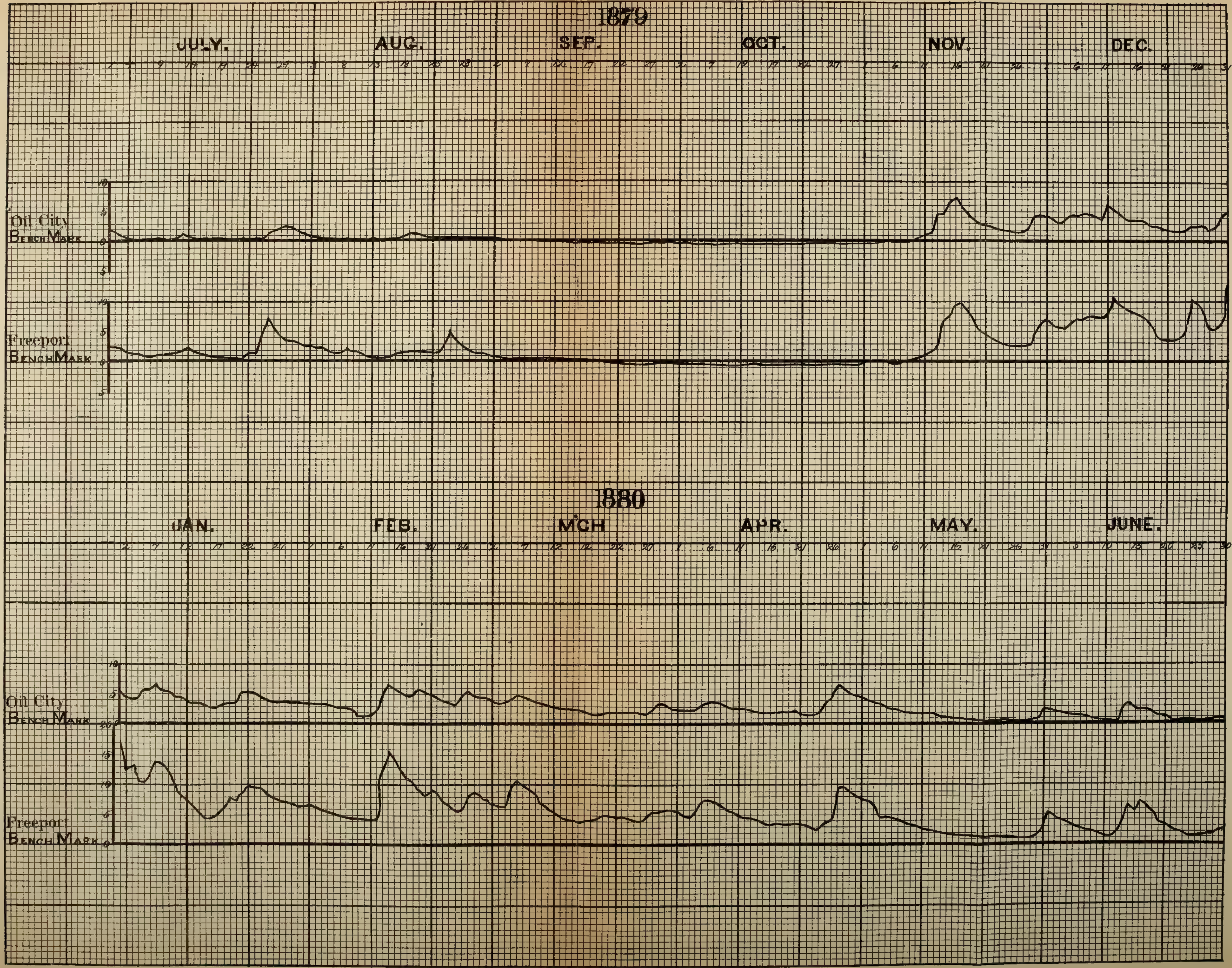
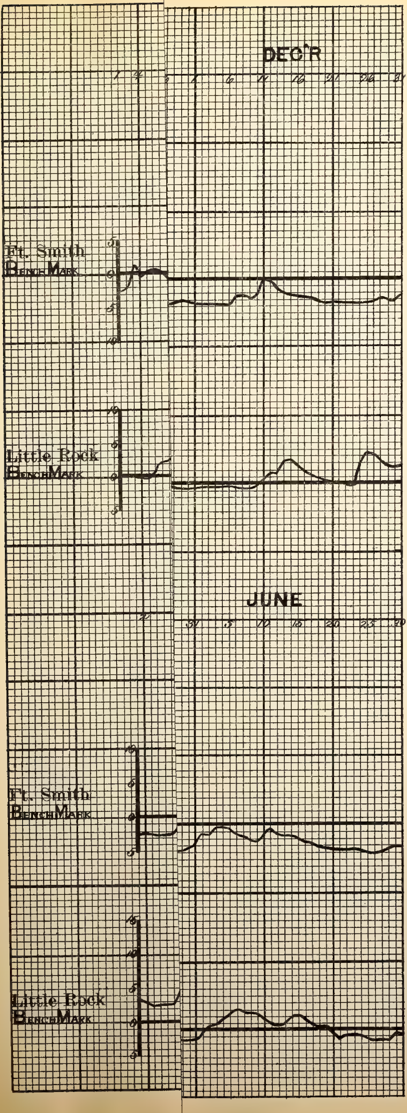
Summary of				435	242	254	279	307	395	434
Wet and dry									616	
Wet and dry (chart)							46–57			
Youghiogheny River:										
Oscillations (chart)						75	78	59	55	68
Profile (chart)					54					

OSCILLATIONS OF THE ALLEGHANY RIVER.




DEC'R
1
4
5
1
6
11
16
21
26
31
Ft. Smith
Bench Mark
5
0
5
10
Little Rock
Bench Mark
10
5
0
5
JUNE
2?
31
5
10
15
20
25
30
Ft. Smith
Bench Mark
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0
5
Little Rock
Bench Mark
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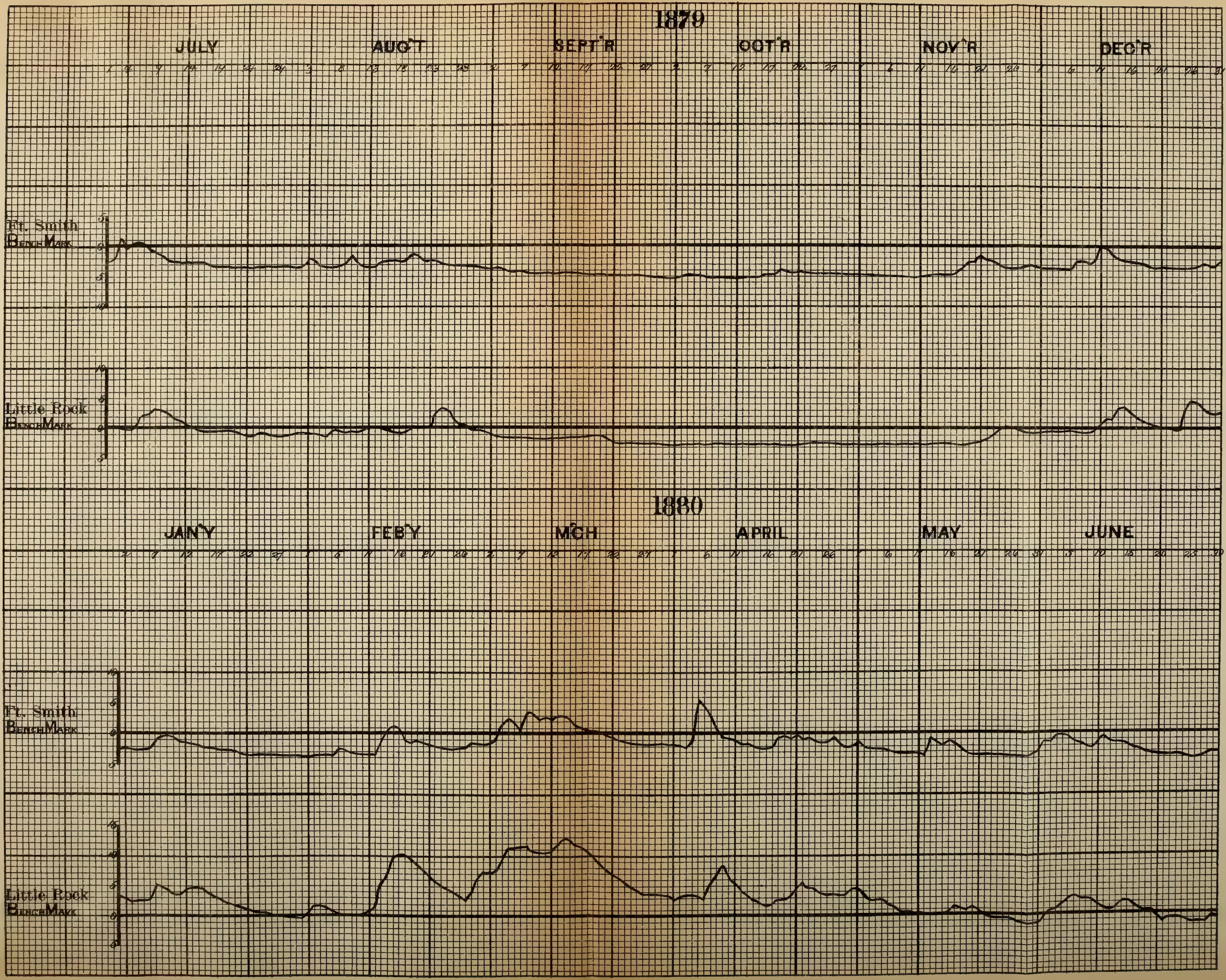
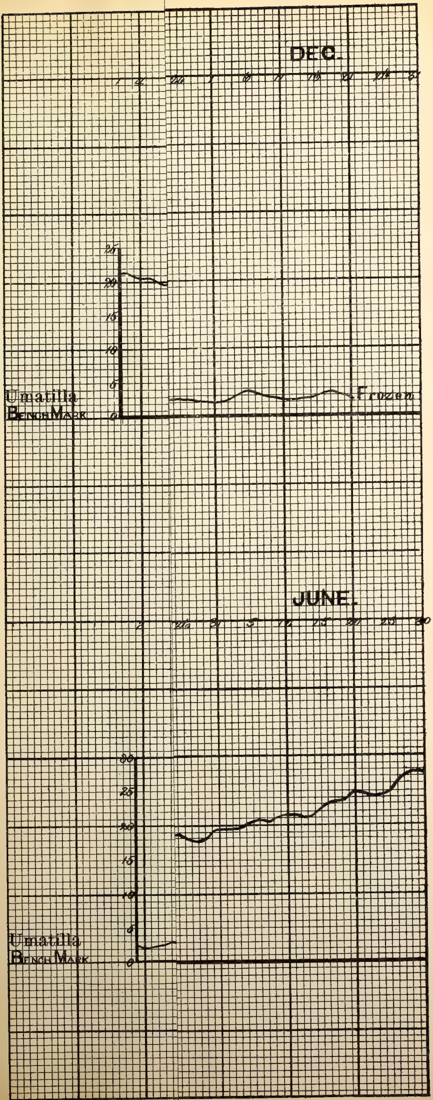
10
5
0
5

OSCILLATIONS OF THE ARKANSAS RIVER.

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2
26
1
6
11
16
21
26
31
25
20
15
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5
0
Frozen
Umatilla
Bench Mark
JUNE.
2
26
31
5
10
15
20
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30
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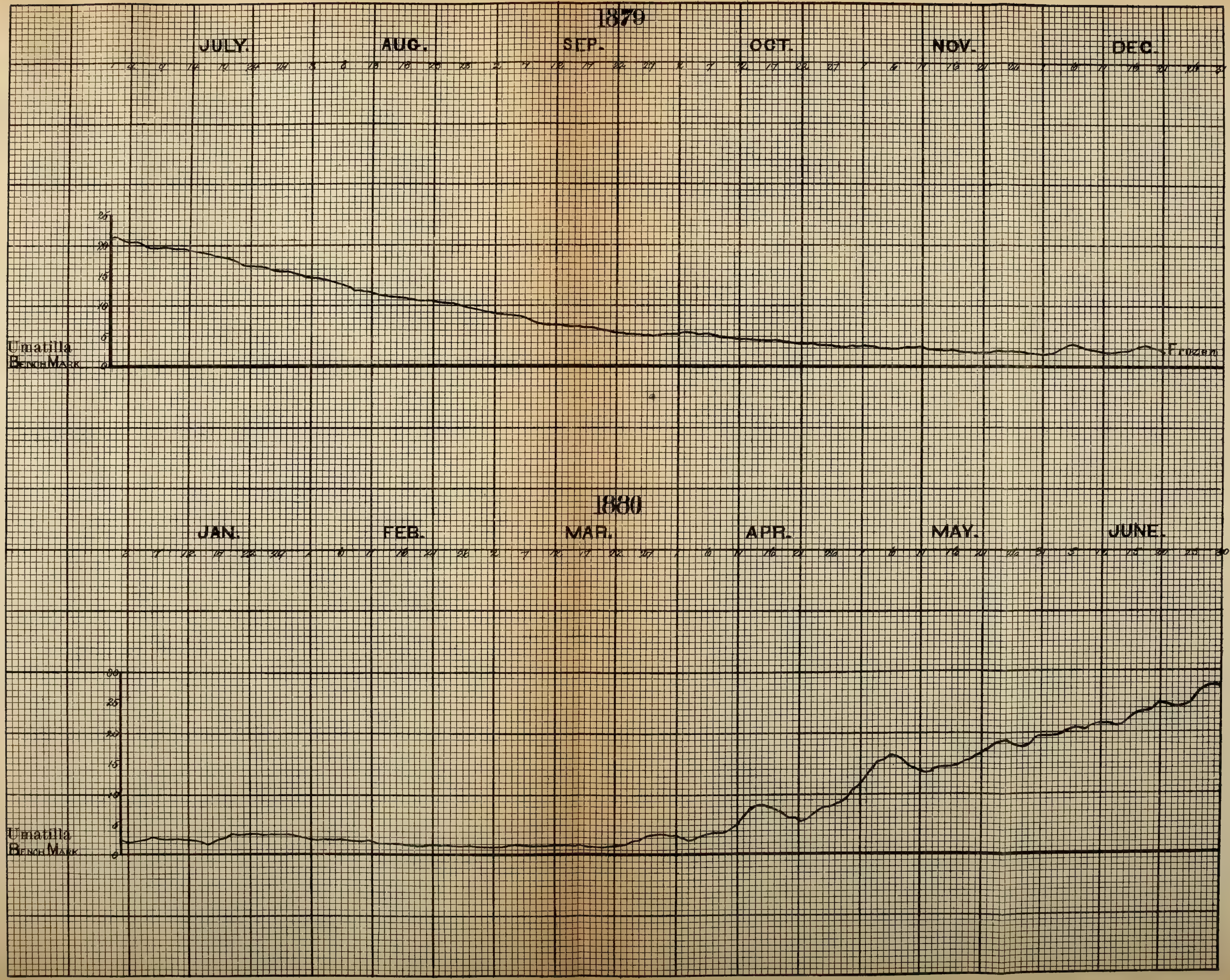
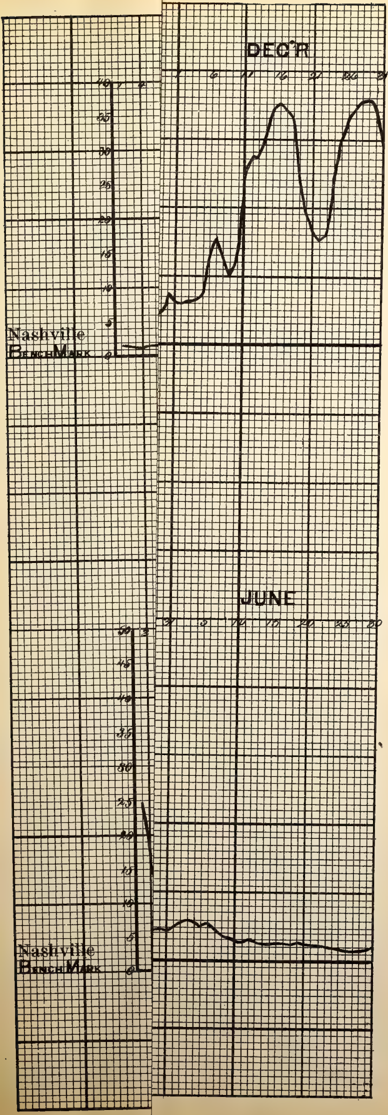
25
20
15
10
5
0
Umatilla
Bench Mark

OSCILLATIONS OF THE COLUMBIA RIVER.




DEC'R
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6
11
16
21
26
31
40
35
30
25
20
15
10
5
0
Nashville
Bench Mark
JUNE
31
5
10
15
20
25
30
50
45
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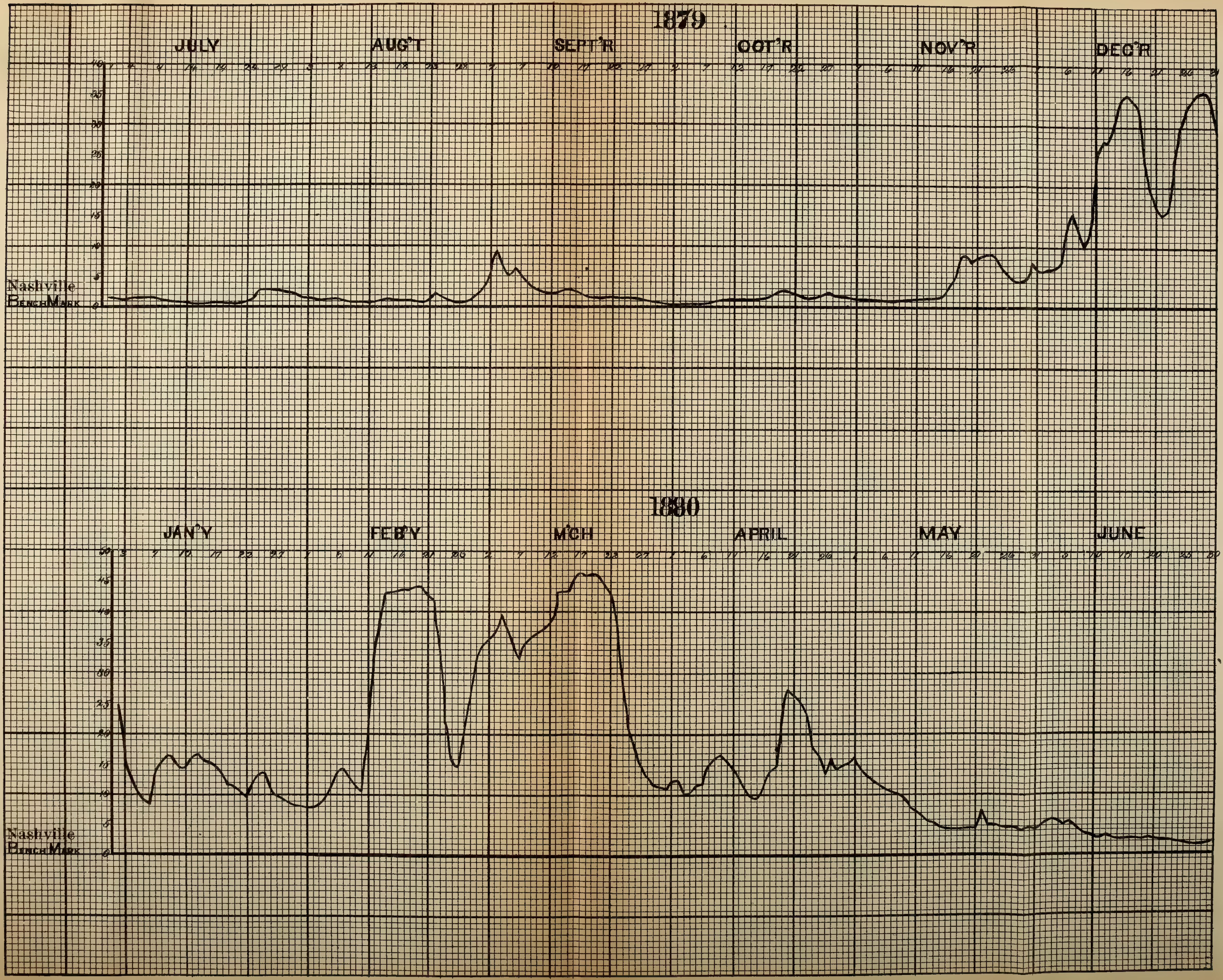
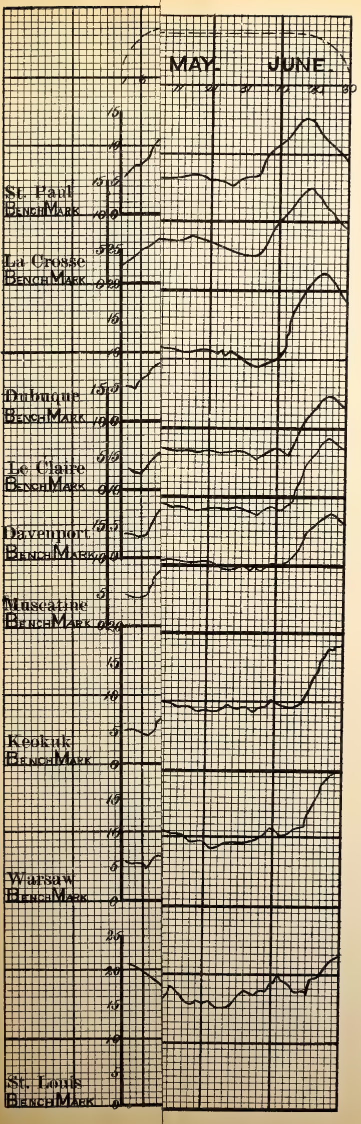
35
30
25
20
15
10
5
0
Nashville
Bench Mark

OSCILLATIONS OF THE CUMBERLAND RIVER.




MAY.
JUNE.
1
6
11
21
31
10
20
30
St. Paul
BenchMark
La Crosse
BenchMark
Dubuque
BenchMark
Le Claire
BenchMark
Davenport
BenchMark
Muscatine
BenchMark
Keokuk
BenchMark
Warsaw
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St. Louis
BenchMark
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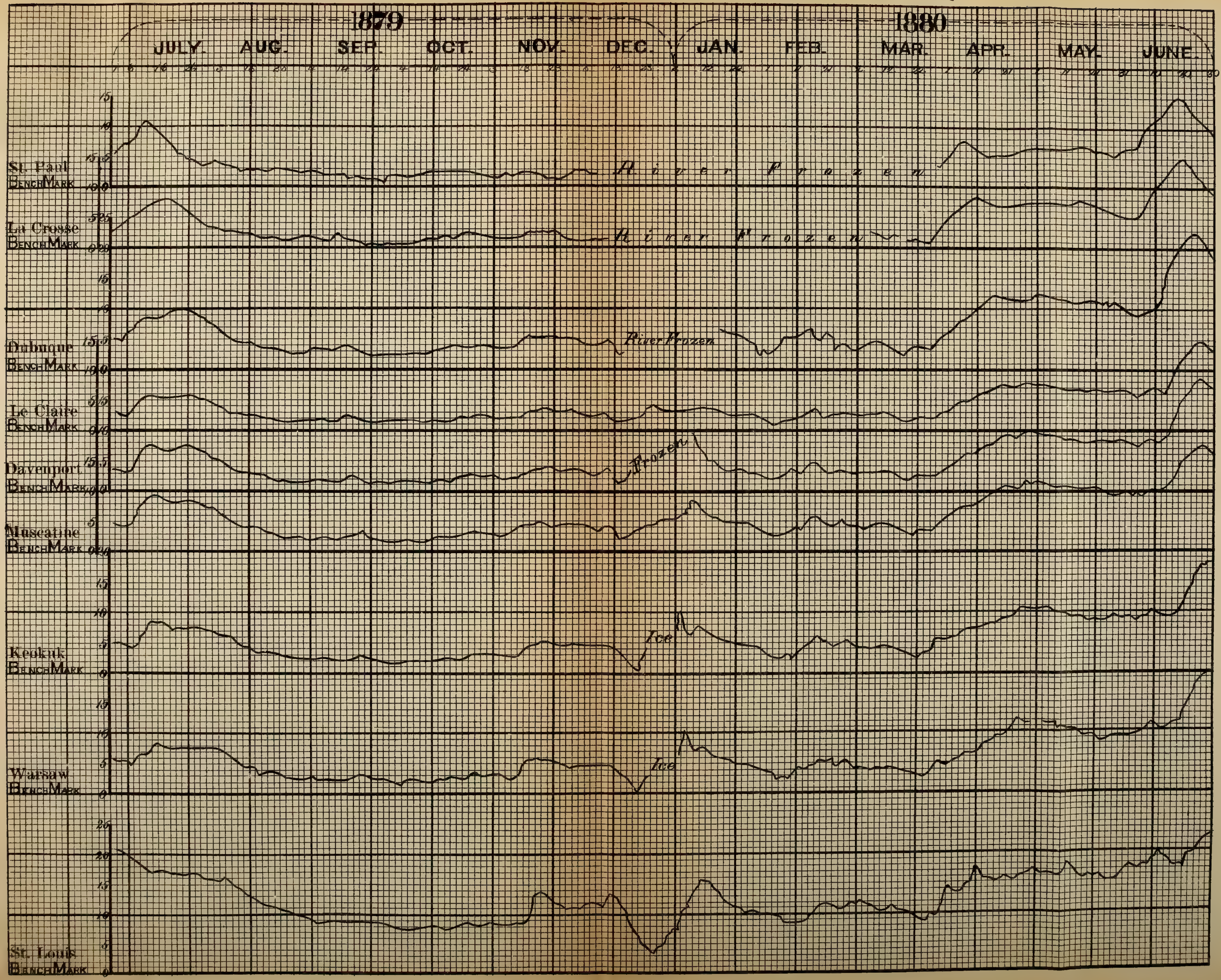
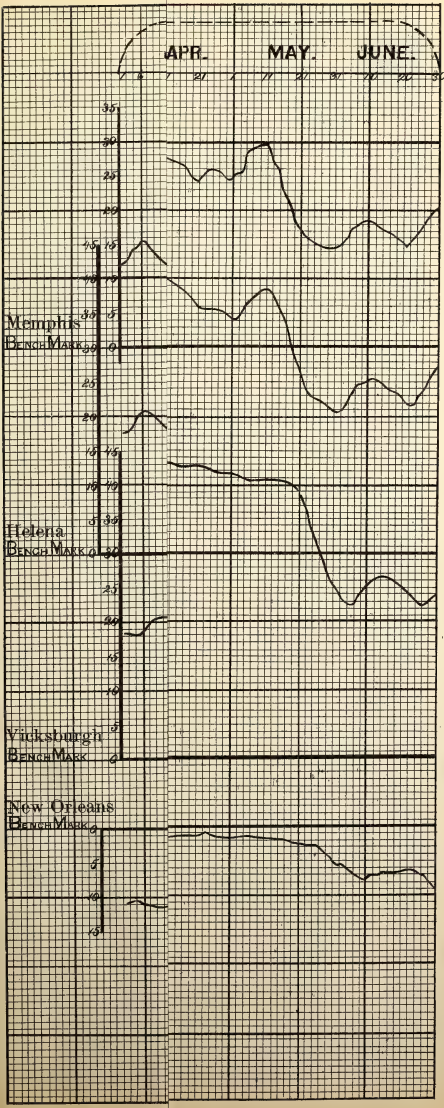
5
10
15
20
25

OSCILLATIONS OF THE UPPER MISSISSIPPI RIVER.




APR.
MAY.
JUNE.
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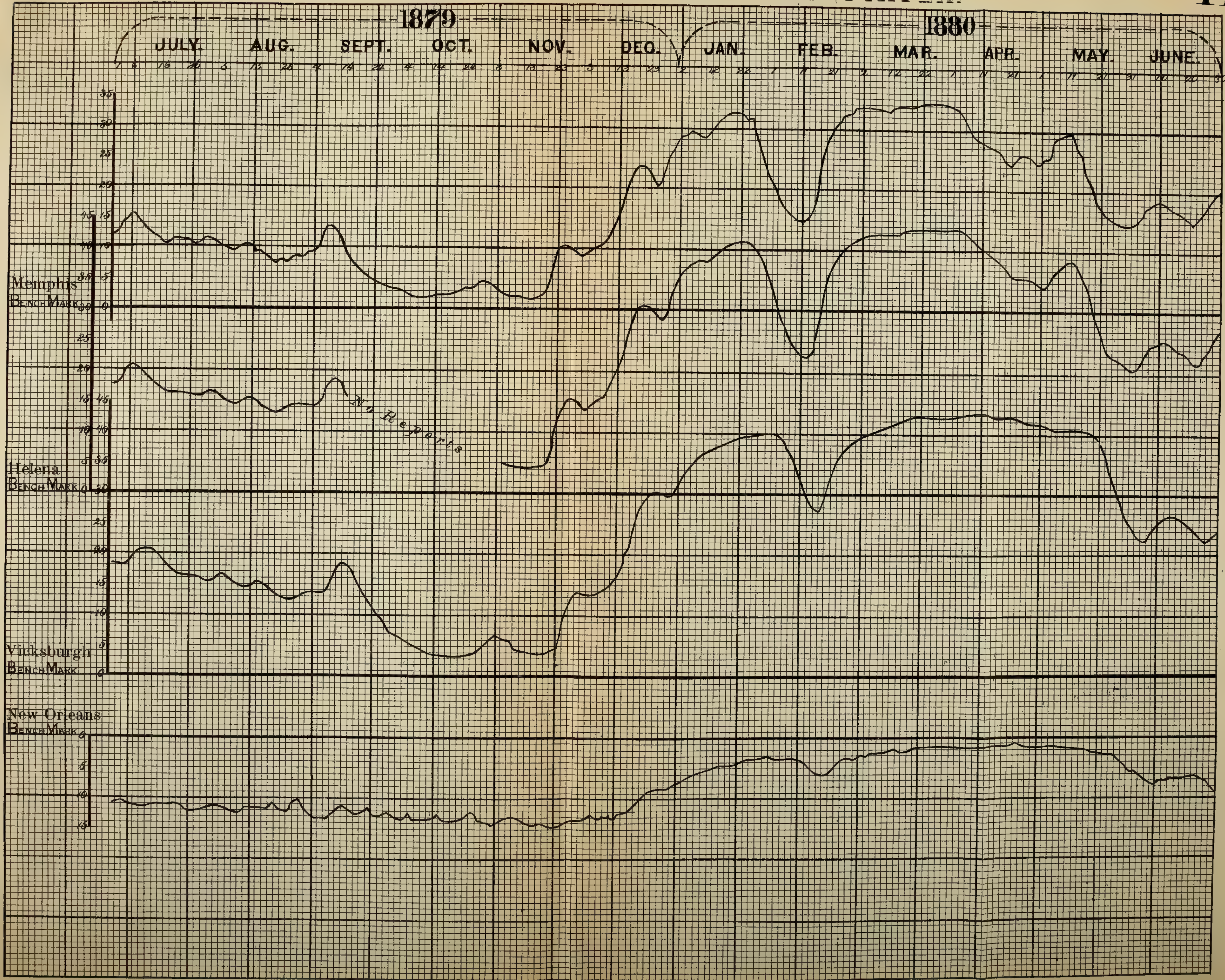
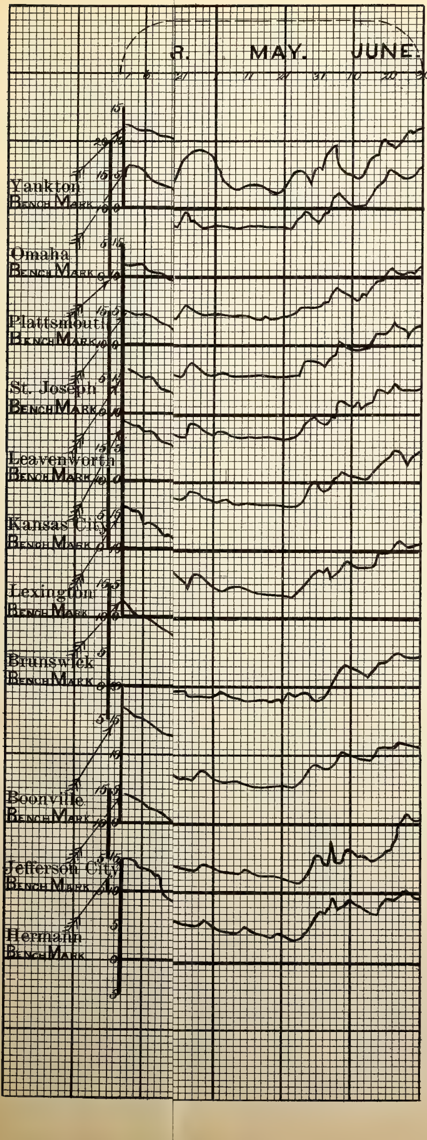
30
35
30
25
20
15
10
5
0
45
40
35
30
25
20
15
10
5
0
Memphis
Bench Mark
Helena
Bench Mark
Vicksburgh
Bench Mark
New Orleans
Bench Mark
5
10
15

OSCILLATIONS OF THE LOWER MISSISSIPPI RIVER.




R.
MAY.
JUNE.
21
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31
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20
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Yankton
Bench Mark
Omaha
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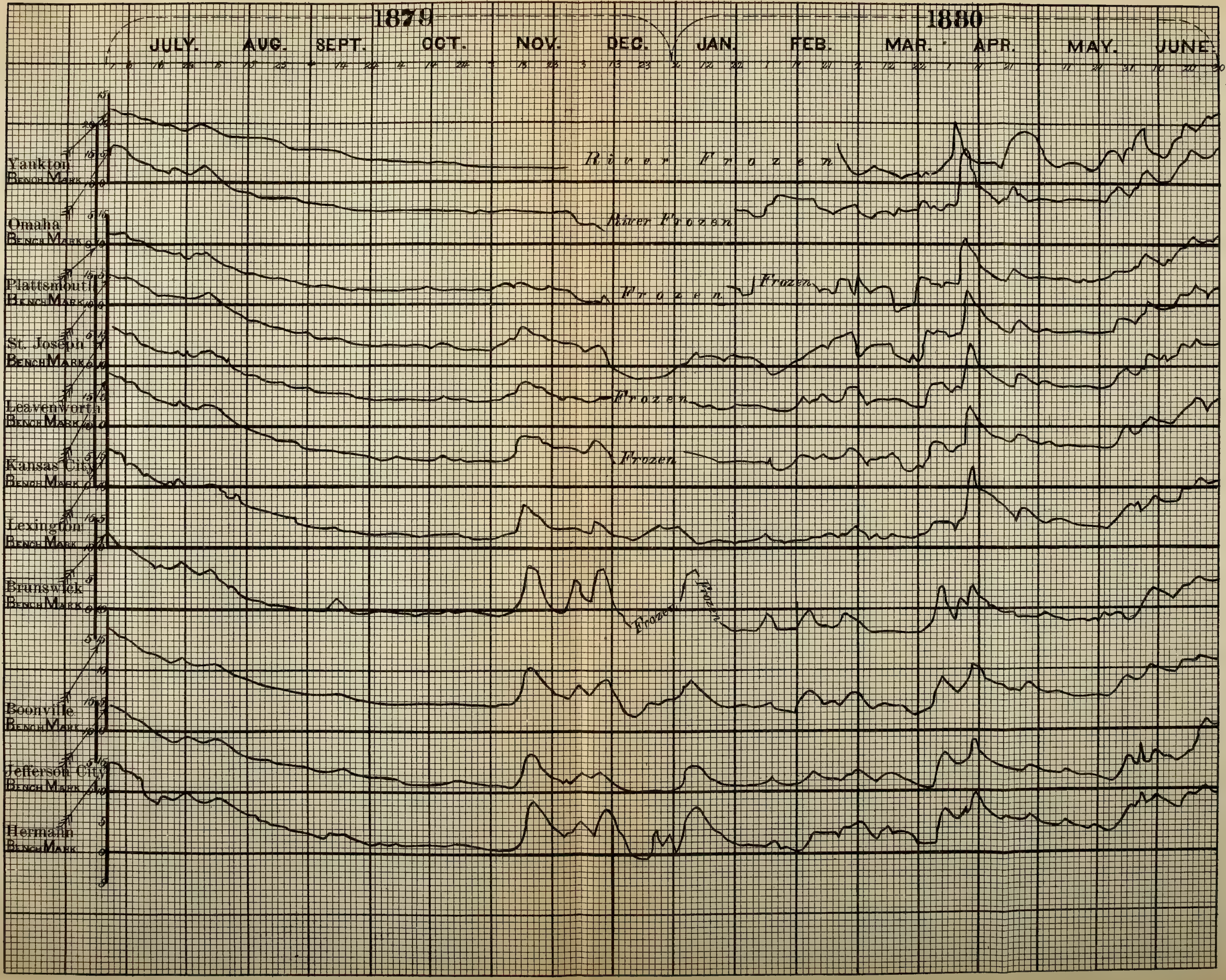
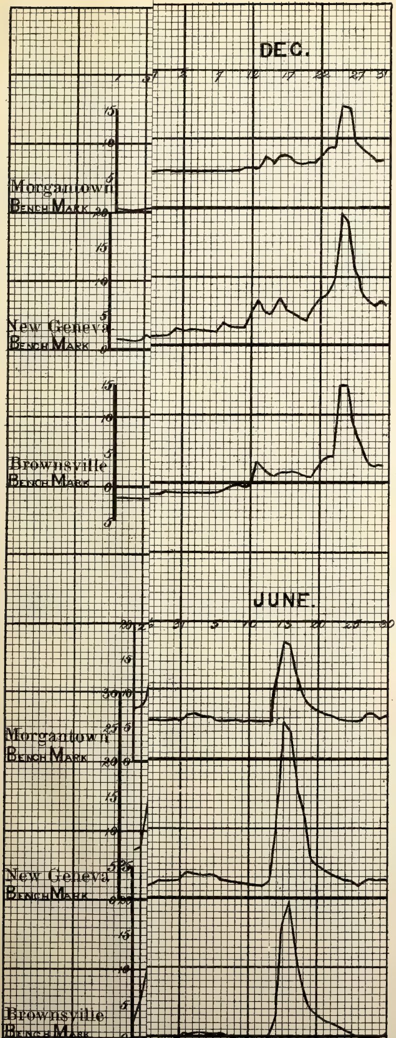
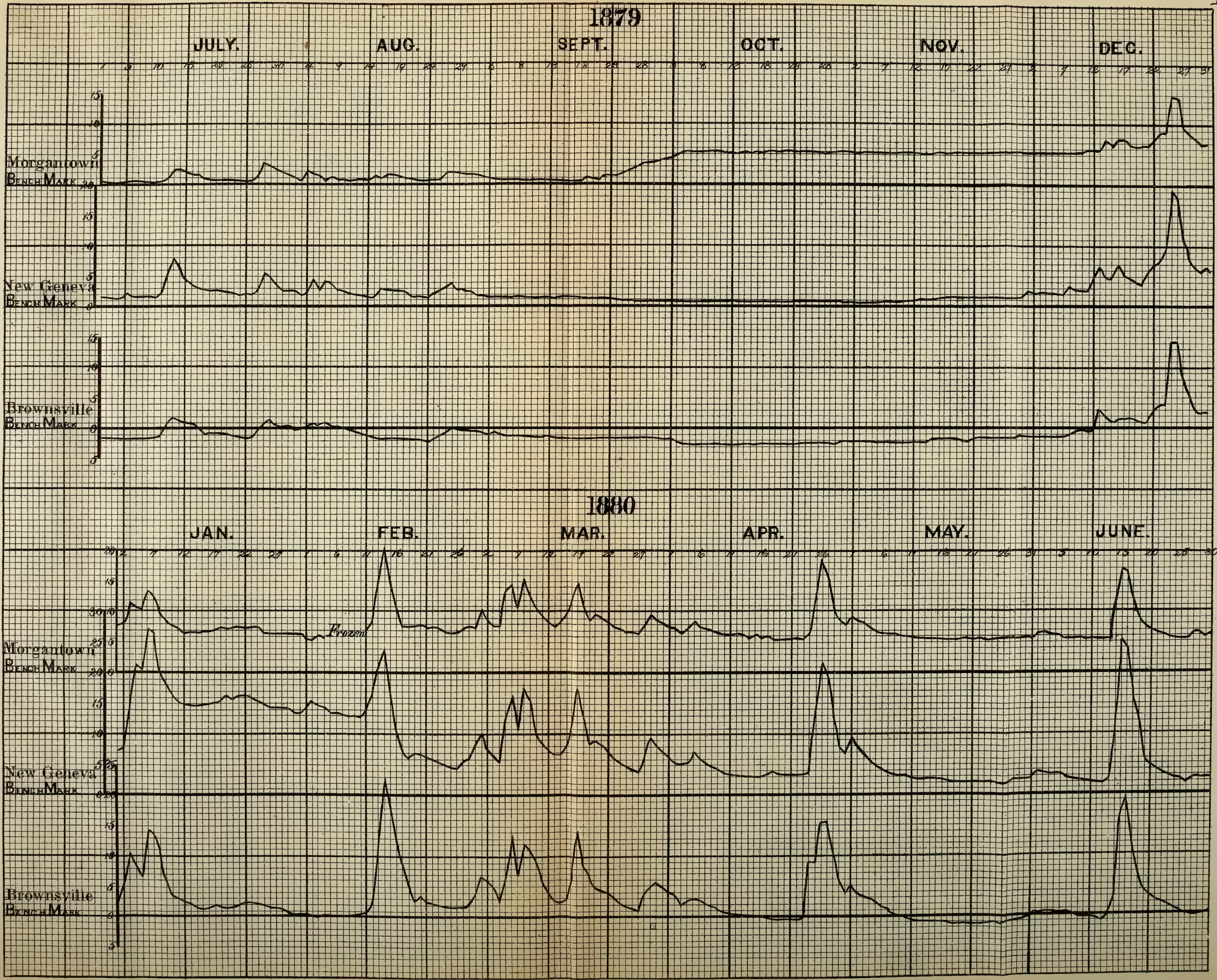
Plattsmouth
Bench Mark
St. Joseph
Bench Mark
Leavenworth
Bench Mark
Kansas City
Bench Mark
Lexington
Bench Mark
Brunswick
Bench Mark
Boonville
Bench Mark
Jefferson City
Bench Mark
Hermann
Bench Mark

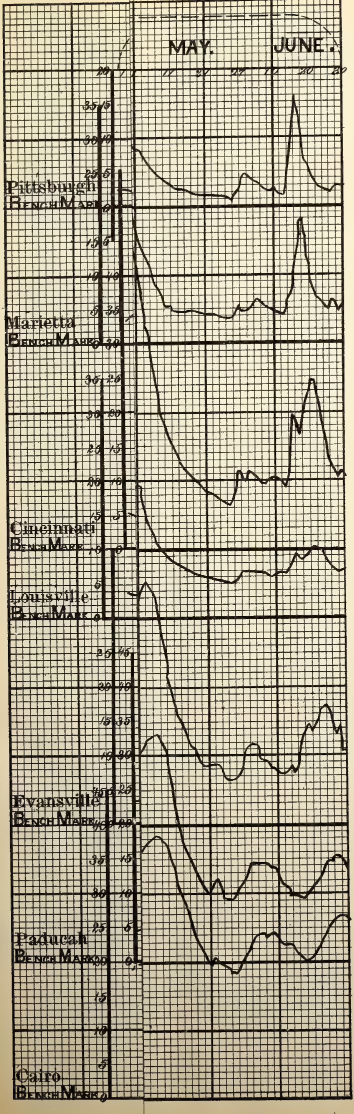
OSCILLATIONS OF THE MISSOURI RIVER.



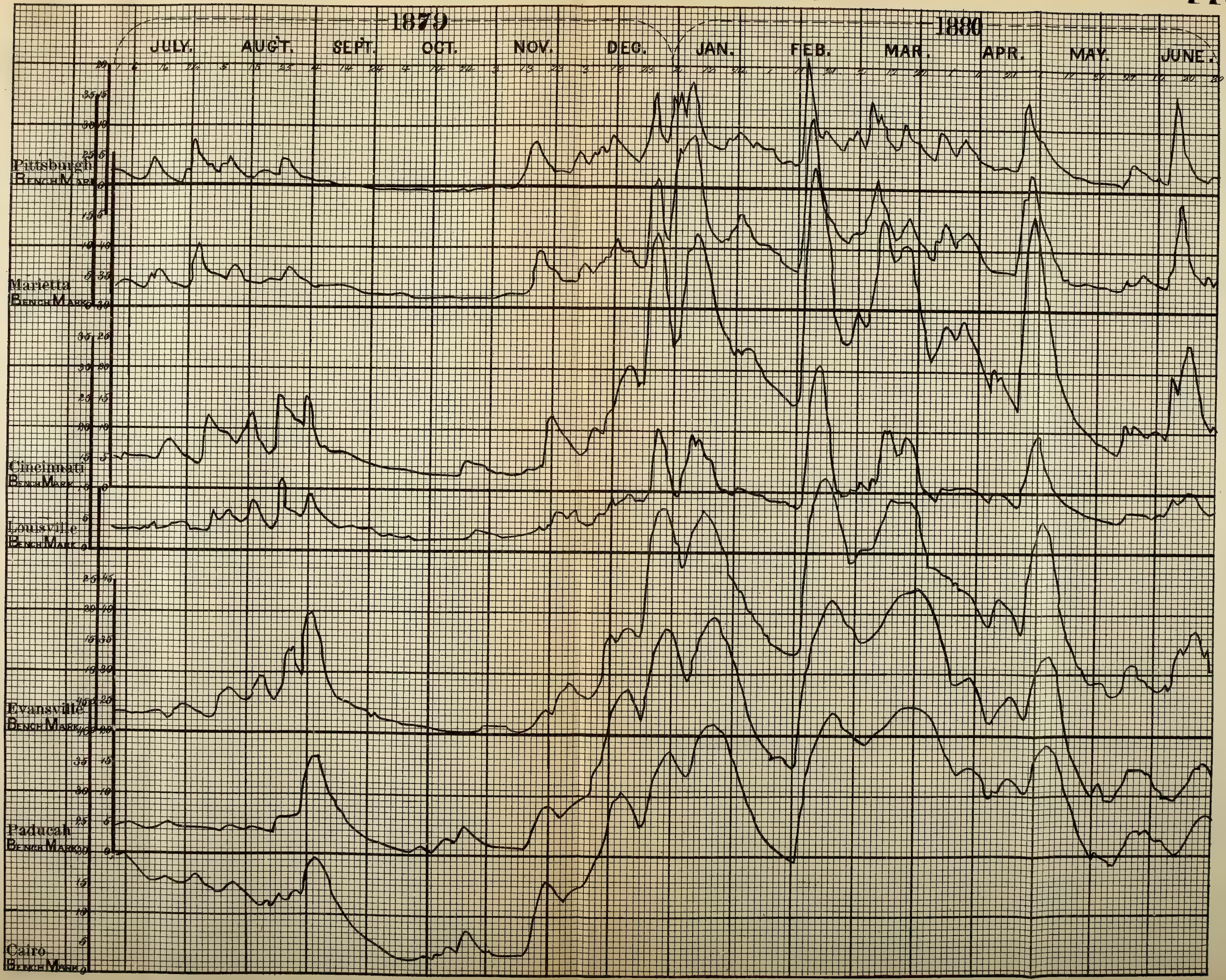

DEC.
1
31
2
7
12
17
22
27
31
15
10
5
Morgantown
Bench Mark
20
15
10
5
New Geneva
Bench Mark
0
15
10
5
Brownsville
Bench Mark
0
5
JUNE.
20
25
31
5
10
15
20
25
30
15
10
5
Morgantown
Bench Mark
20
15
10
5
New Geneva
Bench Mark
0
15
10
5
Brownsville
Bench Mark
0
5

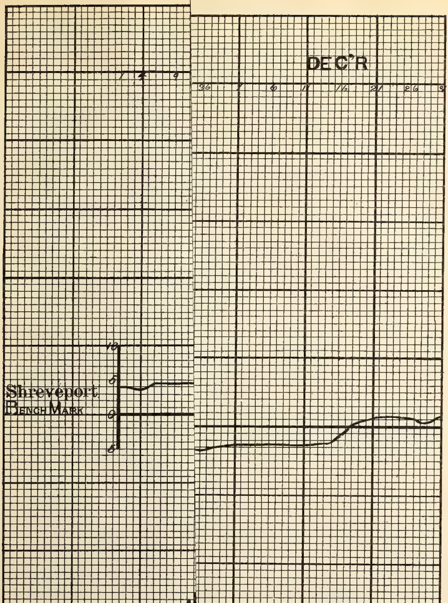
OSCILLATIONS OF THE MONONGAHELA RIVER.




MAY.
JUNE.
Pittsburgh
Bench Mark
Marietta
Bench Mark
Cincinnati
Bench Mark
Louisville
Bench Mark
Evansville
Bench Mark
Paducah
Bench Mark
Cairo
Bench Mark

OSCILLATIONS OF THE OHIO RIVER.

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16
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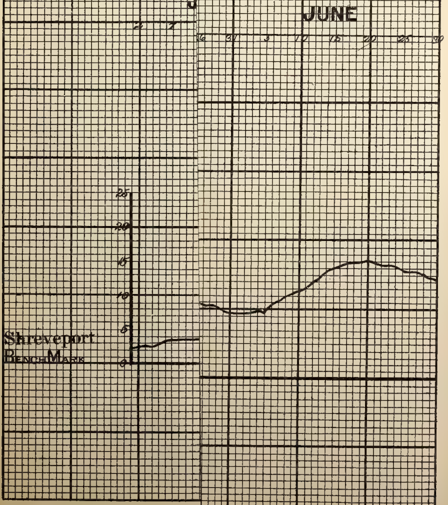
0
5
Shreveport
Bench Mark


J
JUNE
2
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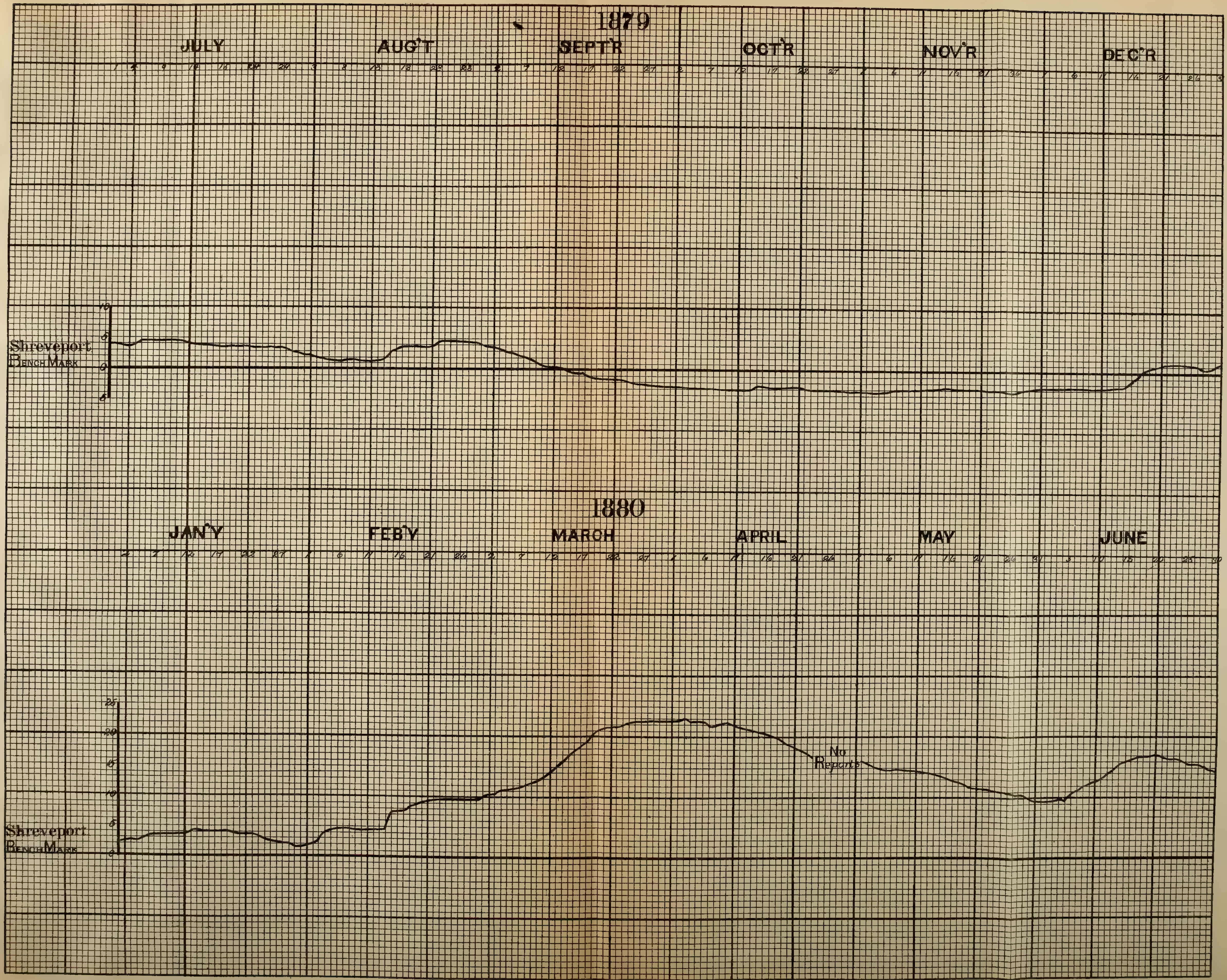
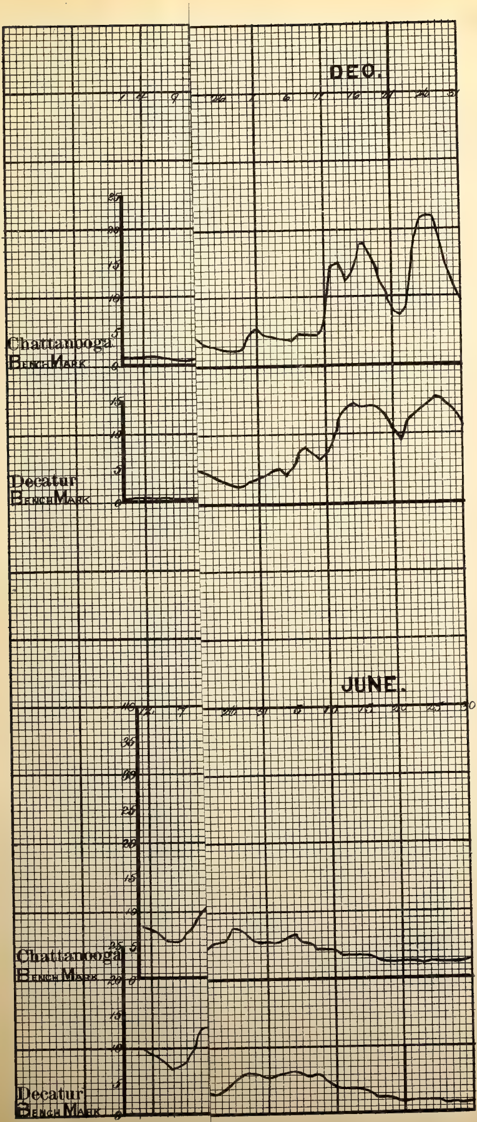
Shreveport
Bench Mark

OSCILLATIONS OF THE RED RIVER.




DEC.
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4
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26
1
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16
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26
31
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15
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5
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Chattanooga
Bench Mark
15
10
5
0
Decatur
Bench Mark
JUNE.
40
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Chattanooga
Bench Mark
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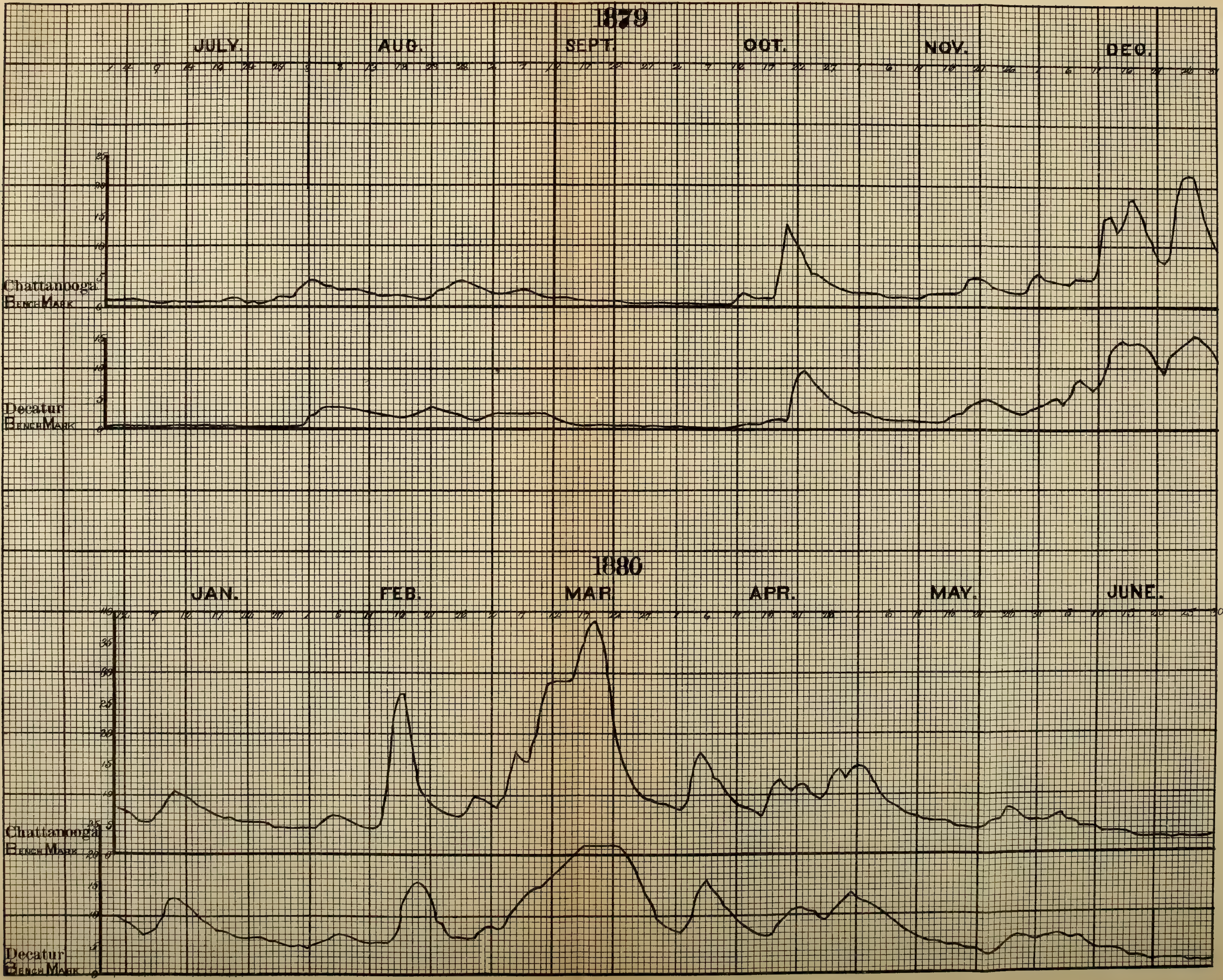
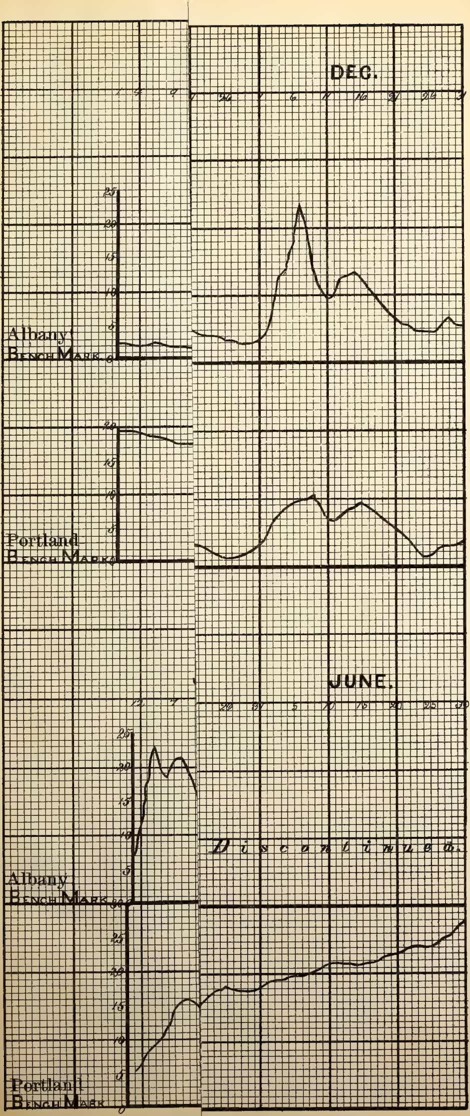
Decatur
Bench Mark

OSCILLATIONS OF THE TENNESSEE RIVER.




DEC.
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15
10
5
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Albany
Bench Mark
20
15
10
5
Portland
Bench Mark
JUNE.
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7
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10
15
20
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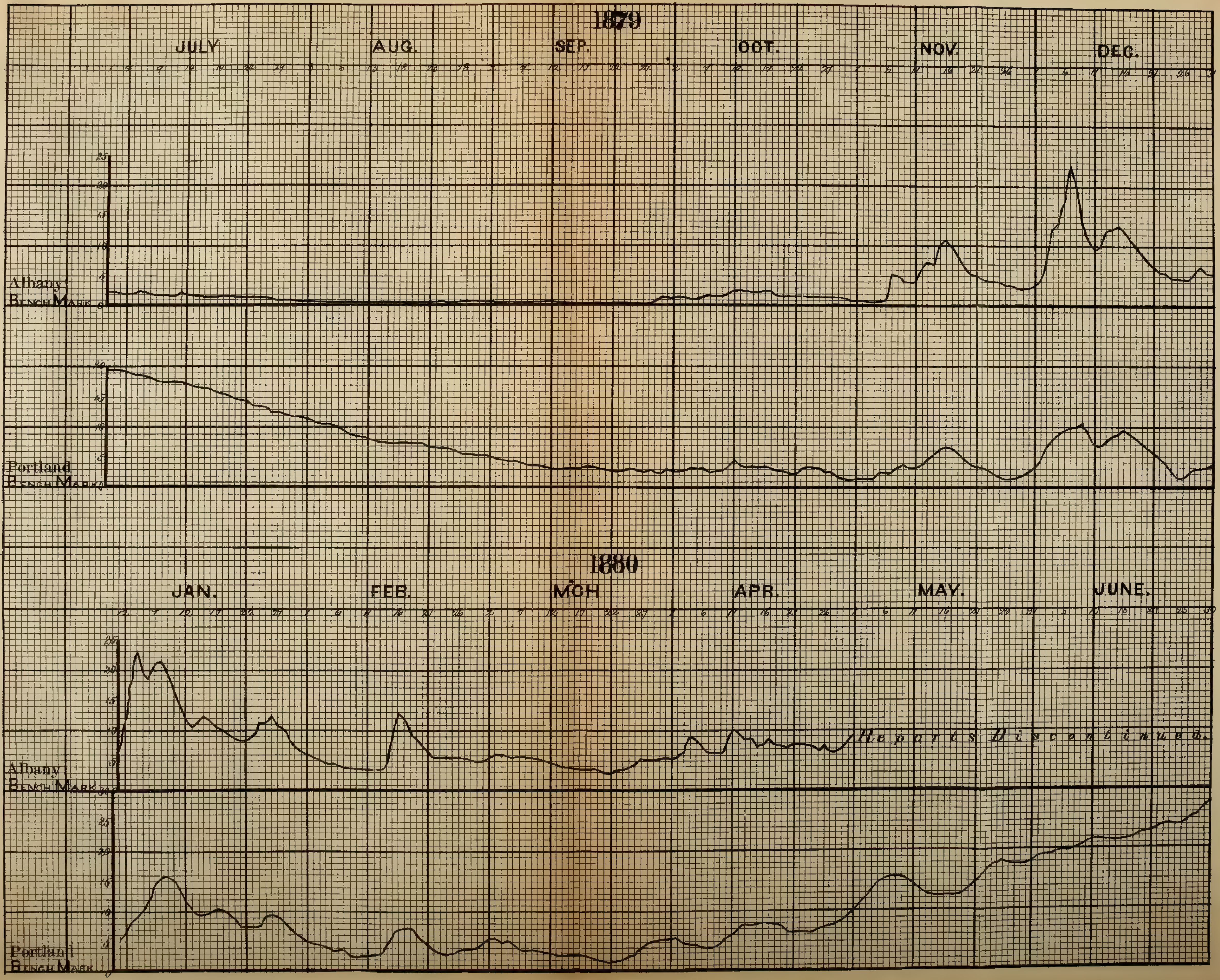
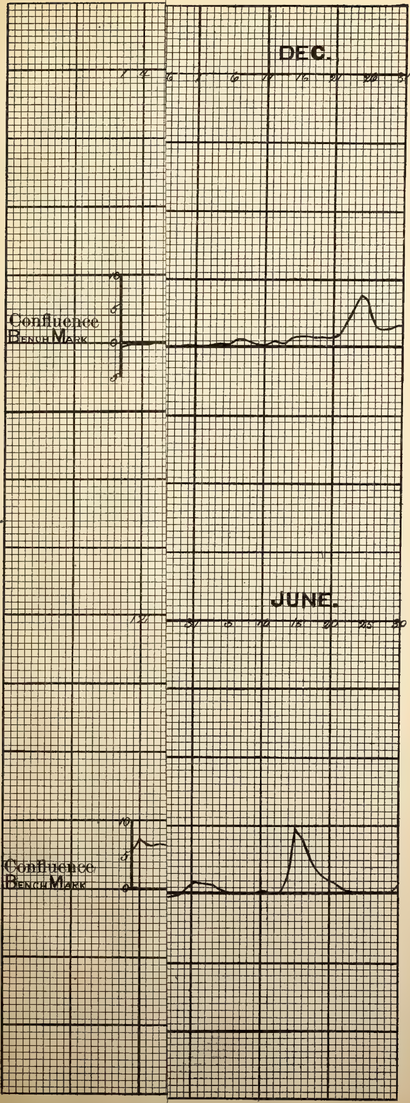
30
25
20
15
10
5
Discontinued.
Albany
Bench Mark
30
25
20
15
10
5
0
Portland
Bench Mark

OSCILLATIONS OF THE WILLAMETTE RIVER.




DEC.
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31
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0
5
Confluence
Bench Mark
JUNE.
12
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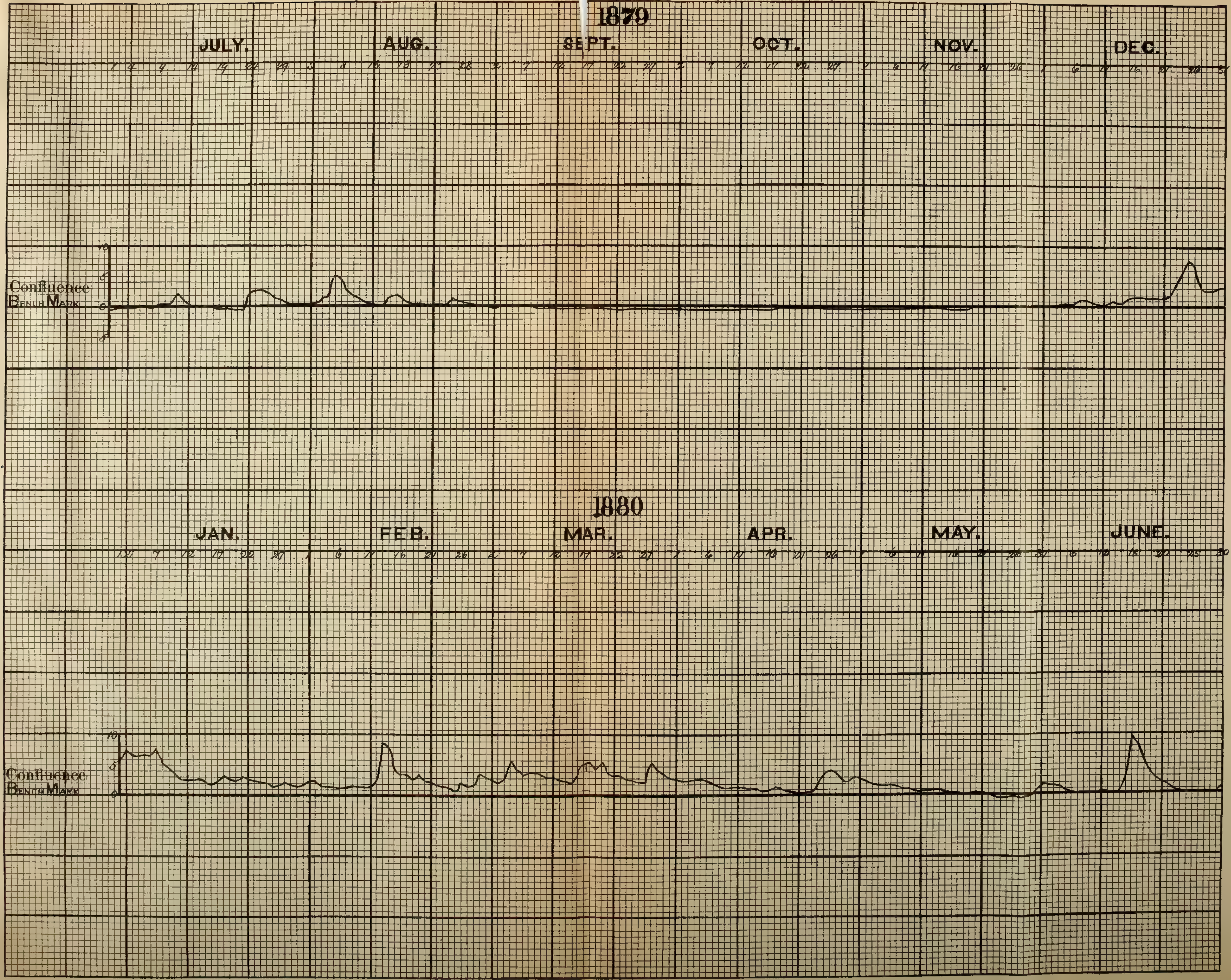
10
15
20
25
30
10
5
0
Confluence
Bench Mark

OSCILLATIONS OF THE YOUGHIOGHENY RIVER.



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